



International Civil Aviation Organization

CAR/SAM REGIONAL PLANNING IMPLEMENTATION GROUP (GREPECAS)

Fifth Meeting of the CNS Committee of the GREPECAS ATM/CNS Subgroup (CNS/COMM/5)

Lima, Peru, 13 to 17 November 2006

CNS/COMM/5-WP/11

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Agenda Item 3: Surveillance systems developments

3.1 Follow-up to the development of surveillance systems and the regional implementation study of the SSR in Mode S.

FOLLOW-UP ON THE REGIONAL IMPLEMENTATION OF SSR MODE S AND STUDIES ON THE DEVELOPMENT OF MULTILATERATION

(Presented by the Secretariat)

SUMMARY

This paper submits to the consideration of the CNS Committee a study and proposed regional actions to continue and promote the planning and implementation of SSR Mode S systems, and presents ICAO information and studies on the multilateration surveillance system.

References:

- Report of the fourth Meeting of the CNS Committee, Mexico City, August 2005.
- Report of the GREPECAS/13 Meeting, Santiago, Chile, November 2005.
- Second amendment to the Global air navigation plan (Doc 9750 – AN/963).
- Plan for the implementation of surveillance systems – Asia/Pac Region.
- Plan for the implementation of surveillance systems – EUR Region
- Reports of group B of the ICAO ASP panel

1. Introduction

Follow-up on the activities concerning the study of a plan for the implementation of radar surveillance systems Mode S

1.1 The GREPECAS/13 Meeting analysed information on the outlook of the secondary surveillance radar system (SSR) mode S, and considered that, for the implementation of SSR Mode S, it was necessary to study and consider those areas where it would be justified to install this type of radar. Likewise, it was noted that the implementation of SSR Mode S in these Regions is easier due to the fact that many of the installed SSR systems are monopulse and generally have the capability to support Mode S.

1.2 The GREPECAS/13 Meeting also considered that the benefits of Mode S surveillance or communications would naturally increase in proportion to the increase in the number of aircraft equipped with SSR Mode S transponder.

1.3 Taking into account the above, GREPECAS/13 formulated Decision 13/86 *Proposal for the assignment of a new task to the CNS Committee concerning the plan for the implementation of SSR Mode S*, which proposes a new task for the CNS Committee concerning the continuation of studies for the development of a plan for the implementation of SSR Mode.

Follow-up on the development of surveillance systems

1.4 As a follow-up on the development of surveillance systems, note should be made of the growing number of multilateration systems installed worldwide, which are mainly used for vehicle and aircraft movement surveillance at airports, but new multilateration applications are also emerging for en route and terminal area surveillance.

1.5 Initial multilateration implementations are taking place in Austria, the Czech Republic, Tasmania, South Africa, Armenia, China, United States and other States.

1.6 Multilateration is a technology derived from secondary radars and relies on the secondary radar system installed on board aircraft (SSR Modes A/C and SSR Mode S transponder). Multilateration would have the potential of fulfilling many roles within ATM surveillance, such as:

- main surveillance system for ATM within a specific airspace/airport (en route, approach and on ground);
- alternate surveillance system where another surveillance technology, like ADS-B, is used as primary surveillance system; and
- to validate an ADS-B position in order to confirm its correct position.

ICAO standards for Mode S

1.7 SSR Mode S standards are found in Volume IV of Annex 10, Chapter 3, Section 3.2.1. Chapter 4 in Volume IV of Annex 10 also contains Mode S transponder standards to meet ACAS II requirements. Furthermore, Volume III Annex 10 Chapter 5 Part I contains standards on Mode S air-ground data links.

2. Analysis

Studies on multilateration surveillance

2.1 At present, ICAO does not have any standard on the multilateration surveillance system. The panel of the ICAO Air Navigation Commission (ANC) that is in charge of drafting technical standards for surveillance systems is the ASP (Aeronautical Surveillance Panel) and on the operational aspects of surveillance systems is the SASP (Separation and Airspace Safety Panel). As instructed by the Commission, the ASP is considering the growing interest in multilateration, and is planning to propose a high-level standard at the next Meeting of the ASP Task Force B (November 2006) for its review and approval.

2.2 Once accepted by the members of the ASP group and approved by the ANC, the drafting of high-level performance development standards will probably begin in early 2007.

2.3 The industry has considered the incorporation of multilateration sensors in ADSB earth stations; therefore, the technical aspects of multilateration can be examined together with the tasks of the ADS-B in order to avoid duplication of activities.

2.4 In this regard, the CNS Committee will follow-up the progress made with respect to the initial work being carried out by the ASP on standards, the operational aspects being discussed by the ACASP, as well as any other information from the industry and the States throughout the world who are planning or implementing multilateration systems.

*Studies on the regional implementation of SSR Mode S
Global air navigation plan*

2.5 The second amendment to the Global air navigation plan (Doc 9750 – AN/963) concerning data transmission systems for surveillance purposes established the Global Efficiency Initiative (GEI) 09 – *Situational awareness*. The ultimate objective of this initiative is to have a surveillance environment on ground and on board the aircraft that permits conflict avoidance and improves efficiency and safety. ES (extended squitter) Mode S is presented as the transmission mode for ADS-B.

