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Agenda Item 3: Activities for the development of the air navigation systems/services
3.4 CNS/ATM

PLANNING AND IMPLEMENTATION OF THE CNS/ATM SYSTEMS

(Presented by the Secretariat)

SUMMARY

This working paper submits for consideration by the C/CAR Working Group, sub-regional actions for planning and implementation of the CNS/ATM systems.

References:

- Report of the Fourth Central Caribbean Working Group Meeting (Santo Domingo, Dominican Republic, February 2004).
- Report of the C/CAR DCA/7 Meeting (San Juan, Puerto Rico, 28 June to 01 July 2004).
- Reports of the GREPECAS/11 and GREPECAS/12 Meetings.
- Global Plan of air navigation for CNS/ATM systems. Second edition – 2000 – Doc 9750 – AN/963.
- ICAO State Letter AN 1/63-04/96, dated 30 November 2004.
- National Plan for the CNS/ATM Systems – ICAO Circular 278-AN/164.

1. Introduction

1.1 In accordance to the Global Plan of air navigation for the CNS/ATM systems and the CAR/SAM Regional Air Navigation Plan, in order to progress in the planning and implementation of the CNS/ATM systems and taking advantage of the technological developments evolution to satisfy civil aviation requirements improving the efficiency, safety and regularity, the establishment and execution of action plans are necessary.

1.2 Working papers WP/05, WP/06 and WP/07 deal with issues on the implementation of ATM and CNS elements. This paper deals with those issues on planning and implementation that for the moment require a CNS/ATM joint treatment.

1.3 ICAO State Letter, Ref.: AN 1/63-04/96, dated 30 November 2004 informed the Sates the amendments to Resolution A33-15 of the 35th Session of the ICAO General Assembly, corresponding to the consolidated statement of the ICAO policies and practices related to a global air traffic management (ATM) system and to the communications, navigation and surveillance/air traffic management (CNS/ATM) systems.

1.4 Based on the mentioned Resolution A35-15, international contribution to favour the evolution of the ICAO CNS/ATM systems is required, in order to ensure that the systems become seamless and interoperable and contribute to a global, seamless ATM system allowing adaptation to efficiently meet regional and local needs.

2. **Discussion**

2.1 In reference to paragraphs 1.1 to 1.4 to this paper, it is suggested that the Meeting analyse the status of development of the following relevant CNS issues and review and develop relevant sub-regional action plans which contribute to the coordination and implementation of these systems:

Studies on the implementation of the ADS and ADS-B

2.2. In accordance with paragraph 3.2.3.46 of Agenda Item 3 of the GREPECAS/12 Meeting Report, GREPECAS noted that in the CAR/SAM FASID (Table CNS 4A), the requirements do not yet appear for ADS and ADS-B surveillance functions. In this respect, it was observed that there are plans in various CAR/SAM States/Territories/International Organizations for the future implementation of these surveillance functions. In this context, the GREPECAS/12 Meeting took note of the need to include ADS requirements in the FASID, but that this required a definition of operational requirements.

ADS System

2.3 It should be reminded that automatic dependent surveillance (ADS) is an application for the ATS use in which the aircrafts transmit to the ATC automatically, through the air-ground data communications, information, sufficiently accurate and reliable, derived from the airborne navigations systems. As a minimum those data include the aircraft identification and in three-dimensional position, but additional data may be provided as appropriate. The ATC system would use the ADS data to present information to the controller and it must also have the capacity to exchange messages between the pilot and the controller, through data and voice links, in order to perform emergency and non-routine communications.

2.4 The ADS may provide surveillance services in the following areas:

a) where the current infrastructure lacks of radar surveillance services in particular the oceanic areas and other in which the conventional systems are difficult, very expensive or impossible to implement;
b) in high density air traffic areas where it may serve as an adjunct and/or back-up for the secondary surveillance radar (SSR) thereby reducing the need for primary surveillance radar (PSR); and
c) in some circumstances, it may substitute the secondary radar.

