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North American, Central American and Caribbean Office
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Ocho Rios, Jamaica, 12-16 May 2008

Agenda Item 3 CNS Developments

3.5 Review of the Planning and Implementation of Surveillance Systems and Follow-up to their Respective Action Plan(s).

FOLLOW-UP TO THE SURVEILLANCE IMPLEMENTATION PLAN

(Presented by the Secretariat)

SUMMARY

This working paper presents a summary of aspects related with the implementation of surveillance systems, its considerations and reference, the follow-up activities to action plans, up-date of the respective rules and other related aspects to planning and implementation of these systems.

References:

- Report of the CAR/WG/01 Meeting (Port of Spain, Trinidad and Tobago, 21-23 June 2007)
- Reports of the GREPECAS/12, 13 and 14 Meetings
- Doc 9750 AN/968 - *Global Air Navigation Plan for CNS/ATM Systems*
- Doc 8733 - *Basic Air Navigation Plan - CAR and SAM Regions*

Strategic Objectives:	*This working paper relates to Strategic Objectives A and D.*

1. Introduction

1. Regional plan de Implementation de the Surveillance systems

1.1 As part of the analysis and update made during the CAR/WG/1 Meeting, the Regional Surveillance Plan contained in Table CNS 4A – *Surveillance Systems* of the FASID (Doc 8733) was updated. Likewise, other update to said Table have been included and therefore, it was updated and informed to States through the amendment to the FASID as per State Letter EMX0274 dated 12 March 2008. This update includes different elements of current conclusions such as: GREPECAS Conclusion 14/53, C/CAR DCA Conclusion 8/1, C/CAR WG Conclusion 5/12 and CAR/WG Conclusion 1/5. The updated plan (Table CNS 4A) in shown in Appendix E to IP/10.

1.2 As a result of the work carried out by the CNS Committee and bearing in mind GREPECAS Decision 13/54 and Initiative IPM-09 to the *Global Air Navigation Plan for CNS/ATM Systems*, the following was presented to GREPECAS/14:

a) CAR/SAM Regional Strategy for ADS-C and ADS-B Systems Implementation in the Short, Medium and Long-Term (**Appendix A** to this paper).

b) Preliminary Elements for a Regional Strategy for Surveillance Systems (**Appendix B** to this paper).

1.3 GREPECAS/14 agreed upon the convenience of integrating preliminary elements for a Surveillance regional strategy into a unified regional strategy on the implementation of surveillance systems, a task that will be carried out by the CNS Committee, through its Surveillance Task Force.

1.4 GREPECAS identified potential airspace to implement ADS-C and ADS-B, information reviewed and updated at the NACC/WG/1 Meeting as initiatives for ADS-C and ADS-B display in the CAR/SAM Regions. **Appendix C** to this paper shows an updated table concerning the CAR Region.

1.5 Following the same considerations for the implementation of surveillance systems, ground implementation of Secondary Surveillance Radars (SSR) in S Mode, high traffic density terminal areas and en route should be prioritized and each State/Territory/International Organization should assess the current traffic density at its respective terminal and en route, as well as forecasts for the next ten years and the currently installed SSR at terminal zones life span. In this regard, note should be taken of Mode S transponders of aircraft operating in the CAR Region, applying the procedure established by ICAO for aircraft identification (Address assignment of 24 bits aircraft as indicated in Annex 10, Volume III, Part I, Appendix to Chapter 9 [A worldwide scheme for the allocation, assignment and application of aircraft addresses]). In this regard and in support of the CAR/SAM Regions States/Territories/International Organizations, the GREPECAS CNS/ATM Subgroup CNS Committee has included in its work programme the standardization of register information of 24 bits addresses assignment for the identification of Mode S transponder aircraft.

2. Considerations and References for the Implementation of Surveillance Systems Action Plan

2.1 The following is a summary of the status of SARPs ICAO guidelines as a reference for the implementation of surveillance systems:

- SARPs concerning SSR are described in Annex 10, Vol. IV., guidance material: Doc 9684 - *Manual of the Secondary Surveillance Radar (SSR) Systems*, Doc 9688 - *Manual on Mode S Specific Services*
- ATN SARPs (Doc 9705 and Doc 9739) as well as Doc 9694 - *Manual of Air Traffic Services Data Link Applications* provide guidelines for the use of ADS-C
- Regarding the application of ADS-B, Annex 10, Vol. IV includes the standards to be followed, as well as the following guidance material depending on the transmission means used:

- VDL Mode 4: Doc 9816
- UAT: SARPs part of amendment 82 to Annex 10, Doc 9861 - *Manual on UAT*
- *Extended Squitter* (1090 ES):
  - Version 0 Amendment 77 to Annex 10
  - Version 1 Amendment 82 to Annex 10
    - Doc 9871 - *Mode S and* (under update process)
- Doc 8071 - *Manual on Testing of RadioNavaid*, Vol III, Doc 9863 "ACAS Manual"
- Circular 311 – *Assessment of ADS-B to support Air Traffic Services and guidelines for implementation*, 1st edition.

