International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)

WORKING PAPER

GREPECAS/22 — WP/24
02/09/24

Fourth GREPECAS–RASG-PA Joint Meeting and
Twenty-second Meeting of the CAR/SAM Regional Planning and Implementation Group (GREPECAS/22)
Virtual Phase (Asynchronous, 16 September to 11 October 2024)
In-Person Phase (Lima, Peru, 20 to 22 November 2024)

Agenda Item 5: **Implementation of CAR/SAM Air Navigation Services (ANS)**
5.2 Communication, Navigation and Surveillance (CNS)

DEPLOYMENT OF ADS-B IN BRAZIL AND COMPLEMENTATION OF THE AIR NAVIGATION SYSTEM – MULTILATERATION IN PORTO ALEGRE

(Presented by Brazil)

EXECUTIVE SUMMARY

This document presents Brazil's current air traffic surveillance model, emphasizing the successful implementation of ADS-B in the Campos Basin, the expansion plans for the Santos and Espírito Santo oil basins, the implementation of Continental ADS-B, and a proposal for Multilateration in the Porto Alegre/RS terminal area. In the future, Brazil intends to extend ADS-B surveillance to continental airspace and explore satellite-based solutions to enhance coverage in oceanic airspace. This strategic approach reflects Brazil's commitment to safety and efficiency in air traffic management, inviting further consideration from stakeholders

Action:	Provide information on the implementation of ADS-B and Multilateration in the CAR-SAM region and analyse the feasibility of adopting an MLAT system as a complement to ATS surveillance for approach in terminal areas.
Strategic Objectives:	• Security operational; and • Ability and Efficiency of the Air Navigation Capacity and Efficiency
References:	• Annex 10, Telecommunications ICAO Aeronautics Volume IV Surveillance and Anti -Collision Systems. • Twenty-first Meeting of the CAR/SAM Regional Planning and Implementation Group (Final Report GREPECAS/21, November 14 to 17, 2023). • Considerations Guide Techniques Operational for the implementation of ADS-B in the SAM Region.

1. Introduction

1.1. The worldwide implementation of ADS-B, as outlined in ICAO's Global Air Navigation Plan (GANP), aims to create a globally interoperable, safe, and efficient air navigation system. This global effort includes using technologies such as ADS-B to improve surveillance, increasing accuracy and coverage, especially in areas where traditional radar is less effective.

1.2. In the Brazilian context, DECEA has followed this global trend by implementing ADS-B to improve airspace surveillance in critical regions, such as offshore oil basins and continental airspace. The implementation of ADS-B in Brazil began in the Campos Basin and is expanding to other regions, such as the Santos and Espírito Santo Basins, with plans for full coverage by 2026. Additionally, Brazil is exploring satellite-based solutions to improve surveillance in oceanic airspace by 2027.

1.3. The implementation of Continental ADS-B in Brazil aims to extend ADS-B surveillance coverage to Brazilian continental airspace, especially above FL 245. Taking advantage of the experience acquired in the Campos Basin, the Continental project began in 2023 and is divided into phases, covering different flight information regions (FIR). The first phase, completed in the first half of 2024, included the installation of 19 receivers in the CINDACTA III FIR. Subsequent phases will continue until 2026, with the expectation that the entire continental airspace will be covered by that date. This implementation ensures that Brazil is prepared for the future ADS-B mandate, scheduled for 2030, guaranteeing a smooth and safe transition in air traffic surveillance.

1.4. In addition to Continental ADS-B, DECEA is implementing a multilateration (MLAT) system in the Porto Alegre Terminal Area (TMA-PA) in response to natural disasters that damaged existing surveillance systems in that locality. The MLAT system, which complements ATS surveillance at lower flight levels, is being implemented, taking advantage of existing Continental ADS-B contracts. This MLAT system includes the installation of receivers at strategic points to ensure full coverage in the TMA-PA and serves as technical and operational redundancy for the radars that will be installed in the region.

