International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)
Fifth Meeting of the Air Traffic Management / Communications, Navigation and Surveillance Subgroup (ATM/CNS/SG/5) - ATM Committee
Lima, Peru, 13-17 November 2006

Agenda Item 6: Matters related to the organization of the ATM Committee
6.1 Review of the ATM Committee Terms of Reference and Work Programme and its Task Forces

ATM PERFORMANCE OBJECTIVES FOR THE CAR AND SAM REGIONS RELATED WITH ICAO GLOBAL PLAN INITIATIVES (GPI)

(Presented by the Secretariat)

SUMMARY

This Working Paper presents a restructuring of the CAR and SAM tasks based on ATM performance objectives with regard to the new ICAO global plan initiatives (GPI).

References:

- *Second Amendment to the Global Air Navigation Plan for the CNS/ATM systems (Doc 9750).*
- *Report of the Fifth All Planning and Implementation Regional Group (ALLPIRG/5) Meeting (Montreal, Canada, 23-24 March, 2006).*
- *Summary of Discussions of the Regional North American/Caribbean (NAM/CAR) Air Traffic Management (ATM) Meeting (Santo Domingo, Dominican Republic, 19-21 April 2006).*
- *Report of the AP/ATM/12 Meeting (Lima, Peru, 15-19 May 2006).*
- *Reports of the ATM Committee Task Forces.*

1. Introduction

ICAO Strategic Objectives

1.1 The ICAO Council in order to accomplish its aims, adopted by on 7 February 1997 a Strategic Action Plan (SAP) conceived to ensure meet the needs of all its Contracting States and the major challenges for civil aviation in the coming years.

1.2 In the year 2000 ICAO reviewed its objectives aimed at promoting its work programme and the connecting processes for the organization's assignment of budgetary priorities. The last revision was carried out by the Assembly held in 2004 which approved the ICAO strategic objectives for the period 2005-2010, which are included in the **Appendix A** to this Working Paper.

Global Air Navigation Plan for CNS/ATM Systems (Doc 9750)

1.3 As the evolution of the CNS/ATM systems continue, it is clear that the planning of a system of such characteristics goes beyond the CNS and ATM systems. The second amendment of the global plan (Doc 9750) integrates all elements of the air navigation infrastructure, therefore, the global plan will be renamed "Global Air Navigation Plan" eliminating the reference to the CNS/ATM systems, which would also allow to maintain a logical alignment with the air navigation regional plans. Furthermore, the homogeneous ATM areas and major traffic flows/routing areas remain valid and will continue to be used as the basis for implementation planning.

1.4 The Air Navigation Commission, reviewed on January 17 2006, a second proposal of amendment to the Air Navigation Global Plan for the CNS/ATM systems (Doc 9750) (Global Plan) and agreed to send the Chapters 1, 2 and 3 to the States and the concerning international organizations to obtain their comments. The three chapters of the amended Global Plan contain a roadmap and guidelines texts for a continued evolution toward a global ATM system, as well as changes in the planning process that such evolution entails; also the compilation of 23 "initiatives" extracted from the industry roadmaps. The technical chapters dealing with the aeronautical information services (AIS), air traffic management (ATM), communications, navigation and surveillance (CNS) and meteorology (MET) were integrated in Chapter 1 of the amended Global Plan.

1.5 The Global Planning initiatives (GPI) are a logical progression of the evolutionary work already accomplished by the Planning and Implementation Regional Groups (PIRGs) and will integrate into the present planning framework. The global initiatives included in **Appendix B** to this paper, are designed to contribute to achieve the regional performance objectives and support the regional implementation programmes, which should be developed based on well identified performance objectives.

1.6 The Global Plan will be supported by planning tools (e.g. software applications, planning documentation, web-based reporting forms, project management tools). As States consider implementation of initiatives, they may use the common programme templates contained in the planning tool, as the basis for establishing performance objectives and implementation time lines, as well as to develop a comprehensive schedule and programme of planning activities to accomplish the work associated with the global initiatives.

1.7 Planning in accordance with the revised Global Plan will facilitate a deliberate and coordinated approach for the implementation of air navigation infrastructure, encouraging complete transparency. It will also ensure effective interaction between ICAO Headquarters and Regional Offices, resulting in harmonization and alignment of regional programmes and implementation activities. In addition, milestones and time lines associated with implementation of the initiatives will serve ICAO in its business planning activities.

1.8 The Global Plan is therefore being gradually transformed into the baseline for measurable achievements and implementation of a global ATM system as the evolution continues from a systems-based to a performance-based approach to planning and implementation of air navigation infrastructure. The amended Global Plan will include a new approach for the regional planning with the purpose to avoid the proliferation of unnecessary planning of systems and activities, serving as an integral planning tool in a short and medium term to the States as well as to the planning and implementation regional groups (PIRGs), offering at the same time a transition outline for the harmonized evolution toward the new global ATM system.

1.9 After the consulting process to the States and the reviewed of the comments received by the Commission, during the first semester of 2006, it is foreseen that the Global Plan amendment will be completely reviewed during the last trimester of 2006 for its presentation and eventually for the Council final approval.

1.10 In light of the budgetary realities and the new ICAO business plan process, the Fifth Meeting of the ALLPIRG (ALLPIRG/5) held in Montreal, Canada, from 23 to 24 March 2006, supported that all the future work of the Planning and Implementation Regional Groups (PIRGs) should be justified and based on clearly established performance objectives that support the ICAO Strategic Objectives. It was mentioned that each region would be considered as a single programme, and that each regional programme should include several regional performance objectives including the PIRG work

1.11 In this context, the Meeting agreed that all the PIRGs terms of reference were reviewed to ensure that the resources will be handled in an appropriate manner and that all the work, including the Secretariat's, will support the ICAO strategic plan. The informing methods to the Commission and to the Council on the PIRGS work are also being reviewed to ensure that the agreed performance objectives are complied and the progress of such work will be measure with time lines. Consequently, among others, the ALLPIRG/5 Meeting agreed the following Conclusion 5/2 (see WP/03) which supports review regional work programmes.

1.12 The ICAO Council examined on June 13 2006 the Report of the Fifth Meeting of the ALLPIRG/Advisory Group and the complementary measures related to its conclusions, and encouraged the planning and implementation regional groups (PIRG), the States and other related implementation Groups to initiate the complementary measures in respect to the conclusions adopted by the meeting.

2 Discussion

2.1 During the ATM NAM/CAR Regional Meeting (Santo Domingo, Dominican Republic 19 to 21 April 2006), and in the AP/ATM/12 Meeting (Lima, Peru, 17 to 21 March 2006), the Chief of Air Traffic Management Section at ICAO Headquarters gave comprehensive presentations on the Second Amendment to the *Global Air Navigation Plan (Doc 9750*and the Global Plan Initiatives (GPI) that were developed by the Air Navigation Commission aiming to bring near and medium term benefits to the ATM community, taking advantage of currently available aircraft capabilities and ATC infrastructure and technology.

