



International Civil Aviation Organization 07/04, NORTH AMERICAN, CENTRAL AMERICAN AND CARIBBEAN OFFICE **Twenty-Eighth Eastern Caribbean Working Group Meeting (28 E/CAR WG)** Montserrat, 26 to 30 April 2004

# Agenda Item 3:Specific Air Navigation Activities and Developments3.5Air Traffic Management (ATM)

## ATS OPERATIONAL REQUIREMENTS FOR AUTOMATED SYSTEMS

(Presented by the Secretariat)

SUMMARY									
The working paper presents a regional strategy for ATS operational requirements in the automated systems of the CAR/SAM Regions.									
References:									
<ul> <li>Annex 11, Air Traffic Services</li> <li>Doc 4444, PANS-ATM</li> </ul>									
• Doc 9750, Global Air Navigation Plan for CNS/ATM Systems									
• Report of the Eleventh Air Navigation Conference									
Montreal (22 September to 3 October 2003)									
• Report of GREPECAS 11 Meeting (Manaus, Brazil, 3-7									

## 1. Introduction

December 2002)

1.1 Annex 11, in its Chapter 2 makes reference to the classification of ATS airspace and units related with the provision of these services. In this context, ATS are divided into Alerting Service, Flight Information Service and Air Traffic Control Service (Aerodrome, Approach and Area). The States must publish in their AIP the classification of the airspace, as indicated in the Appendix 4 to this Annex.

1.2 Doc 4444, PANS-ATM in its Chapter 8, addresses several operational applications of the automated systems; and points out the requirement that the radar systems be able to integrate into the automated systems used for ATS provision and that the MULTI - RADAR systems should be able to receive, process and visualize in the screen in an integrated manner, radar data of other radar sensors connected to the system. Additionally, in its Chapter 13, it indicates the capabilities of the automatic dependent surveillance (ADS) as an element that may be integrated to the ATS automated systems.

1.3 The Global Air Navigation Plan for CNS/ATM Systems points out the automated systems as an element that must have the capability to integrate, compile and diffuse the information required for the different elements of the ATM system, which includes the requirement of interoperability of equipments and facilities of the CNS/ATM systems to increase the efficiency of the surveillance systems. 1.4 During the Eleventh Air Navigation Conference (AN-Conf/11), the importance of automated systems in interface with the ADS-B and the exchange of ATS, AIS and MAP information required for all the phases of flight and for all the fields that intervene in traffic flow management were discussed. The consensus of the conference was that the automated systems provide great advantages with an essential importance, which impacts the collaborative decision-making process of the different elements of the ATM system.

1.5 The AN-Conf/11 recognized that the implementation of CNS/ATM technologies should be based on well-developed plans taking into account particular objectives and operational requirements for the ATM system with a gradual, harmonized and evolutionary vision for the interoperability among systems allowing the exchange of data among ATS units (AIDC) and the collaborative decision-making (CDM), as well as to attain the flexible, *seamless* and optimum airspace management, that will additionally increase the ATM safety required levels, as well as the services that will be necessary for the operation of the ATM global system until and beyond year 2025.

1.6 GREPECAS/11 Meeting approved Decisions 11/51 – *Terms of Reference of the ATM Automation Task Force* and 11/52 – *Actions for the Development of ATM Automation.* The terms of reference of the aforementioned task force were approved through the first decision; the second decision suggested the Group to develop a preliminary regional strategy for ATM automation and other related aspects.

1.7 GREPECAS, through its contributory bodies, has also developed several tasks that will provide guidance to the States/International Organizations of the CAR/SAM Regions in planning the ADS, the radar systems data exchange, use of the MSAW and the RVSM operational requirements in the ATS automated systems.

1.8 In the last GREPECAS ATM/CNS/SG/3 meeting, the ATM Committee, based on task ATM-ATS/306 of its work programme approved by the GREPECAS, defined a strategy for the operational requirements of the ATM automation.

## 2 Analysis

2.1 Nowadays many States have implemented several automated technologies with interconnectivity capabilities that facilitate the interaction among the airborne, ground and human elements of the ATM system considering the heterogeneous situation and the evolution of the available ground infrastructure that complies with several user requirements. This advanced solid state technology allows to design equipment with modular manufacturing, which facilitates its maintenance, the application of a bigger number of functions, the inter-operability of systems as well as the reduction of operation costs; which means a higher versatility and operational-technical function.