1.5. These approaches not only align Brazil with global best practices but also ensure that the country maintains a high standard of safety and efficiency in managing its air traffic. Brazil's ADS-B implementation strategy reflects a commitment aligned with ICAO's global objectives, ensuring that Brazil not only keeps up with international technological developments but also contributes to the safety and efficiency of global aviation, adapting these innovations to its specific needs and regional challenges.

2. Discussion

2.1. SURVEILLANCE SYSTEM IN OIL BASINS

2.1.1. Based on the results of the ADS-B implementation in the Campos Basin region, DECEA initiated a project to deploy the ADS-B system in the Santos Basin, covering an area of approximately 350,000 km², and later in the Espírito Santo Basin, both scheduled for 2026. Subsequently, DECEA will replace the ADS-B equipment currently installed in the Campos Basin.

2.1.2. The deployment and replacement of the mentioned equipment will occur in phases, so that air traffic services via ADS-B will be available throughout the entire oceanic oil exploration region of the Santos, Campos, and Espírito Santo Basins by the end of 2026, through the implementation of 15 (fifteen) ADS-B stations, as detailed in Figure 1.

2.1.3. It is important to highlight that there is a forecast for an ADS-B "mandate" in the oceanic basins by 2030. However, the specific ADS-B version has not been defined yet.

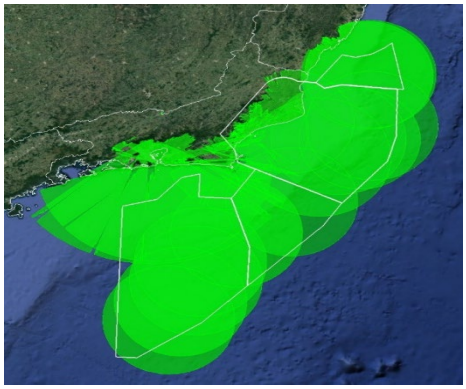

Figure 1 – ADS-B Coverage in the Campos, Santos, and Espírito Santo Basins (FL 010)

2.2. CONTINENTAL ADS-B

2.2.1. Considering the experience gained from the ADS-B project in the Campos Basin, DECEA initiated a process in 2018 to provide ADS-B surveillance for Brazilian continental airspace based on the following premises:

a) The ADS-B system will provide coverage for en-route aircraft control over the continent above FL 245;

b) Primary and secondary radars will continue to be an alternative means of aeronautical surveillance, providing their respective services both in the transition phase to ADS-B and for the control of aircraft not equipped with adequate transponders;

c) It is important to highlight that the continental ADS-B "mandate," version DO260B, is expected by 2030; and

d) Continental ADS-B implementations follow the schedule according to the phases shown in the table below:

Table 1 – Phases of Continental ADS-B Implementation

Phase	FIR	Start	End	No. of Receivers	Status
1st	CINDACTA III	January/23	July/24	19	Completed
2nd	CINDACTA II	March/24	December/24	13	In progress
3rd	CINDACTA I	December/24	August/25	06	To be started
4th	CINDACTA IV	September/25	May/26	28	To be started
Total Acquisitions: 66 Receivers; 4 Processing Centers; 1 Monitoring Center (CGTEC)					

2.2.2. Regarding the implementations planned for Phase 2, DECEA has already implemented the ADS-B system in 4 (four) locations out of the 13 (thirteen) planned in the contract, with the completion of the remaining 9 (nine) stations scheduled by December 202.

2.2.3. The following figures illustrate the locations where ADS-B has already been deployed (Phase 1) and the total number of locations served, containing the respective planned theoretical coverage (FL 200).