2.2 During the presentation, it was stressed that the work programmes of GREPECAS and its subgroups were very well organized, however, a review process should be undertaken to align the work programme into specific projects that would have the advantage of focusing all regional work activities, ensuring that resources are efficiently utilized. Noting that although ATM related projects were often overarching, regions may also establish AGA, AIS, CNS or MET projects.

2.3 It was recognized that the work of GREPECAS should evolve based on the new processes described and that there would have a transition among this review process. . It was also agreed that both CAR and SAM regions should agree on a common set of work projects with specific high level strategic objectives. At the same time however, it was recognized that the regions had differences and that implementation activities could vary to some degree on the basis of their specific requirements and may be progressed through regional task forces of each region.

2.4 As a follow-up to the discussions in the mentioned meetings, it was agreed to adopt a performance-based approach to its work programme and take steps to ensure that its work fully supports the regional planning processes, the directives of the ICAO Council and the ALLPIRG/5 Conclusions.

2.5 Some guidelines considered for the performance objectives planning are:

- The work for the CAR and SAM Regions should be re-organized in the basis of project management techniques and based-performance objectives in support of the Global Plan strategic objectives in alignment with the ICAO SAP. The work programmes should be in common for both regions in accordance to the progress, characteristics and each CAR and SAM Region needs. The strategies agreed will serve as the CAR and SAM inter-regional work programmes; each one may adapt them to their own characteristics and needs of implementation.

- 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 transparency to the highest level.

- In the activities planning, including the Secretariat, it should be ensured that the resources will be efficiently use avoiding the planning of 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.

- 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.

2.6 The ANC has initiated actions in order to update the terms of reference of the different study groups in Headquarters as well as the ICAO Technical Work Programme/TWP in the field of air navigation, which has been evolving toward an Air Navigation Integrated Programme Plan /ANIPP. The goal is to align all the work programmes in support of the strategic objectives of the ICAO Strategic Action Plan (SAP).

2.7 In order to receive feedback, the Regional Offices on their part, are also carrying out coordination with the ATM experts of the NAM, CAR and SAM Regions and with ICAO Headquarters to develop project management charts that will be uploaded in a inter active website. This coordination process will continue with the purpose to report progress of the planned work and include the results in the interactive site of ICAO webpage. Actually, coordination with the ICAO Headquarters on some inter-regional work has been made and presented to the ANC as advances of interregional work.

2.8 The **Appendix C** to this Working Paper includes CAR and SAM interregional planning performance objectives agreed in the ATM NAM/CAR and AP/ATM/12 Meetings; for the automation is included the strategy approved by GREPECAS/12 reviewed by the AUTOM/TF/1 with title ATM situational awareness and for the implementation of ATFM system is included the strategy *Demand and Capacity Balancing* agreed by the ATFM/TF/2 meeting. All strategies were organized by the Secretariat with few track changes and format to facilitate harmonization and review of regional work

2.9 Each one of performance objectives describes benefits expected and their connection with strategic objectives of ICAO, tasks designator in accordance with Doc 9854 gather with regional work programme to be completed in short and medium term by the implementation groups concerned, including description of strategic tasks and their connection with the GPIs of the reviewed global plan.

2.10 In the basis to this performance objectives 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.

2.11 Taking into consideration that the strategies mentioned before the States, Territories and International Organizations of CAR and SAM Regions in coordination with ICAO should continue process to develop, reorganize and implement regional and national ATM work programmes, therefore the following Draft Conclusion is recommended:

DRAFT
CONCLUSION ATM/5/XX **REORGANIZATION OF THE WORK PROGRAMMES IN SUPPORT TO ATM PERFORMANCE OBJECTIVES FOR CAR AND SAM REGIONS**

That in support the evolution continues from a systems-based to a performance-based approach to planning and implementation of the air navigation infrastructure;

a) States, Territories and International Organizations of CAR and SAM Regions take required actions to develop and implement national ATM work programmes considering performance objectives included in the Appendix C to this Working Paper: and,

b) ICAO continue coordination to reorganize ATM work programmes of CAR and SAM Regions in performance objectives according to the new Global Planning Initiatives (GPI) in support to ICAO strategic Objectives.

3. Actions suggested to the Meeting

3.1 The Meeting is invited to:

a) take note of the information contained in this Working Paper;

b) approve Draft Conclusions as shown in paras 2.4 and 2.11; and,

c) agree to other actions as deem necessary.

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STRATEGIC OBJECTIVES OF ICAO FOR 2005-2010

CONSOLIDATED VISION AND MISSION STATEMENT

The International Civil Aviation Organization, a UN Specialized Agency, is the global forum for civil aviation.

ICAO works to achieve its vision of safe, secure and sustainable development of civil aviation through cooperation amongst its member States.

To implement this vision, the Organization has established the following Strategic Objectives for the period 2005-2010:

A: Safety - Enhance global civil aviation safety
B: Security - Enhance global civil aviation security
C: Environmental Protection - Minimize the adverse effect of global civil aviation on the environment
D: Efficiency - Enhance the efficiency of aviation operations
E: Continuity - Maintain the continuity of aviation operations
F: Rule of Law - Strengthen law governing international civil aviation

Strategic Objective A: Safety — *Enhance global civil aviation safety*

Enhance global civil aviation safety through the following measures:

1. Identify and monitor existing types of safety risks to civil aviation and develop and implement an effective and relevant global response to emerging risks.
2. Ensure the timely implementation of ICAO provisions by continuously monitoring the progress toward compliance by States.
3. Conduct aviation safety oversight audits to identify deficiencies and encourage their resolution by States.
4. Develop global remedial plans that target the root causes of deficiencies.
5. Assist States to resolve deficiencies through regional remedial plans and the establishment of safety oversight organizations at the regional or sub-regional level.
6. Encourage the exchange of information between States to promote mutual confidence in the level of aviation safety between States and accelerate the improvement of safety oversight.
7. Promote the timely resolution of safety-critical items identified by regional Planning and Implementation Groups (PIRGs).
8. Support the implementation of safety management systems across all safety-related disciplines in all States.
9. Assist States to improve safety through technical cooperation programmes and by making critical needs known to donors and financial organizations.