2.6 Surveillance systems, such as conventional primary and secondary radars, as well as secondary radars Mode S, constitute the main surveillance elements to support air traffic management in the short and medium term. The implementation of additional dependent surveillance systems, such as ADS-B or multilateration systems, would contribute to provide surveillance in areas not covered by radar, and, in places where radar surveillance (primary SSR and SSR Mode S) already exists, they would contribute to increase the precision, availability and integrity of surveillance information.

2.7 The implementation of secondary Mode S radars in the CAR/SAM Regions is shown in the amended FASID Table CNS 4A contained in Appendix D to working paper 12 of this Meeting. The members of Administrations that have plans to implement this system are invited to inform so to the Meeting so as to include it in the proposed amendment to Table CNS 4A.

Identification of potential airspaces for the implementation of secondary radar Mode S

2.8 The implementation of secondary surveillance radars Mode S on ground should have priority in en route and terminal areas with high traffic density. Accordingly, each State/Territory/Organisation should assess current traffic density in their respective terminal areas and that expected for the next ten years, as well as the life cycle of secondary radars currently installed in terminal areas.

2.9 For en route and terminal areas that do not have very high traffic density, use would be made of monopulse secondary radar, adaptable to Mode S, and Mode S would be implemented once air traffic volume warrants it.

2.10 For the aforementioned scenarios, the installation of primary radars would continue, as well as the reconditioning, replacement or installation of new primary radars according to State requirements.

2.11 Mode S transmission in aircraft represents the primary means to be used for the ACAS system, and will represent the primary means of transmission for ADS B (ES Mode S), together with multilateration. Mode S transmission would also be used for controlling airport surface movements (aircraft and vehicles).

Information on current and planned capacity of the aircraft fleet operating in the CAR/SAM Regions

2.12 As an initial step for the implementation of Mode S, the CAR/SAM/3 RAN Meeting, through Conclusion 11/6 – *Application of procedures for the assignment of 24-bit addressing in aircraft*, urged CAR/SAM States/Territories to apply the addressing scheme specified in Annex 10, Volume III, Part I, Table 9.1, Appendix Chapter 9.

2.13 At present, CAR/SAM States, Territories and Organisations apply the procedure established by ICAO for aircraft identification. Every aircraft that has a Mode S transponder has a unique code that identifies it worldwide; no other aircraft can have that same identification.

2.14 Aircraft included in Annex 6, Part I, paragraph 6.18, must be equipped with the ACAS II system. This system must have a Mode S transponder amongst its components. In the CAR/SAM Regions, most commercial aircraft have the ACAS II system, so they also have the Mode S transponder.

2.15 ACAS II is slowly being implemented in general aviation, but it is expected that, by the year 2010, all of the general aviation fleet will have implemented the ACAS II system. Thus, all the aircraft fleets in the CAR/SAM Regions would have Mode S implemented on board.

2.16 Furthermore, consideration should be given to the fact that, initially, these transponders are geared for ACAS application, and the expanded capacity would be required in order to respond to Mode S queries.

Target date for the implementation of Mode S transmission capabilities

2.17 For the implementation of Mode S at the regional and sub-regional level, the Meeting should propose that GREPECAS recommend the States, Territories and International Organisations to undertake activities based on target dates and on a regional strategy that is in keeping with the operational requirements of these Regions and with the global ATM system.

2.18 In order to continue updating the regional implementation plan, including SSR Mode S, as well as the use of Mode S for ADS B applications, and follow up on the studies on the multilateral system and contribute to the necessary coordination, the Meeting should propose follow-up actions to be taken by the mechanism of the ATM/CNS Subgroup and its Committees, integrating them with the strategy for the implementation of ADS-C and ADS B described in working paper 12 of this Meeting. It could also develop a general surveillance plan containing all the required surveillance applications, harmonising it with the Global air navigation plan. The **Appendix** to this paper contains preliminary elements that the Meeting could analyse in order to develop a regional consolidated strategy for the implementation of surveillance systems.

3. Suggested actions

3.1 The Meeting is invited to:

- a) take note of the information contained in this working paper;
- b) consider the information on the studies being carried out by ICAO on multilateral systems;
- c) follow up on the plans for the implementation of secondary radar Mode S systems;
- d) review the identification of potential airspaces for the implementation of secondary radar Mode S, as well as the information on the current and planned capacity of the aircraft fleet operating in the CAR/SAM Regions, described in paragraphs 2.9 to 2.16 of this paper;
- e) study and recommend actions for the implementation of SSR Mode S systems, as well as applications associated to Mode S, as part of a harmonised aeronautical surveillance strategy based on the considerations expressed in paragraphs 2.17 and 2.18 of this paper;
- f) study the possibility of developing a single general surveillance plan for the CAR/SAM Regions, containing all the required surveillance applications;
- g) propose other actions related to this matter.

APPENDIX

PRELIMINARY 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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