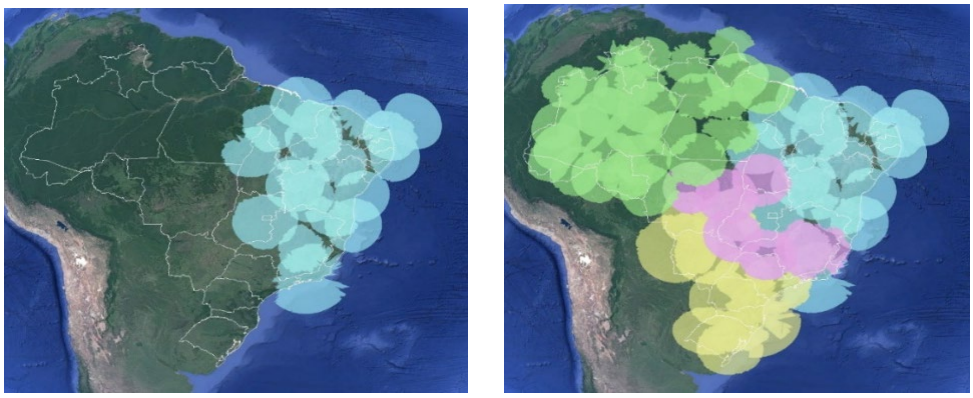

Figure 2 – ADS-B Systems Implemented in Phase 1 (completed) and at the End of the Phases – FL 200

2.2.4. During the execution of Phase 1 of the Continental ADS-B project, it was found necessary to change the location of the ADS-B system's receiving antennas, which were initially designed to be installed on a metal tower at an estimated height of 25 meters and were later modified to be installed on the station's roof, where the ADS-B system equipment is located. This change occurred after an analysis of the antenna coverage revealed that the metal tower itself would be an obstacle to aircraft signals. As a result, the projects needed to be adapted at all locations.

2.2.5. Considering the experiences gained during the Phase 1 implementation process, the following lessons learned can be considered for future ADS-B deployments:

a) It is essential to analyze the visibility coverage of the ADS-B system's receiving antennas to obtain their optimal positioning; and

b) When conducting a site study at the locations to be implemented, it is essential to verify the existence of an adequate grounding network, telecommunications network infrastructure, stabilized power supply, and lightning protection, as well as the existence of security infrastructure.

2.3. SATELLITE-BASED ADS-B IN OCEANIC AIRSPACE

2.3.1. It is important to add that, based on the results of analyses on the use of satellite-based ADS-B in areas of interest in Brazil, DECEA considered the use of satellite ADS-B services to be technically and financially viable for improving surveillance coverage in oceanic airspace.

2.3.2. In this context, DECEA plans to contract a satellite ADS-B solution by acquiring services from a constellation of satellites that would provide Air Traffic Management (ATM) services in the FIR-AO under DECEA's jurisdiction, which includes vast remote airspace over the Atlantic Ocean, measuring approximately 11 million square kilometers.

2.3.3. Therefore, DECEA intends to implement space-based (satellite) ADS-B surveillance to cover oceanic airspace using satellite ADS-B services by 2027.

2.4. MULTILATERATION IN TERMINAL AREA

2.4.1. In April and May 2024, the state of Rio Grande do Sul experienced a natural disaster due to heavy rains across the state, which resulted in the flooding of several cities, including Salgado Filho International Airport (SBPA). This event rendered all infrastructure, equipment, and systems supporting the provision of ATS surveillance services in the Porto Alegre terminal area (TMA-PA) inoperative.

2.4.2. As a result of this tragedy, it was found that the primary and secondary radars at SBPA were damaged beyond repair, as they were completely submerged by the floodwaters. Consequently, DECEA planned to initiate the installation of primary and secondary radars in Canoas (SBCO), approximately 13 km from SBPA; an autonomous secondary radar in Caxias do Sul (SBCX); and a Wide Area Multilateration (WAM) system, to restore radar coverage in TMA-PA, including at lower flight levels, while also providing redundancy for the radars to be installed in SBCO.

2.4.3. In the analysis of technical feasibility and time to implement conducted by DECEA, it was determined that the installation of primary and secondary radars in SBCO would not significantly impact radar coverage in TMA-PA compared to the radars previously installed at SBPA, thus not hindering the provision of surveillance services in that location.