Strategic Objective B: Security — *Enhance global civil aviation security*

Enhance the security of global civil aviation through the following measures:

1. Identify and monitor existing types of security threats to civil aviation and develop and implement an effective global and relevant response to emerging threats.
2. Ensure the timely implementation of ICAO provisions by continuously monitoring the progress toward compliance by States.
3. Conduct aviation security audits to identify deficiencies and encourage their resolution by States.
4. Develop, adopt and promote new or amended measures to improve security for air travellers worldwide while promoting efficient border crossing procedures.
5. Develop and maintain aviation security training packages and e-learning.
6. Encourage the exchange of information between States to promote mutual confidence in the level of aviation security between States.
7. Assist States in the training of all categories of personnel involved in implementing aviation security measures and strategies and, where appropriate, the certification of such personnel.
8. Assist States in addressing security related deficiencies through the aviation security mechanism and technical cooperation programmes.

Strategic Objective C: Environmental Protection — *Minimize the adverse effect of global civil aviation on the environment*

Minimize the adverse environmental effects of global civil aviation activity, notably aircraft noise and aircraft engine emissions, through the following measures:

1. Develop, adopt and promote new or amended measures to:
   - limit or reduce the number of people affected by significant aircraft noise;
   - limit or reduce the impact of aircraft engine emissions on local air quality; and
   - limit or reduce the impact of aviation greenhouse gas emissions on the global climate.
2. Cooperate with other international bodies and in particular the UN Framework Convention on Climate Change (UNFCCC) in addressing aviation's contribution to global climate change.

Strategic Objective D: Efficiency — *Enhance the efficiency of aviation operations*

Enhance the efficiency of aviation operations by addressing issues that limit the efficient development of global civil aviation through the following measures:

1. Develop, coordinate and implement air navigation plans that reduce operational unit costs, facilitate increased traffic (including persons and goods), and optimize the use of existing and emerging technologies.
2. Study trends, coordinate planning and develop guidance for States that supports the sustainable development of international civil aviation.
3. Develop guidance, facilitate and assist States in the process of liberalizing the economic regulation of international air transport, with appropriate safeguards.
4. Assist States to improve efficiency of aviation operations through technical cooperation programmes.

Strategic Objective E: Continuity — *Maintain the continuity of aviation operations*

Identify and manage threats to the continuity of air navigation through the following measures:

1. Assist States to resolve disagreements that create impediments to air navigation.
2. Respond quickly and positively to mitigate the effect of natural or human events that may disrupt air navigation.
3. Cooperate with other international organizations to prevent the spread of disease by air travellers.

Strategic Objective F: Rule of Law — *Strengthen law governing international civil aviation*

Maintain, develop and update international air law in light of evolving needs of the international civil aviation community by the following measures:

1. Prepare international air law instruments that support ICAO's Strategic Objectives and provide a forum to States to negotiate such instruments.
2. Encourage States to ratify international air law instruments.
3. Provide services for registration of aeronautical agreements and depositary functions for international air law instruments.
4. Provide mechanisms for the settlement of civil aviation disputes.
5. Provide model legislation for States.

SUPPORTING IMPLEMENTATION STRATEGIES

To implement its Strategic Objectives, the Organization will take the necessary steps to:

1. operate in a transparent manner and communicate effectively both externally and internally;
2. maintain the effectiveness and relevance of all documents and materials;
3. identify risk management and risk mitigation strategies as required;
4. continuously improve the effective use of its resources;
5. enhance the use of information and communication technology integrating it into its work processes at the earliest possible opportunity;
6. take into account the potential impacts on the environment of its practices and operations;
7. improve its use of diverse human resources in line with the best practices in the UN system; and
8. operate effectively with the highest standard of legal propriety.

Figure 1. Diagram showing the relationship between the Objectives and the Supporting Implementation Strategies

Safety	Security	Environment Protection	Efficiency	Continuity	Rule of Law
Supporting Implementation Strategies					

Adopted by Council on 17 December 2004

Schedule for review: before January 2006

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APPENDIX B

Global plan initiatives and their relationships to the major groupings

G P I		En-route	Terminal Area	Aerodrome	Supporting Infrastructure
GPI-1	Flexible use of airspace	X	X		
GPI-2	Reduced vertical separation minima	X			
GPI-3	Harmonize level systems	X			
GPI-4	Align upper airspace classifications	X			
GPI-5	Performance-based navigation	X	X	X	
GPI-6	Air traffic flow management	X	X	X	
GPI-7	Dynamic and flexible ATS route management	X	X		
GPI-8	Collaborative airspace design and management	X	X		
GPI-9	Situational awareness	X	X	X	X
GPI-10	Terminal area design and management		X		
GPI-11	RNP and RNAV SIDs and STARs		X		
GPI-12	FMS-based arrival procedures		X		X
GPI-13	Aerodrome design and management			X	
GPI-14	Runway operations			X	
GPI-15	Match IMC and VMC operating capacity		X	X	X
GPI-16	Decision support systems	X	X	X	X
GPI-17	Implementation of data link applications	X	X	X	X
GPI-18	Electronic information services	X	X	X	X
GPI-19	Meteorological systems	X	X	X	X
GPI-20	WGS-84	X	X	X	X
GPI-21	Navigation systems	X	X	X	X
GPI-22	Communication network infrastructure	X	X	X	X
GPI-23	Aeronautical spectrum	X	X	X	X

(GPI-1) FLEXIBLE USE OF AIRSPACE

Scope: The optimization and equitable balance in the use of airspace between civil and military users, facilitated through both strategic coordination and dynamic interaction.

Related ATM objectives: Airspace desegregation/flexible use of airspace

Description of strategy

1.19 The use of airspace should be optimized through the dynamic interaction of civil and military air traffic services including real-time civil/military controller-to-controller co-ordination. This requires system support, operational procedures and adequate information on civilian traffic position and intentions.

1.20 The flexible use of airspace (FUA) concept is based on the principle that airspace should not be designated purely as civil or military, but rather as a continuum in which all user requirements are accommodated to the greatest possible extent. FUA should result in the removal of large tracts of permanent or transient restricted airspace or special use airspace.

1.21 Where there are continued requirements to accommodate specific individual airspace uses, thereby blocking airspace of certain dimensions, this should be accommodated on a transient basis. Airspace should be released immediately after the operation requiring the restriction is complete.

(GPI-2) REDUCED VERTICAL SEPARATION MINIMUM

Scope: The optimization of the utilization of airspace and enhanced aircraft altimetry systems.

Related ATM objectives: Reduced vertical separation

Description of strategy

1.22 Reduced vertical separation minima (RVSM) reduces vertical separation to 300 metres (1 000 ft) above FL 290 from the current 600 metres (2000 ft), thereby providing six additional flight levels. The Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive provides specific guidance on implementation of (Doc 9574).

1.23 A great deal of experience has been gained with RVSM and all necessary Standards and Recommended Practices (SARPs) guidance material are available to support implementation.

(GPI-3) HARMONIZE LEVEL SYSTEMS

Scope: The adoption by all States of the ICAO Flight Level Scheme based on feet as contained in Appendix 3 to Annex 2 – *Rules of the Air*.