ADS-B system

2.5 The ADS-B is an application of the ADS technique that involves a broadcast of the position information to multiple aircraft or multiple ATM units. Each ADS-B equipped aircraft or ground vehicle periodically broadcasts its position and other relevant data derived from the airborne equipment. All user segment, airborne or on ground within range of this broadcast, can process the information. Nowadays, the ADS-B it defined only for line-of-sight operations (e.g. broadcast over VHF digital link or by Mode S SSR extended squitter). GREPECAS, by its Conclusion 12/44 provided guidance on the

initial usage of the SSR Mode S extended squitter signals for implementation of the ADS-B in the CAR/SAM Regions.

2.6 Well equipped aircrafts with ADS-B can be used:

a. to complete the coverage of SSR (to cover areas without secondary radar coverage);
b. to replace the SSR service in areas with low and medium traffic density;
c. as the basis for a air traffic presentation of the piloting position (CDTI); and
d. for the surface movement, therefore becoming an alternative for the surface radar such as the airport surface detection equipment (ASDE) and the Advanced Surface Movement Guidance and Control System (A-SMGCS).

2.7 The essential technical requirements for the ADS and the ADS-B implementation systems are the following:

Technical requirements for the implementation of the ADS and ADS-B in the short term			
No.	**Technical requirement**	**ADS**	**ADS-B**
1	Position data supplied by the airborne navigational equipment.	✓	✓
2	Message time stamp within one second coordinated universal time (UTC).	✓	✓
3	VHF data communication links by air-ground or bi-directional satellite.	✓	
4	Unidirectional data links by spontaneous extended signals of the SSR in Mode S.		✓
5	A ground infrastructure that provides ATC information.	✓	✓*

2.8 GREPECAS, through its Conclusion 11/50 also adopted the preliminary regional guidelines on the ADS systems, which are presented in Appendix R to Agenda Item 3 of the Report.

Study of the ICAO SARPs and guidance material on ADS and ADNS-B

2.9 ICAO has issued operational guidance material on ADS for air traffic services in Annex 2, Annex 11 and Doc 4444, PANS-ATM as well as in ICAO Circular 226-AN/135. The Operational Data Link Panel (OPLINKP) developed the ADS-B concept, which was adopted by the AN-Conf/11 as a key application of data link for the future ATM system as an integral co-operation and collaboration environment offering new surveillance capabilities for pilots and controllers as well as for other elements of the global ATM community.

2.10 Currently, ICAO is developing work to include additional amendments on ADS-B in several of its documents. The overall intention of these proposals for amendment is to carry out procedures regarding the use of radar and ADS-B as identical as possible. The result of this, from the pilot's and the air traffic controller's perspective, is the provision of a highly up-to-date surveillance system technology. Other tasks assigned by the ANC to the OPLINKP include the operational concept of the Required Communication Performance (RCP), ADS-C, CPDLC and AIDC.

2.11 On the other hand, the Surveillance and Conflict Resolutions Systems Panel (SCRSP) under ANC tasks number CNS-9601 and CNS-9701 is developing new guidelines text and amendments to the existing texts that relate to the ADS-B and the Airborne Separation Assistance System (ASAS), as well as improvements to the SSR Mode S. The amendments to Annex 10 on ADS-B, SSR Mode S and ASAS and related documents are expected to be finalized in the fourth quarter of 2007.

Recommendations for sub-regional actions for the study and implementation of the ADS and ADS-B systems for the "short-term"

2.12 The Meeting should consider and review the following action proposals for the deployment of ADS and ADS-B systems in the Caribbean and Central America for the "short-term" (to implement during the next five years with a useful life for at least 10 years):

a) that ICAO requests IATA information on the currently avionics capacity and on their member airlines plan for the deployment of the use of ADS and ADS-B in the Caribbean and Central America;

b) each State/Territory/International Organization – ACC should,

- taking into account the operational requirements of its airspace, evaluate its respective radar coverage, its radars' useful life and the potentialities of covering empty spaces and substitute or replace the radar coverage with ADS or ADS-B;
- evaluate and plan the existing and future ATC automated systems capacity in order to support ADS or ADS-B systems;
- investigate and evaluate their policies related to the ADS and ADS-B data sharing with their respective neighbouring areas in which the position is provided by the same aircraft instead of being measure by the radars; and
- consider the feasibility to apply ADS-B as a solution to the movement control in the airports surface.