2.2 The CAR/SAM Regions have defined a surveillance systems implementation strategy as detailed in paragraph 1 to this paper, based on the Regional plan (Table CNS 4A) and bearing in mind the *Global Air Navigation Plan for CNS/ATM Systems* (Doc 9750), in its Global Plan Initiative GPI-09 – *Situational Awareness*, recommending the application of data-based surveillance (ADS-C, ADS-B and Mode S SSR).

2.3 Based on GREPECAS Conclusion 13/87, States/Territories/International Organizations, were urged that, in collaboration with airspace users, an ADS-B trials programme be established and implemented, using the available services and technology in order to improve the knowledge on ADS-B and to assess the benefits for Air Traffic Management in the CAR/SAM Regions. In this regard, the NACC/WG/01 Meeting formulated Conclusion 1/14 - *ADS-B Trials*, urging 1) Cuba to continue its ADS-B trials, 2) Trinidad and Tobago and the United States to establish and implement an ADS-B trials project in the Piarco FIR, c) the other States to participate in the ADS-B trials Project and d) inform their results to the ICAO NACC.

2.4 During the CAR/WG/1 Meeting, information was provided on initiatives taken by several States on ADS-C trials and studies on multilateration, and Conclusions 1/12 - *ADS-C Trials in the CAR Region* and 1/13 - *Application of Multilateration System as a Surveillance Option* were formulated.

2.5 At the GREPECAS/14 Meeting, IATA informed that member airlines were supporting ADS-B implementation. Likewise, IATA informed during the CAR/WG/1 Meeting on the results of a survey on this matter wherein data was provided on available ADS and Mode S capacities in the fleet of various airlines operating in the CAR Region.

2.6 In order to follow-up on the implementation of surveillance systems within the strategy and regional guidelines, CAR/WG/1 Conclusion 1/15 urged States/Territories/International Organizations to review, finalize and implement their national action plans.

ICAO SARPs and Guidance Material Development Status

2.7 Amendment 5 to Doc 4444 - PANS-ATM is valid as at 22 November 2007, which changes promote improvement to safety and efficiency, facilitating the application of available technology concerning a variety of ATS datalink applications, including ADS-B and ADS-C. This amendment also includes operational procedures and phraseology for the use of ADS-B.

2.8 Amendment 82 to Annex 10, in force since November 2007, introduces the following relevant Surveillance aspects:

- Update to texts on SSR in mode S and extended squitter and Airborne collision avoidance system (ACAS);
- SARPs for the universal access transceptor (UAT); and
- Update to SARPs and technical specifications supporting the new version of extended squitter (Version 1 based on DO 260A)

2.9 ICAO Aeronautical Surveillance Panel (ASP), formerly named Surveillance Conflict Resolution Systems Panel (SCRSP) intends to review and update SARPs and relevant guidance material for the implementation of improvement and the future communication systems through its different working groups. The next meeting of this Group (November 2008) will consider the following subjects:

a) draft high-level SARPs for multilateration systems

b) new provisions on required surveillance performance (RSP) and the application of airborne surveillance (regarding the use of ADS-B reports on board aircraft);

c) report on RF pollution study relating to 1030/1090 MHz in light of increased traffic and new systems (e.g. MLAT);

d) consolidation of guidance material on surveillance in a new aeronautical surveillance manual; and

e) update to existing ICAO provisions on surveillance and collision avoidance systems in light of operational experience.

2.10 For further information visit the panel website at: http://www.icao.int/anb/panels/scrsp.

3. Discussion

3.1 Bearing in mind the progress achieved by States/Territories/International Organizations, the Meeting should follow-up on the implementation of surveillance systems in accordance with ICAO strategic objectives, the strategy defined for these systems in the Global Air Navigation Plan, ICAO SARPs and guidelines, as well as the regional GREPECAS guidelines, with regard to the implementation activities of other sub-regional groups. Therefore, this paper suggests the review and follow-up to the following aspects:

Surveillance Systems Regional Implementation Plan

3.2 Bearing in mind the information of areas or potential airspace for the implementation of ADS-C and ADS-B as informed in paragraph 1.4 and Appendix C to this paper, and considering the strategy and guidelines provided in paragraphs 1.2 and 1.3, the Meeting is invited to review and update the information included in Appendix C.