Related ATM objectives: nil

Description of strategy

1.24 The majority of ICAO Contracting States have chosen to use the imperial measurement system for referencing altitudes and levels, however, some States continue to use the metric system. To compound matters, some States that use the metric system, have adopted different vertical spacing standards than what is contained in ICAO Annex 2 **—** *Rules of the Air*.

1.25 Aircraft registered in States that have adopted the imperial system have altimetry systems calibrated in feet. Those registered in States that have adopted the metric system generally have altimeters calibrated in metres. Aircraft operating across boundaries into States with differing systems are required to carry additional altimeters, or to use conversion charts. Air traffic controllers handling such flights are also required to use conversion charts.

1.26 The implementation of RVSM at the interface between States using the different systems has increased safety concerns and causes the loss of several levels resulting in a less efficient operation for aircraft and a loss in airspace capacity. In addition, certain States that utilize the metric system have not made certain high level cruising altitudes available; thereby, imposing significant operating restrictions on aircraft operating on long-range sectors.

1.27 Harmonization of level systems, whereby all States adopt the ICAO Flight Level Scheme based on feet, should be pursued.

(GPI-4) ALIGNMENT OF UPPER AIRSPACE CLASSIFICATIONS

Scope: The harmonization of upper airspace and associated traffic handling through application of a common ICAO ATS Airspace Class above an agreed division level.

Related ATM objectives: nil

Description of strategy

1.28 To the extent possible airspace should be structured as a continuum, free from operational discontinuities, inconsistencies and differing rules and procedures. Alignment of airspace classifications can help to achieve this goal. It would also facilitate the introduction and better utilization of data link communications, improved flight plan processing systems, and advanced airspace management coordination tools and message exchange capabilities, leading to progressively more flexible and dynamic management of airspace. Airspace classifications should be harmonized intra-regionally and, where possible, across several regions.

1.29 Air transport and most business aircraft operations should be contained within airspace within which positive air traffic control services are provided to all aircraft (i.e. Class A, B, C or D).

1.30 ATM provided in various airspace volumes should be based on the ICAO airspace classification system as defined in Annex 11 — *Air Traffic Services* (i.e. Class A to G), and those classifications should be implemented on the basis of a safety assessment, taking into account the volume of nature of the air traffic.

(GPI-5) PERFORMANCE BASED NAVIGATION

Scope: The incorporation of advanced aircraft navigation capabilities into the air navigation system infrastructure.

Related ATM objectives: Application of required navigation performance; Application of required surveillance performance; Reduced longitudinal separation; Reduced lateral separation

Description of strategy

1.31 The implementation of the concept of performance based navigation will lead to increased capacity and enhanced efficiency through reductions in separation minima, bringing benefits to aircraft operators that equip to meet performance requirements. Performance-based navigation will also improve safety, particularly on approach through a reduction of controlled flight into terrain.

1.32 A significant number of aircraft are capable of area navigation (RNAV) and required navigation performance (RNP). These capabilities should be further exploited to develop more efficient routes and aircraft trajectories that are not directly tied to ground-based navigation aids. Certain RNAV equipped aircraft also have a significantly enhanced capability to achieve sequencing requirements to runways, particularly through the use of the "required time of arrival" function within the flight management system (FMS).

1.33 The performance-based navigation concept, a variation of the RNP concept, recognizes that a clear distinction must be made in the designation of operations, between those aircraft operations that require onboard self-contained performance monitoring and alerting and those that do not. The specifications in Figure 4, will allow global harmonization, leading to greater efficiency and lower costs for aircraft operators. Furthermore, they are fully compatible with existing implementations.

Area of application	Navigation accuracy (NM)	Navigation specification (current)	Navigation specification (new)
Oceanic/remote	10	RNP 10	RNP 10
	4	RNP 4	RNP 4
Enroute continental	5	B-RNAV RNP 5	RNAV 5
Enroute continental/Terminal	2	USRNAV type A	RNAV 2
Terminal	1	USRNAV type B and P-RNAV	RNAV 1

Figure 4. Conversion of existing navigation specs to the new specs

1.34 The above figure only addresses the enroute and terminal segments. ICAO is also addressing performance-based navigation in the final approach phase through development of a manual that provides guidance for design and implementation of RNP0.3 scaleable to RNP0.1 approach procedures.

(GPI-6) AIR TRAFFIC FLOW MANAGEMENT

Scope: The implementation of strategic, tactical and pre-tactical measures aimed at organizing and handling traffic flows in such a way that the totality of the traffic handled at any given time or in any given airspace or aerodrome is compatible with the capacity of the ATM system.

Related ATM objectives: Centralized ATFM; Inter-regional cooperative ATFM; Establishment of ATFM databases; Application of ATFM strategic planning; Application of pre-tactical ATFM planning; Application of tactical ATFM planning

Description of strategy

1.35 The implementation of demand/capacity measures, commonly known as air traffic flow management (ATFM), implemented on a regional basis where needed, will enhance airspace capacity and improve operating efficiency.

1.36 In the event that traffic demand regularly exceeds capacity, resulting in continuing and frequent traffic delays, or when it becomes apparent that forecast traffic demand will exceed the available capacity, the appropriate ATM units, in consultation with aircraft operators, should consider implementing steps aimed at improving the use of the existing system capacity, and developing plans to increase capacity to meet the actual or forecast demand. Any such planning to increase capacity should be undertaken in a structured and collaborative manner.

1.37 States and regions should evolve to a collaborative based approach to capacity management. The ATM Operational Concept envisages a more strategic approach to ATM overall, and through collaborative decision-making, a reduction in the reliance on tactical flow management. It is inevitable that tactical flow intervention will continue to be required; however closer coordination between airspace users and ATM service providers can reduce the need for routine tactical intervention which is often disruptive to aircraft operations.

(GPI-7) DYNAMIC AND FLEXIBLE ATS ROUTE MANAGEMENT

Scope: The establishment of more flexible and dynamic route systems, on the basis of navigation performance capability, aimed at accommodating preferred flight trajectories

Related ATM objectives Fixed RNAV ATS routes; Contingency RNAV routes; Random RNAV routes; Application of required Navigation Performance; Dynamic Accommodation of user-preferred flight ; profiles; Trajectory conformance monitoring

Description of strategy

1.38 The implementation of ATS route structures that avoid concentrations of aircraft over congested points and implementation of an ATS routing environment that meets the needs of the airspace users to operate along preferred and dynamic flight trajectories, will increase capacity and increase aircraft operating efficiency.

1.39 RNAV routes are not restricted to the location of ground-based aids and provide benefits to aircraft operators and the ATM system. All modern aircraft are RNAV capable and every effort should be made to design and implement RNAV routes.