c) The C/CAR Working Group should,

- review the last activities related to the ADS and ADS-B conducted by the States, Territories and International Organizations that have responsibility of the FIRs control;
- identify the areas with more air traffic density, current and foreseen until 2015;
- gather information from the States/Territories/International Organizations on the existing and planned ATC automated systems capacities to support ADS or ADS-B systems; and
- identify the design phases and deployment development of the ADS and ADS-B systems, in order to improve and to extend the surveillance data sharing plan, taking advantage of the ADS or ADS-B systems ground potential stations.

Evolutionary Integration of ATM Automated Systems

2.13 The GREPECAS/12 Meeting held in Havana, Cuba, 3-7 June 2004, formulated through Conclusion 12/31 the *"Regional Strategy for the Integration of ATM Automated Systems"* contained in Appendix K to Agenda item 3 of the GREPECAS/12 Report.

2.14 In the design of these strategies, it was taken into account the need to gradually evolution towards the inter-functional, flexible and adaptable systems for the digital processing of the required information with security, quality, integrity and in real time as a platform for the process of the collaborative decision-making (CDM) in benefit of the global ATM community, as stressed in the ATM operational concept approved by the AN-Conf.-11.

2.15 As a result of its deliberation, the AN-Conf-11 recommended the States to begin the studies of regional implementation according to the ATM planning guidelines and requirements approved by ICAO. In accordance with this recommendation, the CNS, MET, AIS and AGA elements should be taken into account for the design and integration of information and data in the automated systems as an early evolution for the air traffic flow management (ATFM). Some aspects concerning ATFM are the provision of ATM services, the balance between demand and capacity, the traffic synchronization, the operations of the airspace users, aerodromes operations, etc.

2.16 As it may be observed, during the evolutionary application of the ATM automated systems, the integration, utilization and technical infrastructure development, including the communication systems as a support mean, for the operational applications implementation, are very important. In view of the characteristics and evolution of air navigation in the CAR Region, the C/CAR WG should take action towards this regional CNS/ATM evolution.

2.17 Likewise, a technical infrastructure should be available and be used, such as the AFTN plus an Inter-phase Control Document (ICD), in order to begin the evolutionary integration of the ATM automated systems towards the final phases of the ATN ground-ground and air-ground sub-networks implementation, as well as the ATN applications. Based on the previously mentioned and in the strategy for the integration of the ATM automated systems approved by GREPECAS; the Meeting is invited to review the preliminary Guidance on the technical infrastructure which is necessary and should be available during each implementation phase, shown in the **Appendix** to this paper.

Sub-Regional Plan and National Plans for the CNS/ATM Systems

2.18 Conclusion 4/18 – *"C/CAR CNS/ATM Implementation Plan"*, formulated by the C/CAR WG/4 Meeting and approved by the C/CAR DCA/7 Meeting, requested to ICAO to coordinate with the States/Territories to study options, prepare and propose an action plan for the development of a C/CAR CNS/ATM Implementation Plan. In addition, the mentioned conclusion requested ICAO to guide the C/CAR WG in carrying out this task.

2.19 The CNS/ATM Implementation Plan of the Central Caribbean should be harmonized with the CAR/SAM Regional Plan for the Implementation of the CNS/ATM Systems. Developed by the GREPECAS mechanism and approved by the GREPECAS/8 Meeting, the mentioned Plan was incorporated to the Air Navigation Regional Plan by the Third Regional CAR/SAM Air Navigation Meeting, carried out in October 1999. In its last Meeting, GREPECAS updated some regional guidelines on communication, navigation and surveillance elements. For example, based on the AN-Conf/11 results, it updated the Guidelines for the transition to the GNSS, as well as the strategy for the introduction and application of non-visual aids for approach, landing and departure. The CAR/SAM regional plans are being reviewed and developed for the introduction of other CNS/ATM system elements. For example, the ATN and AMHS Plan, the air-ground data communications Plan, the SSR Mode S Plan, the ADS-C and ADS-B systems implementation regional plan and others.