2.2 ATS automated systems also facilitate the integration of dverse information sources. The multitracking function or mosaic display of the radar data processing system (RDPS) allows to view in the screen of an ATS unit all the aircraft flying on airspace with radar coverage from different facilities; the radar signals may be transmitted through different channels as telephone cable, optic fiber and/or modem, depending on the technical characteristics.

2.3 For the implementation and integration of ATM automated systems, it is advisable to carry out a strategy for ATM operational requirements pointed out in **Appendix** of this Working Paper, through different complementary activities as the specification, design and planning the future ATM system starting with the identification of expectations of the ATM community, as well as the

development of the standards, procedures and guidance material necessary for the functional operation of the ATM system.

2.4 A framework is very useful for this strategy in order to describe and coordinate the activities that are inter-related in a well-organized and disciplined development process. This ensures that the development of the ATM requirements, standards and procedures is done in a strict and easy to document manner, and to focus all the work on the ATS requirements, as well as the definition of new requirements for an inter-functional ATM global system. The framework may be defined by the following six interactive steps:

- a) **Conceive**. In response to the needs and expectations of the ATM community a conceptual framework is first developed for the operation of the future ATM system.
- b) **Specify**. Functional and system operating requirements are specified.
- c) **Desig**n. A functional framework and system architecture is designed for the delivery of services and the functional integration and interoperability of system components.
- d) **Select**. Service and technology options are selected for development and implementation.
- e) **Deploy**. Plans for services, facilities, and capabilities are developed and the system is implemented.
- f) **Operat**e. The modified and evolved ATM system commences operation.

## ATS Operational Requirements in the automated systems

2.5 ATS automated systems have proven to be a very important element for the future ATM automated environment. The required automation levels should be planned and implemented to the maximum extent with regard to the ATS function provided in the aerodromes and airspace, depending on the classification declared by the State.

2.6 For instance, in an F airspace, IFR and VFR flights are provided Advisory Service and Flight Information Service upon request by the pilot; whereas in a classification C, Air Traffic Control Service is provided to all the IFR and VFR flights; Traffic Avoidance Service, upon request by the pilot, and Traffic Information Service to the VFR flights of other VFR flights. In all lower airspace Alert Service must be provided. The automation of ATS units providing services in this airspace should be planned and implemented in line with the ATC, FIS and SAR functions assigned to the ATS unit.

2.7 Although planning should be done depending on ATM expectations, these may vary from an airspace to another, and from a region to another, other requirements of the elements of the system and of the ATM community should be considered, allowing its interaction in a networked information-rich electronic environment, with real time data and trends and system forecasting data, together with a variety of automated instruments to support the collaborative decision-making process.

2.8 Information services concern the exchange and management of information used by different processes and services among the seven components of the ATM system in order to ensure the required cohesion links. The automated systems should be able to provide information to all the ATM system in order to optimize the capabilities of the services provided to the airspace users.

2.9 In the aeronautical industry, the meteorological weather is also a very important factor that affects air operations like cancellation or delays at a worldwide level. The provision of meteorological information is an integrated function to the ATM system; the automated systems should be adapted in an inter-active manner in order to provide enough meteorological information to fulfill the requirements of the ATM community.

## Collaborative decision-making (CDM)

2.10 The ATM system depends on the fact that associates ensure their operation in accordance with the expectations that the ATM system be safe, efficient, predictable and stable enough to ensure that timely measures may be adopted through the collaborative decision-making and advantageous results may be obtained at a strategic level rather than at a tactical level. The distribution of timely and accurate information plays a key role in the ability of the system to adapt itself dynamically and to start contingency measures. The following are some guidelines to be considered in order to design the system architecture:

- a) *Air traffic management.* the dynamic and integrated air traffic and airspace management, in a safe, economic and efficient manner, through the provision of facilities without interruption, in collaboration with all parties concerned.
- b) **Technology.** Use of advanced information management technologies to functionally combine the ground-based and airborne system elements into a fully-integrated, interoperable and robust ATM system. This allows flexibility across the regions, homogeneous areas or major traffic flows to meet with the requirements of the system.
- c) *Information.* The ATM community depends extensively on the provision of timely, relevant, accurate, accredited and quality-assured information to collaborate and to make informed decisions. When shared on a system-wide basis, information will allow the ATM community to conduct its business and operations in a safe and efficient manner.
- d) *Collaboration*. The ATM system is characterized by strategic and tactical collaboration in which the appropriate members of the ATM community participate in the definition of the types and levels of service. Equally important, the ATM community collaborates to maximize system efficiency by sharing information leading to dynamic and flexible decision-making.