1.40 Dynamic route management involves the aircraft in the planning process. Typical scenarios include the generation of change-of routing requests by the dispatch functions of the aircraft operators, the processing and approval of these requests by ATS providers and transmission of the change-or-routing approval to the aircraft. Advanced scenarios would have the aircraft making requests directly to ATS providers who would process and modify the request if necessary and then forward the approved route to aircraft.

1.41 Random routing strategically or pre-tactically defines areas within which fixed routes are not designated and where aircraft determine an appropriate track from an entry point to an exit point.

1.42 User-preferred routes make use of the capability of aircraft operators to determine optimum tracks, based on a range of flight parameters. In accordance with this concept, ATS routes or tracks would not be fixed to pre-determined routes or waypoints, except where required for control purposes, however, trajectories would be available to ATM staff.

1.43 User-preferred routing requests are generated by the airspace user or their dispatch functions and submitted to the ATS provider for approval or renegotiation if a conflict is determined followed by their transmission to aircraft. Advanced scenarios would have the aircraft making requests directly to ATS providers who would process and modify the request if necessary and then forward the approved route to aircraft.

(GPI-8) COLLABORATIVE AIRSPACE DESIGN AND MANAGEMENT

Scope: The application of uniform airspace organization and management principles on a global basis, leading to a more flexible airspace design to accommodate traffic flows dynamically.

Related ATM objectives: Airspace desegregation/flexible use of airspace; Dynamic accommodation of user-preferred flight profiles

Description of strategy

1.44 Collaborative airspace design and management is aimed at organizing airspace in a cooperative manner involving all users so that airspace is managed to accommodate the preferred trajectories of the users. States and regions should take advantage of aircraft capabilities when designing airspace. In designing and implementing airspace changes, account needs to be taken of the fleet capabilities among airspace users within a given airspace. Furthermore, collaboration with airspace users will identify procedures and/or solutions that make use of available aircraft capabilities.

1.45 Other emerging developments such as collaborative decision-making, the "required time of arrival" function in the flight management system (FMS), the endorsement of the global ATM operational concept and the implementation of data link applications, will also allow improved airspace design and management.

1.46 Over an evolutionary period, dynamic airspace management should be applied. Dynamic airspace management comprises integrated decision making; demand-based capacity (see air traffic flow management, paragraph 1.36); and user preferred routes (see dynamic and flexible ATS route management, paragraph 1.39).

1.47 Integrated decision making is an extension of the principles of the flexible use of airspace concept to include airspace users in flight in decision making with respect to tactical assessment of the use of reserved airspace and requirements for transit times of special use airspace.

1.48 Aircraft FMSs can provide information on estimated time enroute for proposed route changes. In addition, data link communication through CPDLC, providing the ability to uplink and downlink flight planning information, can support deployment of integrated decision making.

(GPI-9) SITUATIONAL AWARENESS

Scope: Operational implementation of data link-based surveillance. The implementation of equipment to allow traffic information to be displayed in aircraft supporting implementation of conflict prediction and collaboration between flight crew and the ATM system. Improve situational awareness in the cockpit by making available electronic terrain and obstacle data of required quality.

Related ATM objectives: application of data link; Functional integration of ground systems with airborne ; ADS; ADS-B; SSR Mode S

Description of strategy

1.49 The further implementation of enhanced surveillance techniques (ADS-C or ADS-B) will allow reductions in separation minima and an enhancement of safety, increase in capacity, improved flight efficiency, all on a cost-effective basis. These benefits may be achieved by bringing surveillance to areas where there is no primary or secondary radar, when cost-benefit models warrant it. In airspaces where radar is used, enhanced surveillance can bring further reductions in aircraft separation minima and improve, in high traffic density areas, the quality of surveillance information both on the ground and in the air, thereby increasing safety levels. The implementation of sets of quality assured electronic terrain and obstacle data necessary to support the ground proximity warning systems with forward looking terrain avoidance function as well as minimum safe altitude warning (MSAW) system will benefit safety substantially.

1.50 Implementation of surveillance systems for surface movement at aerodromes where weather conditions and capacity warrant will also enhance safety and efficiency while implementation of cockpit display of traffic information and associated procedures will enable pilot participation in the ATM system and improve safety through greater situational awareness.

1.51 In remote and oceanic airspace where ADS-C is used, FANS capabilities exist on many air transport aircraft and could be added to business aircraft. ADS-B can be used to enhance traffic surveillance in domestic airspace. in this respect, it should be noted that 1090 extended squitter is both available and should be accepted as the global choice for the ADS-B data link.

1.52 At terminal areas and at aerodromes surrounded by significant terrain and obstacles, the availability of quality assured terrain and obstacle databases containing digital sets of data representing terrain surface in the form of continuous elevation values and digital sets of obstacle data of features, having vertical significance in relation to adjacent and surrounding features considered hazardous to air navigation, will improve situational awareness and contribute to the overall reduction of the number of controlled flight into terrain related accidents.

(GPI-10) TERMINAL AREA DESIGN AND MANAGEMENT

Scope: The optimization of the terminal control area (TMA) through improved design and management techniques.

Related ATM objectives: Application of RNP; Functional integration of ground systems with airborne systems; Independent IFR approaches to closely spaced runways; Curved and segmented approaches; Application of data link; WGS-84

Description of strategy

1.53 There are many ways that a well designed and managed TMA can have an important impact on safety, capacity and efficiency. TMA design should be implemented uniformly across all TMAs within a State or Region and should provide benefits while minimizing pilot/controller communications and optimizing pilot and controller workload. TMA arrival acceptance rates should be based tactically on a collaborative decision-making process involving tower, TMA and en-route sectors, while strategically involving airspace users, to ensure optimum traffic handling.

1.54 The enhancement of TMA management includes:

1) Complete the implementation of WGS-84 (see WGS-84, paragraph 1.89 below);
2) Develop and implement RNAV approach and departure procedures (see also Performance-based navigation in paragraph 1.32 above);
3) Implement RNP-based RNAV procedures (see also Performance-based navigation in paragraph 1.32 above);
4) Implement optimized arrival procedures; and
5) Enhance traffic and capacity management.

1.55 The implementation of dynamic TMA management procedures may comprise several elements such as dynamic wake vortex detection and mitigation, and collaborative capacity management (see Capacity management at paragraph X.X above).

1.56 At those locations where a business case supports implementation, decision support tools should be developed and implemented to provide a more structured and efficient management of arrival and departure traffic flows and more efficient use of the runway(s); more fuel-efficient trajectories and reduced noise exposure.

(GPI-11) RNP AND RNAV STANDARD INSTRUMENT DEPARTURES (SIDS) AND STANDARD TERMINAL ARRIVALS (STARS)

Scope: The optimization of the terminal control area (TMA) through implementation of RNP and RNAV SIDs and STARs.