2.20 The C/CAR WG continues its follow-up work to implement the CNS/ATM systems contained in the FASID; studying the feasibility of implementing some elements of the CNS/ATM systems, for example, the new ADS and ADS-B surveillance systems.

2.21 According to that expressed in the above-mentioned paragraphs, the Meeting is suggested to consider that it would be more adequate that the C/CAR Working Group continue its studies on the feasibility of implementing some new CNS/ATM systems, issuing proposals for the amendment to the Regional Plan. Subsequently, in order to also consider the results of the work carried out by GREPECAS, which will have an impact on the Regional Plan update, the C/CAR WG should develop a Central Caribbean CNS/ATM sub-regional Plan.

2.22 On the other hand, the States, Territories and International Organizations should update their regional plans according to the GREPECAS regional work development evolution and based on the work results of the C/CAR WG, approved by the Directors of Civil Aviation .

International Cooperation for the CNS/ATM Systems Implementation

2.23 ICAO recognizes that for a globally coordinated and harmonious implementation and the early realization of benefits to States, users and providers, the technical cooperation in the implementation and efficient operation of CNS/ATM systems is necessary. ICAO also invites States in a position to do so, to provide assistance with respect to technical, financial, managerial, legal and cooperative aspects of implementation.

2.24 The NACC DCA/1 Meeting, held in Grand Cayman, 8-12 October 2003, formulated Conclusion 1/24 - *Instruments for the effective implementation of new Civil Aviation Systems*, guided the States/Territories and International Organizations to: dedicate financial resources to provide the necessary support to the implementation of new civil aviation systems, analyze the feasibility of developing regional technical cooperation projects, consider promoting the international cooperation and bilateral/multilateral agreements, make greater efforts to actively integrate and participate in the CAR/SAM Region Technical Cooperation projects, currently in execution, and propose new projects as consider appropriate.

3. Suggested actions

3.1 The Meeting is invited to:

a) take note of the contents of this working paper;

b) review the studies on the ADS and ADS-B implementation, based on the background and considerations expressed in paragraphs 2.2 to 2.12 of this paper;

c) review the considerations on the evolutionary integration of ATM automated systems presented in paragraphs 2.12 to 2.17 and in the Appendix to this paper;

d) review the considerations on the Sub-regional Plan and the National Plans for the CNS/ATM systems implementation described in paragraphs 2.18 to 2.22;

e) propose actions to establish international cooperation projects, based on the considerations expressed in paragraphs 2.23 to 2.24 of this paper; and

f) propose other actions as deemed appropriate.

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APPENDIX

PRELIMINARY GUIDANCE ON TECHNICAL INFRASTRUCTURE AS SUPPORT OF THE EVOLUTIONARY IMPLEMENTATION OF ATM AUTOMATED SYSTEMS		
Phase	**Function**	**Technical infrastructure available/ necessary**
Phase I	Flight data processing (FDPS, FLP, RPL)	- AFTN
Phase II	ATS radar data processing system (RDPS); Mono-radar; Multi-radar/multitraking; and Radar data sharing.	- AFTN - Communication circuit through the Frame Relay digital networks.
Phase III	Automated digital communication (Automated traffic handoff, AIDC, CPDLC and other.	- AFTN + Regional Interphase Control Document (ICD). - Communication circuit through the Frame Relay digital networks. - AMHS. - ATN Sub-networks ground-to-ground and air-to-ground, using some applications.
Phase IV	Implementation of CDM aspects.	- ATN Sub-networks ground-to-ground and air-to-ground.

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