2.11 In a CDM process through automated systems, all the actors are provided with the most accurate available information in order to reduce to its minimum extent uncertainty, to reduce the adverse effects and to mitigate risk, and to provide an additional capability to the system and at the same time optimizing resources for more particular activities. The final objective is that information be completely shared and that the technologies serve to all the users in a profitable manner.

## 3 Conclusion

3.1 Technology in itself has a limited role in the efficiency and capability of the ATM system. The essential is to migrate from a rigid ATC system to the flexible air traffic management; from the unilateral decision making to a form of collaboration through sharing information and data of integrated automated systems. It is obvious that a collaboration approach may attain very important advantages with little investment.

3.2 It is advisable that the ATM community carries out a strategy of the activities in order to determine requirements, coordination and implementation of programmes that facilitate the implementation and integration of the ATS automated systems, through bilateral or multilateral agreements, with a view to an ATM regional automation.

3.3 This strategy should have a gradual, harmonious and evolutionary vision for the interoperability among systems allowing data exchange among ATS units in order to attain a flexible, seamless and optimum airspace management, increasing at the same time the required ATM safety levels.

3.4 To this end, the work developed by GREPECAS contributory bodies on guidelines for the implementation of ATM automation should be considered, as well as aspects for the regional successful development and implementation of the CNS/ATM systems.

3.5 Bearing in mind the background expressed in the paragraphs above, it is suggested that the E/CAR ATM Committee carry out a strategy, as pointed out in **Appendix** of this Working Paper, to determine operational requirements and integration of the ATS automated systems, considering other operational requirements for the ATM regional automation. To this end, it should take into account the following main aspects for regional strategy of operational requirements on ATM automation:

- a) study and adopt actions to develop the regional strategy for ATM automation, based on the conclusions expressed in paragraphs 3.1 to 3.5 of this working paper;
- b) in light of the operational requirements of the global ATM system and of safety, take note of the advantages of the ATS automated systems in processing information for coordinated decision-making;
- c) based on radar surveillance systems and other available ATM supporting technologies, define the required level of integration of ATM automated systems for the optimum, dynamic and flexible airspace management and international aerodromes, in a coherent manner with traffic flows and homogeneous areas;
- d) consider other long-term operational requirements of the ATM community when implementing automated systems, with a view to a regional ATM automation, in accordance with ICAO guidelines;
- e) develop a strategy for the operational integration of ATM automated systems, so that it may be presented to the E/CAR/IWG/29 meeting;
- f) carry on an inter-operable, harmonized, gradual and evolutionary strategy for the operational integration of ATM automated systems in the E/CAR to be included in the CAR/SAM ANP; and
- g) coordinate its work with the ICAO NACC Regional Offices in order to ensure that the integration of ATM automated systems be coherent with the Regional Air Navigation Plan (ANP).

#### 4 Suggested Action.

4.1 The Meeting is suggested to approve the following:

#### DRAFT CONCLUSION 28/XX STRATEGY FOR OPERATIONAL REQUIREMENTS OF AN ATM AUTOMATED SYSTEM

That the ATM Committee of the E/CAR:

- a) develop an action plan to establish ATS operational requirements for the integration of automated systems in the E/CAR, through the strategy pointed out in the Appendix of this Working Paper;
- b) present the action plan in the next E/CAR/IWG meeting; and,
- c) coordinate the action plan with ICAO NACC Regional Office, so as to ensure an harmonious integration of the ATM automated systems in CAR Region to be coherent with the Regional Air Navigation Plan (ANP).

#### APPENDIX

## STRATEGY FOR AN OPERATIONAL INTEGRATION OF THE ATS AUTOMATED SYSTEMS OF THE CAR/SAM REGIONS

**Objective:** Through a committed participation of the States, users and ATS providers of the CAR/SAM Regions,

1) to cooperate jointly in the implementation/integration of technologies for ATM automation, in accordance with ICAO guidelines, considering the best regional and global alternatives;

2) develop a well-balanced strategy for the operational implementation/integration among ATS automated systems with a safe, gradual, harmonious, evolutionary and interoperable vision that facilitates the information exchange and the collaborative decision-making of all the components of the ATM system for a transparent, flexible, optimum and dynamic management of airspace and international aerodromes, and at the same time that it increases the required safety levels.