Related ATM objectives: Application of RNP; Functional integration of ground systems with airborne systems; RNAV SIDs and STARs; Curved and segmented approaches

Description of strategy

1.57 The implementation of optimized standard instrument departures (SIDs), standard instrument arrivals (STARs), instrument flight procedures, holding, approach and associated procedures, taking advantage of aircraft navigation capabilities such as RNP and RNAV, as well as ATM decision support systems, will improve capacity and efficiency substantially.

1.58 The use of SIDs and STARs, will maximize system capacity and predictability while easing the environmental impact, reducing fuel consumption, and reducing ATS coordination. States should take advantage of the performance characteristics that are currently available to design such route structures. Near-term benefits can be achieved by applying RNAV 5, 2 and 1 criteria to the design of SIDs and STARs allowing optimum spacing between the routes leading to greater capacity and efficiency benefits (see paragraph 1.3.2).

1.59 SIDs and STARs allow the efficient transit of aircraft from the runway to enroute flight and vice versa; the segregation of departing traffic from arriving traffic to provide safe aircraft spacing; the maintaining of obstacle clearance requirements; the meeting of environmental requirements; and provision of a predictable flight trajectory compatible with aircraft RNAV systems.

(GPI-12) FLIGHT MANAGEMENT SYSTEM (FMS)-BASED ARRIVAL PROCEDURES

Scope: The optimization of the terminal control area (TMA) to provide for more fuel efficient aircraft operations through FMS-based arrival procedures

Related ATM objectives: Functional integration of ground systems with airborne systems; RNAV SIDs and STARs; Curved and segmented approaches; Arrival metering, sequencing and spacing; Application of data link

Description of strategy

1.60 In recent years there have been several efforts to develop flight procedures that provide the most efficient trajectory during an aircraft's approach to the destination aerodrome. These procedures allow an uninterrupted flight trajectory from top of descent until the aircraft is stabilized for landing. For the purposes of design work, it may be necessary to implement these procedures in phases.

1.61 Continuous descent arrival (CDARR) is an unimpeded, low thrust vertical descent from an aircraft's commencement of descent until established on the continuous descent approach (CDAPP); CDAPP is an unimpeded, low thrust vertical descent from an appropriate intermediate altitude above the aerodrome elevation and within an appropriate distance from the landing runway threshold until the aircraft is configured for landing. A continuous descent final approach (CDFA) is a descent from a final approach fix to landing which is conducted in a continuous descent in a stabilized manner.

1.62 The design of en-route and arrival air routes and associated procedures should facilitate the routine use of continuous descent procedures. Similarly, the design of departure procedures should facilitate the routine use of unrestricted climb procedures.

(GPI-13) AERODROME DESIGN AND MANAGEMENT

Scope: The implementation of management and design strategies to improve movement area utilization.

Related ATM objectives: nil

Description of strategy

1.63 Improved design and management activities, including coordination and collaboration between ATM providers, vehicle operators and aircraft operators can have an important impact on safety and capacity at aerodromes.

1.64 In most cases, the operation of the parking areas at an aerodrome is the responsibility of either the aerodrome operator or the aircraft operator. The ability to get an aircraft from its gate to the departure holding position, or from the exit taxiway to its gate, is critical to meeting performance expectations. Efficient use of parking areas requires coordination between all parties. A surface traffic management function would also address the movement of ground vehicles on the maneuvering area.

1.65 At many locations, aerodrome structural improvements will result in significant efficiency gains. These include, the installation of additional taxiways, parallel taxiways to main runways for two-way traffic flow to and from runways, additional runway exits including high speed or rapid exit taxiways and improved lighting and signage.

1.66 Local collaborative decision-making processes should lead to sharing of key flight scheduling data that would enable all participants (aerodrome, ATC, ATFM, aircraft operators, ground handling) to improve their awareness of aircraft status throughout the “turn around” process. This will allow minimal and precise ATFM measures to be applied and higher predictability of schedules to be achieved. Benefits would include more efficient use of aerodrome resources and ground handling, reduction in delays and higher predictability of schedules.

(GPI-14) RUNWAY OPERATIONS

Scope: Reduce runway occupancy times.

Related ATM objectives: A-SMGCS

Description of strategy

1.67 Enhancing the performance of runway operations begins with the establishment of runway capacity benchmarks which are usually defined as the maximum number of flights an aerodrome can routinely handle in an hour for above Category I weather minimum. These benchmarks are estimates that vary with runway configurations and the mix of aircraft types. It should be an objective to utilize aircraft capabilities and available runways in the most appropriate manner to move the all weather throughput as close to the visual throughput as possible.

1.68 Achieving the optimum capacity for each runway is a complex task involving many factors, both tactical and strategic. In order to effectively manage that task it is essential to measure the effects of changes and to monitor performance of the airspace users and ATM providers. The latter case will be applicable to the analysis of pilot and controller performance and must recognize the requirement to maintain the confidence of the users and to work within the existing culture of safety. A system of performance indicators that forms the basis of measurements and analyses should be devised. Tactical factors affecting runway occupancy include flight operations and ATM factors. The flight operations aspects include operator performance; effects of company procedures; use of the airfield infrastructure; and aircraft performance issues.

1.69 Runway capacity constraints are defined by procedures, surface area design, aircraft performance capabilities, surveillance capabilities, aircraft spacing, and weather limitations. Improved procedures for minimizing spacing such as reduced runway separation, precision runway monitoring (PRM) and RNP RNAV approaches for closely-spaced parallel runways will optimize spacing capability.

(GPI-15) MATCH IMC AND VMC OPERATING CAPACITY

Scope: Improve the ability of aircraft to manoeuvre on the aerodrome surface in adverse weather conditions.

Related ATM objectives: A-SMGCS

Description of strategy

1.70 It should be an objective of the ATM system to utilize all airborne and service provision capabilities to maintain VMC capacity during IMC conditions to the greatest practical extent. More use should be made of the capability of modern aircraft systems and ground systems in evolving toward this objective. Taxiway design and guidance capability should then be matched to those conditions.

1.71 Implementation of A-SMGCS, decision support tools and associated procedures offer the best solution for aircraft to operate in all weather conditions. At those locations where benefit/cost analysis indicate a positive value, the improved guidance and control of taxiing aircraft and moving vehicles on the movement area as well as impending conflict alert may be fully automated.

1.72 Synthetic vision, based on detailed aerodrome map, can enhance situational awareness under adverse weather conditions where runway/taxiway markings may be obscured. Head-up display and guidance systems that can synthesize enhanced vision sensor data and synthetic vision images can offer an integrated solution to enhance situational awareness.