2.4.4. In pursuit of the rapid restoration of ATS surveillance in TMA-PA, DECEA opted to implement an MLAT system as a complement to ATS surveillance at lower flight levels, due to the speed of its deployment, leveraging the existing contract for Continental ADS-B implementation.

2.4.5. In his context, considering the ongoing Continental ADS-B project, DECEA plans to deploy a Multilateration (MLAT) system with 4 receivers to complement surveillance in TMA-PA. It is important to note that the MLAT system will need to meet the following operational requirements:

- Coverage of the entire Porto Alegre terminal area;
- Provide surveillance in TMA PA-1 from FL035 to FL195;
- Ability to determine the instantaneous geographic position of the target;
- Ability to monitor the target's movement history (track);
- Ability to display the target's movement speed;
- Ability to display the target's course (direction vector); and
- Ability to display the identification and altitude of aircraft collaboratively for ATC units.

2.4.6. The figure below shows the estimated final coverage for ATS surveillance in TMA-PA at FL 010 and FL 100, considering the primary and secondary radars in SBCO, an autonomous secondary radar in SBCX, and the MLAT system described above.

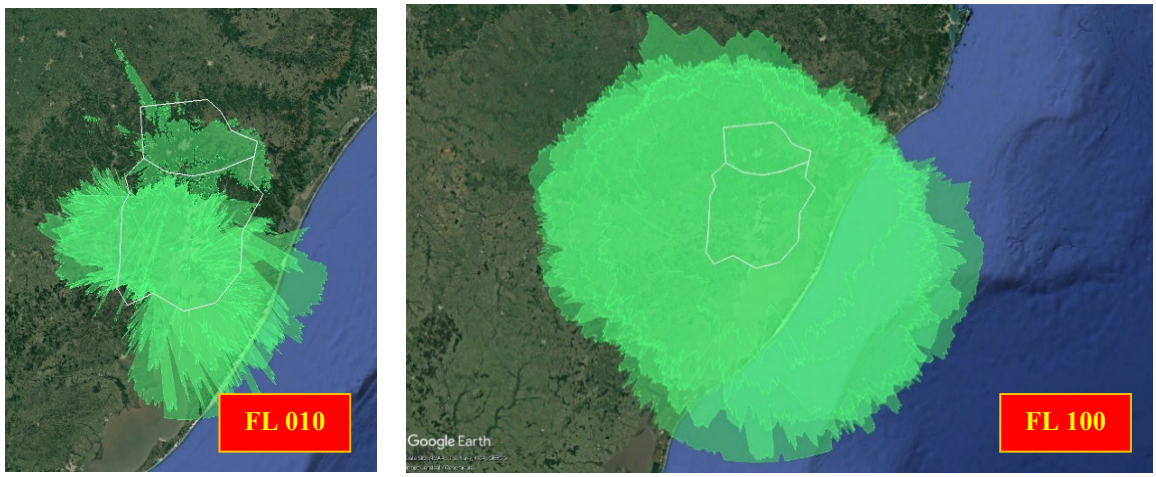

Figure 3 – Estimated ATS Surveillance Coverage in TMA-PA with MLAT.

2.4.7. Thus, DECEA has adopted the combination of a terminal primary and secondary radar installed at SBCO, an autonomous secondary radar installed at SBCX, and an MLAT system in the Porto Alegre area as the most appropriate solution to restore ATS surveillance in TMA-PA, providing both a complement to ATS surveillance and technical and operational redundancy for the radars.

3. Suggested actions

3.1. The Meeting is invited to:

a) Take note of the activities carried out by Brazil;

b) provide information on the implementation of ADS-B and Multilateration in the CAR-SAM region;

c) analyze the feasibility of adopting an MLAT system as a complement to ATS surveillance for approach in terminal areas; and

d) consider other aspects that the Meeting deems relevant.

— END —