3) take into account an electronic and network environment, considering the use of ground and spatialbased segments for the ATS information interactive process, under integrity, quality and real-time criteria.

#### FRAMEWORK

a) identify homogeneous areas on the basis of traffic flows operating in the different airspace and international aerodromes;

b) carry out a study on the operational environment scenarios of the air traffic services currently provided and those that are planned;

c) determine the scope, architecture design, characteristics and attributes of the operational requirements for the short-term integration of the current automated systems of the ATS units depending on the current provided service levels, as well as other operational requirements that respond to future expectations of the components of the ATM system, considering;

• \	.1	• . •	1 . 1		.1 1 .	1 C 11	•	
1)	arrange the red	nurements in	lomeal	sequence	through t	he toll	$\alpha$	eta nec ·
1)	analige the rec	juncinents m	logical	sequence	unougn i		JWING	stages,
	0		0		0		0	0 /

Phase	Function						
Phase I	- Flight Data Processing System (FDPS)						
Phase II	- ATS Radar Data Processing System (RDPS/, ADS);						
	mono-radar;						
	multi-radar/multi-tracking;						
	radar data sharing.						
Phase III	- Automated digital communications (Automated traffic hand off,						
	AIDC/ CPDLC, etc).						
Phase IV	- Implementation of CDM aspects (Collaborative Decision Making) for						
	other ATM requirements (AOM [Airspace Organization and						
	Management], CM [conflict management], DCB [Demand/Capacity						
	Balancing], AO [Aerodrome Operation], TS [Traffic Synchronization],						
	AUO [Airspace User Operation], ASDM [ATM Service Demand]						
	Management], AIS, MET, statistics, etc)						

NOTE: SAR should be considered in all the stages in all the lower airspace.

ii) identify the ATS functions required in the airspace and international aerodromes as follows:

ATS Operational functions required in the automated systems							
APPLICABLE ATS FUNCTIONS	۸	R			ace F	F	C
Identification	Π	D	C		L	<b>T</b> .	U
Separation							
Nevigation guide							
Surveillence							
Transfor							
Coordination							
Luformation of flight							
plane in real time							
Visualization of the							
visualization of the							
geographical position							
(longitudo latitudo							
history)							
Statistical data of flight							
plans (past and							
forecasted							
information)							
Radar data processing							
system (RDPS)							
Flight data processing							
system (FDPS)							
ATS inter-facility data							
communications							
(AIDC)							
Controller-pilot data							
link communications							
(CPDLC)							
Flight profile							
information (altitude,							
vertical speed, offset							
speed, predictive							
vector, turn angle, etc.)							
Automatic alerts							
(STCA, MSAW,							
DIAW, emergency,							
communication failure,							
unlawful interference,							
etc.)							

ATS Operational functions required in the automated systems (ATC, FIS, SAR)							
APPLICABLE	PPLICABLE ATS Airspace						
ATS FUNCTIONS	Α	B	С	D	Ε	F	G
AIS Interface							
Meteorological							
information							

iii) define the incoming and outgoing data, and functional interfaces data applicable to functions and sub-functions of the service;

iv) define from the highest to lowest level the functional decompositions for all the ATM components;

v) successively determine the different operational applications from the functional level or lowest interface to the upper interface;

vi) define the current and future operational applications needs;

- vii) determine the short-term operational requirements; and
- viii) determine the future operational requirements.

d) determine the existing facilities and technological equipments in the CAR/SAM Regions, as well as the inter-operability technical requirements, data bases, equipped aircraft, software tools, etc., required for the implementation/integration of automated systems;

e) develop a cost-benefit analysis for the implementation/integration of ATM automated systems;

f) establish bilateral and multilateral agreements as appropriate, among States/Territories/International Organizations of adjacent airspace and regions for trials and the operational implementation/integration of ATS automated systems;

g) develop standards, procedures and guidance material (among which the Interphase Control Document (ICD) for data communications and the common coordination among ATM centres, document based on SARPs) required for the functional operation of ATS automated systems, including the critical contingency cases, so that it may be helpful for users;

h) take the necessary measures for human resources training on a national and regional basis and allowing the facilitation of the implementation/integration of ATS automated systems;

i) identify other potential benefits for the ATM community that may be obtained in the long-term; and

j) assess and document all the available information in order to establish an action plan for the regional implementation/integration of ATS automated systems on 31 March 2008.