1.73 Enhanced conflict detection and alerting technologies and procedures will improve the aerodrome surface movement throughput while meeting established levels of safety. Controllers should also have access to systems to help them develop and maintain situational awareness of all traffic on the movement area in all weather conditions.

(GPI-16) DECISION SUPPORT AND ALERTING SYSTEMS

Scope: Implement decision support tools to assist air traffic controllers and pilots in detecting and resolving air traffic conflicts and in improving traffic flow

Related ATM objectives: Minimum safe altitude warning; Conflict prediction; Conflict alert; Conflict resolution advice; Trajectory conformance monitoring; Functional integration of ground systems with airborne systems

Description of strategy

1.74 Decision support systems facilitate early resolution of potential conflicts, provide basic levels of explorative probing to optimize strategies and reduce the need for tactical action. The executive role of controllers is thereby enhanced, giving scope for management of more traffic within acceptable workload limits.

1.75 Several tools are available that have the ability to substantially enhance safety. These include minimum safe altitude warning systems, short term conflict alert and runway incursion alerting tools. Tools that can improve efficiency include automated flight data processing systems, longer term conflict prediction and sequencing tools and online data interchange systems.

1.76 Conflict prediction tools span several sectors and permit improved sectoral planning, thereby providing the advantage of more expeditious traffic flow and less potential conflicts within established arrival schedules. This will allow sector teams to operate more effectively and will result in more optimum and efficient arrival flows.

1.77 The automation of coordination tasks between adjacent sectors improves the quality of information on traffic transiting between sectors and makes it more predictable, thereby allowing reduced separation minima, decreased workload, and increased capacity and more efficient flight operations.

(GPI-17) IMPLEMENTATION OF DATA LINK APPLICATIONS

Scope: Increase the use of data link applications.

Related ATM objectives: Application of data link; Functional integration of ground systems; with airborne systems; ATS inter-facility data communication (AIDC)

Description of strategy

1.78 The implementation of less complex data link services (e.g. pre-departure clearance, oceanic clearance, D-ATIS, automatic position reporting, etc) can bring immediate efficiency benefits to the provision of ATS. Transition to the use of data link communications for more complex safety related uses that take advantage of a wide variety of Controller Pilot Datalink Communication (CPDLC) messages, including ATC clearances is already being successfully implemented.

1.79 Use of CPDLC and implementation of other data link applications can bring significant advantages in terms of workload and safety over voice communication for both pilots and controllers. In particular, they can provide efficient linkages between ground and airborne systems, improved handling and transfer of data, reduced channel congestion, reduced communication errors, interoperable communication media and reduced workload. The reduction of workload per flight translates into capacity increases and enhances safety.

1.80 Communication data link and data link surveillance technologies and applications must be selected and harmonized for seamless and interoperable global operations. ADS-C, ADS-B and CPDLC are in service in various regions of the world but lack global harmonization. Current regional initiatives, including utilizing unique message subsets and CPDLC procedures, hinder efficient development and acceptance for global aircraft operations. Existing and emerging technologies should be implemented in a harmonized global manner in the near term to support long-term goals. Harmonization will define global equipage requirements and therefore minimize user investment.

1.81 FANS-1/A and ATN applications support similar functionality, but with different avionics requirements. Many internationally operated aircraft are equipped with FANS-1/A avionics initially to take advantage of data link services offered in certain oceanic and remote regions. FANS-1/A equipage on international business aviation aircraft is underway and is expected to increase.

(GPI-18) AERONAUTICAL INFORMATION

Scope: To make available in real-time, quality assured electronic information (aeronautical, terrain and obstacle).

Related ATM objectives: Functional integration of ground systems with airborne systems; ATS-inter-facility (AIDC) communications

Description of strategy

1.82 RNAV, RNP, computer-based navigation systems and ATM requirements introduced a need for new corresponding AIS requirements for quality and timeliness of information. To be able to cope and manage the provision of information and satisfy these new requirements, the traditional role of aeronautical information service will change into an information management service with changing duties and responsibilities.

Electronic information

1.83 To facilitate coordination, improve efficiency and safety and ensure that the ATM Community shares the same information when collaborating on decisions, availability, in real-time, of quality assured electronic information (aeronautical, terrain and obstacle) is essential. Electronic information will enhance pilots' situational awareness during enroute, terminal and aerodrome operations by loading onboard equipment with geo-referenced data sets containing enroute, terminal and aerodrome information. The same information may be made available at different ATC positions, pre-flight planning units as well as for access by airlines flight planning departments or private/general aviation users. The electronic information can be tailored and formatted so that it satisfies ATM user requirements and applications. Standardized data formats will be used in creating the information databases which will then be populated with quality assured data sets.

(GPI-19) METEOROLOGICAL SYSTEMS

Objective: To improve the availability of meteorological information in support of a seamless global ATM system.

Related ATM objectives: nil

Description of strategy

1.84 Enhancements of the World Area Forecast System (WAFS), the International Airways Volcano Watch (IAVW) and the ICAO tropical cyclone warning system to improve the accuracy, timeliness and usefulness of the products issued will facilitate optimization of the use of airspace. Increasing use of data-link to downlink and uplink meteorological information to assist in the automatic sequencing of aircraft on approach will contribute to the maximization of capacity.

1.85 The global ATM system will require immediate access to real-time, global meteorological information. Such stringent requirements will dictate that most meteorological systems must be automated. Automatic downlink of MET information included in ADS messages will provide accurate upper wind fields and real-time wind profiles. The use of data-link to uplink information related to meteorological conditions to aircraft on approach and departure should increase, including the implementation of Digital-Automatic Terminal Information Service (D-ATIS) and D-VOLMET.

1.86 The foregoing enhancements will provide ATC units with access to accurate background upper wind fields for display, both in the form of WAFS global upper wind forecasts and “real-time” wind fields and wind profiles derived from the wind information reported automatically by aircraft using automatic dependent surveillance (ADS), and to reports and forecasts of hazardous weather, particularly volcanic ash, tropical cyclones, thunderstorms, clear-air turbulence, icing and wind shear. This information will assist ATM in tactical decision-making for aircraft surveillance, air traffic flow management, and flexible/dynamic aircraft routing, and will contribute to the optimization of the use of airspace.

1.87 To achieve this, States and regions will have to implement the following improvements in accordance with planned dates:

1) *WAFS*: binary universal form for the representation of meteorological data (BUFR)-coded significant weather (SIGWX) forecasts; improvements to the spatial and temporal resolutions of WAFS forecasts; and GRIB2-coded forecasts of turbulence, icing and convective clouds

2) *IAVW:* selected State volcano logical observatories

3) *Tropical cyclone* (TC) warning system: graphical tropical cyclone advisories

4) *Data link:* ICAO provisions related to the use of data link taking due account of the implementation of ADS and SSR Mode S data link; replacement of VOLMET broadcasts by D-VOLMET in the regions where appropriate data link communications are available.