3.3 Taking into account paragraphs 2.1 to 2.5 and 2.7 to 2.10, the Meeting is invited to provide information of its plans, activities and considerations on the implementation of surveillance systems, as well as the progress concerning CAR/WG conclusions 1/12, 1/13 and 1/14.

National Action Plans for Follow-up and Implementation of Surveillance Systems

3.4 Based on CAR/WG Conclusion 1/15, the background and the analysis expressed above, the Meeting is invited to present the States national action plans for the implementation of surveillance systems in accordance with the format recommended by the CAR/WG/1 Meeting.

4. Suggested Actions

4.1 The Meeting is invited to:

a) note the information contained in this working paper;

b) proceed with the actions mentioned in paragraphs 1.1, 1.5, and 3.2 to 3.4 to this paper; and

c) consider and recommend other relevant actions.

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APPENDIX A

CAR/SAM Regional Strategy for ADS-C and ADS-B Systems Implementation

Short-Term (until 2011)

1. The ADS-C surveillance implementation is used in oceanic and remote airspace associated with FANS capacities. The ADS-B surveillance implementation should be prioritize in the continental airspaces where there is no radar surveillance available, taking into consideration the density of traffic, the operational requirements and aircrafts capability. Also, consideration should be given to the potentialities to complement or replace the SSR in a scarcely to medium traffic density area, for route surveillance, in terminal areas, for surface movement control (ADS-B) and other applications.
2. Each State/Territory/International Organization needs to evaluate the: maximum density traffic nowadays and expected for the year 2015. The useful life of their radars and the potentiality for their replacement with ADS-B, the locations of potential ADS-C or ADS-B ground station sites, and the capabilities of existing and planned ATC automation systems to support the ADS-C or ADS-B.
3. The proportions of equipped aircrafts are also critical for the ADS-C and ADS-B deployment, for which it is required to periodically provide, al least, the following information: number of equipped aircrafts operating in the concern airspace, number and name of the airlines that have equipped aircrafts for ADS-C and ADS-B, type of equipped aircrafts, categorization of the accuracy/integrity data available in the aircrafts.
4. The ADS-B deployment should be associated at early stages in coordination with the States/Territory/International Organizations responsible for the control of adjacent areas, and the correspondent ICAO Regional Office, establishing a plan in the potential areas of ADS-B data sharing, aimed at a coordinated, harmonious and interoperable implementation.
5. Each State/Territory/Organization should investigate and report their own Administration's policy in respect to the ADS-B data sharing with their neighbours and from cooperative goals.
6. The ADS-B data sharing plan should be based selecting centres by pairs and analyzing the benefits and formulating proposals for the ADS-B use for each pair of centre/city with the purpose to improve the surveillance capacity.
7. Likewise, it is necessary to consider implementing surveillance solutions for surface movement control by the implementation of ADS-B.
8. To support the ADS-C and ADS-B regional plan, the States/Territories/International organizations, as well as the entity representing the airspace users, should organized and provide the following information; a focal point of contact, its respective implementation plan, including a time-table, and information on its air-ground communications and automation systems.
9. The ADS-B data links technology that will be use for the Mode S 1,090 MHz extended squitter to (1090 ES). Likewise, al the end of the medium term the introduction of ADS-B data sharing could be initiated and be approved by ICAO for its use in a long-term to satisfy the new requirements of the global ATM system.
10. The implementation would be in conformity with the SARPs, ICAO guidelines and the GREPECAS conclusions.

Medium-Term (2011 – 2015)

11. Continuation of the ADS-B use with the 1090 ES technique and the planning initiation for the ADS-B implementation by new data links to satisfy the ATM global system requirements.

Long-Term (From 2015 to 2025)

12. The planning and implementation would be carried out according to the ADS and ADS-B evolution, with the associated technology developments, in accordance with the global ATM systems, with the new SARPs and ICAO guidance.

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APPENDIX B

DRAFT ELEMENTS FOR A REGIONAL STRATEGY FOR SURVEILLANCE SYSTEMS

- **Short term: (until 2011)**

Installation of surveillance systems on ground

- Implementation of SSR radars Mode S only in high-traffic-density approach, en route, and terminal areas,
- Implementation of monopulse SSR, adaptable to Mode S, in medium- and high-traffic en route and terminal areas.
- Begin ground implementation for ADS-B (ES Mode S receivers) for en route and terminal areas not covered with radar, and strengthen surveillance in areas covered with SSR Modes A/C and S.
- Begin the implementation of multilateration, where aircraft respond to SSR Mode A/C or SSR Mode S queries for aerodrome surface movement surveillance