(GPI-20) WGS-84

Objective: The implementation of WGS-84 by all States.

Related ATM objectives: Implementation of WGS-84

Description of strategy

1.88 The geographical coordinates used across various States in the world to determine the position of runways, obstacles, aerodromes, navigation aids and ATS routes are based on a wide variety of local geodetic reference systems. With the introduction of RNAV, the problem of having geographical coordinates referenced to local geodetic datum's is more evident and has clearly shown the need for a universal geodetic reference system. ICAO, to address this issue, adopted in 1994 the World Geodetic System – 1984 (WGS-84) as a common horizontal geodetic reference system for air navigation with an applicability date of 1 January 1998.

1.89 Fundamental to the implementation of GNSS is the use of a common geographical reference system. ICAO adopted the WGS-84 Geodetic Reference System as that datum, and many States have implemented, or are implementing the system. Failure to implement, or a decision to use an alternative reference system will create a seam in ATM service, and will delay the full realization of GNSS benefits. Completion of the implementation of the WGS-84 Geodetic Reference System is a prerequisite for a number of ATM enhancements, including GNSS.

(GPI-21) NAVIGATION SYSTEMS

Scope: Enable the introduction and evolution of performance-based navigation supported by a robust navigation infrastructure providing an accurate, reliable and seamless global positioning capability.

Related ATM objectives: WGS-84; NPA; Precision approach; Required navigation performance

Description of strategy

1.90 Airspace users need a globally interoperable navigational infrastructure that delivers benefits in safety, efficiency and capacity. Aircraft navigation should be straight-forward and conducted to the highest level of accuracy supported by the infrastructure.

1.91 To meet those needs, the progressive introduction of performance-based navigation must be supported by an appropriate navigation infrastructure consisting of an appropriate combination of global navigation satellite systems (GNSS), self-contained navigation systems (inertial navigation system) and conventional ground-based navigation aids.

1.92 GNSS provides standardised positioning information to the aircraft systems to support precise navigation globally. One global navigation system will help support a standardisation of procedures and cockpit displays coupled with a minimum set of avionics, maintenance and training requirements. Thus, the ultimate goal is a transition to GNSS that would eliminate the requirement for ground-based aids, although the vulnerability of GNSS to interference may require the retention of some ground aids in specific areas.

1.93 GNSS-centered performance-based navigation enables a seamless, harmonised and cost effective navigational service from departure to final approach that will provide benefits in safety, efficiency and capacity.

1.94 GNSS implementation will be carried out in an evolutionary manner, allowing gradual system improvements to be introduced. Near-term applications of GNSS are intended to enable the early introduction of satellite-based area navigation without any infrastructure investment, using the core satellite constellations and integrated multisensor airborne systems. The use of these systems already allows for increased reliability of non-precision approach operations at some airports.

1.95 Medium/longer term applications will make use of existing and future satellite navigation systems with some type of augmentation, or combination of augmentations required for operation in a particular phase of flight.

(GPI-22) COMMUNICATION NETWORK INFRASTRUCTURE

Scope: To evolve the aeronautical mobile and fixed communication infrastructure, supporting both voice and data communications, accommodating new functions as well as providing the adequate capacity and quality of service to support ATM requirements.

Related ATM objectives: AMSS; HF data; VHF data; SSR Mode S; ATN

Description of strategy

1.96 ATM depends extensively and increasingly on the availability of real-time or near real-time, relevant, accurate, accredited and quality-assured information to make informed decisions. The timely availability of appropriate aeronautical mobile and fixed communication capabilities (voice and data) to accommodate ATM requirements and to provide the adequate capacity and quality of service requirements is essential. The aeronautical communication network infrastructure should accommodate the growing need for information collection and exchange within a transparent network in which all stakeholders can participate.

1.97 The gradual introduction of performance-based SARPs, system-level and functional requirements will allow the increased use of commercially available voice and data telecommunication technologies and services. In the framework of this strategy, States should, to the maximum extent possible, take advantage of appropriate technologies, services and products offered by the telecommunication industry.

1.98 Considering the fundamental role of communications in aviation as an enabler, the common objective is to seek the most efficient communication network service providing the desired services with the required performance and interoperability required for aviation safety levels at minimum cost.

(GPI-23) AERONAUTICAL RADIO SPECTRUM

Scope: Timely and continuing availability of adequate radio spectrum, on a global basis, to provide viable air navigation services (communication, navigation and surveillance).

Related ATM objectives: nil

Description of strategy

1.99 States need to address all regulatory aspects on aeronautical matters on the agendas for ITU World Radiocommunication Conferences (WRC). Particular attention is drawn to the need to maintain the current spectrum allocations to aeronautical services.

1.100 The radio spectrum is a scarce natural resource with finite capacity for which demand from all users (aeronautical and non-aeronautical) is constantly increasing. Thus, the ICAO strategy on aeronautical radio spectrum, aims at long-term protection of adequate aeronautical spectrum for all radio communication, surveillance and radio navigation systems. The process of international coordination taking place in the International Telecommunication Union (ITU), obliges all spectrum users (i.e. aeronautical and non aeronautical) to continually defend and justify spectrum requirements. Civil aviation operations are expanding globally creating pressure on the already stressed and limited available aeronautical spectrum.

1.101 The framework of this initiative involves the support and dissemination by States of the ICAO quantified and qualified policy statements of requirements for aeronautical radio frequency spectrum agendas for ITU World Radio communication Conferences (WRC). This is necessary to maintain the current spectrum allocations to aeronautical services, ensure the continuing availability of adequate aeronautical radio spectrum and ultimately the viability of existing and new air navigation services globally.

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APPENDIX C

ATM PERFORMANCE OBJECTIVES FOR CAR AND SAM REGIONS

<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><td>TASK</td><td>DESCRIPTION</td><td>START-END</td><td>STATUS</td></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>

<table>
<tr><th colspan="4">IMPLEMENT RNP APPROACHES</th></tr>
<tr><th colspan="4">Benefits</th></tr>
<tr><td>Efficiency
Safety</td><td colspan="3">• Improvements in capacity and efficiency at aerodromes.
• Improvements in safety at aerodromes.</td></tr>
<tr><td colspan="4">Strategy
(2008-2015)</td></tr>
<tr><th>TASK</th><th>DESCRIPTION</th><th>START-END</th><th>STATUS</th></tr>
<tr><td>AOM</td><td>• 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</td><td></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>

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**
~~**ATFM**~~ ***CDM***	• 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 ~~airway~~ *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 **Safety**	• 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; • 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**
~~**ATS**~~ ***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.		

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