Aircraft

- Assignment of *24-bit addressing for unique aircraft identification*
- Complete the implementation of ACAS II systems throughout commercial and general aviation. Use of basic Mode S transponder
- Begin the update of Mode S transponder so that it can operate in ADS-B and multilateration environments

- **Medium term: (2011 – 2015)**

Installation of surveillance systems on ground

- Implementation of Mode S in those monopulse SSRs that have Mode S capabilities, in areas with coverage and increased air traffic.
- SSR Mode A/C and SSR Mode S continue to be the main surveillance elements for approach, en route, and terminal areas.
- Increase ADS-B installations on ground (ES Mode S receivers) for en route and terminal areas not covered by radar, and strengthen surveillance in areas covered by SSR Mode A/C and SSR Mode S.
- Increase the implementation of multilateration, where aircraft respond to SSR Modes A/C and S queries for surveillance of aerodrome surface movements, and begin the implementation of surveillance applications in approach, en route and terminal areas (wide area multilateration, WAM) in areas that are not covered by radar surveillance and to strengthen radar surveillance

Aircraft

- Increase updating of Mode S transponder for ADS-B and multilateration operations

- **Long term: (2015 - 2025)**

Installation of surveillance systems on ground

- Begin the non-replacement of SSR Mode A/C radars that have completed their life cycle.
- Implement ADS-B or multilateration systems to replace the SSRs that have completed their life cycle
- Begin the implementation of new ICAO-approved surveillance systems

Aircraft

- New updates of Mode S transponder to support new ADS-B functions, such as improved information transmission capability, more information on board to give the pilot the capability to make decisions on separation.

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APPENDIX C

POTENTIAL AIR SPACE TO IMPLEMENT ADS-C AND ADS-B CONSIDERED BY CAR STATES, TERRITORIES, AND INTERNATIONAL ORGANIZATIONS / ESPACIOS AÉREOS POTENCIALES PARA IMPLANTAR ADS-C Y ADS-B CONSIDERADOS POR LOS ESTADOS/ TERRITORIOS/ORGANIZACIONES INTERNACIONALES DE LA REGIÓN CAR

No.	State or Oganization/ Estado u Organización/ Centre/Centro	Airspace/ Espacio aéreo	Type/ Tipo	Status/ Estado	Data sharing with/ Intercambio de datos con	Impl. Date Fecha de Impl.	Remarks/ Observaciones
1	2	3	4	5	6	7	8
	CAR						
1.	**Bahamas/** Nassau ACC	**Nassau FIR**	**ADS-B**	**S**			Studies are being carried out. /Se están realizando estudios.
2.	**Cuba/** Havana ACC	**Havana FIR** (South East Zone)	**ADS-B**	**S/P**			Studies are being carried out. /Se están realizando estudios.
3.	**Haiti/** Port au Prince ACC	**Port au Prince FIR**	**ADS-B**	**S**			Studies are being carried out. /Se están realizando estudios.
4.	**Mexico/** Merida ACC Monterrey ACC	**Gulf of Mexico** (Central zone between Houston Oceanic and Mexico FIRs / Zona central entre las FIRS Houston Oceanic y México)	**ADS-B**	**P**	**Houston ARTCC**		Based on an agreement Mexico - USA/ Basado en acuerdo México - Estados Unidos.
5.	**Trinidad and Tobago/** Piarco ACC	**Piarco FIR**	**ADS-B** **ADS-C***	**P**			ADS-B Trials scheduled between Trinidad &Tobago and United States/ Ensayos ADS programados entre Trinidad y Tabago y Estados Unidos. Multilateration studies are being carried out. /Se están realizando estudios de multilateración. * Oceanic East Sector/Sector Este oceánico

No.	State or Oganization/ Estado u Organización/ Centre/Centro	Airspace/ Espacio aéreo	Type/ Tipo	Status/ Estado	Data sharing with/ Intercambio de datos con	Impl. Date Fecha de Impl.	Remarks/ Observaciones
1	2	3	4	5	6	7	8
6.	**United States/** Houston ARTCC	**Domestic** (Houston Oceanic zone / Zona Houston Oceanic)	**ADS-B**	**P**			Based on an agreement Mexico - USA/ Basado en acuerdo México - Estados Unidos.
		Miami Oceanic FIR **(Domestic zone)**					
	Miami ARTCC		**ADS-B**	**P**			
7.	**COCESNA/** Cenamer ACC	**Cenamer FIR** (Caribbean and Pacific Oceanic sectors / Sectores oceánicos Caribe y Pacífico)	**ADS-B**	**S**			Studies are being carried out. /Se están realizando estudios.
8.		**Other airspace/ Otros espacios aéreos**					Studies are pending / Pendiente de estudios.

P – Planned/Planificado S – Study/Estudio I – Implemented/Implantado

– END -