International Civil Aviation Organization
ICAO South American Regional Office
Seventeenth Meeting of the Civil Aviation Authorities of the SAM Region (RAAC/17)
(Santiago, Chile, 10 – 14 April 2023)

Agenda Item 1A: Current situation and regional priorities

FOLLOW-UP TO THE IMPLEMENTATION OF CAPACITY AND EFFICIENCY IMPROVEMENTS TO AIR NAVIGATION IN THE SAM STATES

(Prepared by the Secretariat)

Summary

This working paper presents the progress made in the implementation of improvements in Capacity and Efficiency to Air Navigation, in the areas of ATM and CNS, as well as the support of AIM/MET information, and implementation of improvements in Aerodromes. The current priorities of the SAM Region in the context of the recovery of Aviation after the pandemic are emphasized.

The efficiency of services and airspaces contributes directly to the recovery of Aviation in the Region, in the context of the difficult global economic situation. Improvements in efficiency and capacity are crucial to drive the restoration of air connectivity in the Region, according to commitments of the Declaration of Fortaleza, Brazil.

References:

- Declaration to promote connectivity through the development and sustainability of air transport in the Pan-American Region – Vision 2020-2035 (Fortaleza, Brazil, 17 to 19 September 2018).
- Sixteenth Meeting of the Civil Aviation Authorities of the SAM Region (RAAC/16) (Lima, Peru, 6 to 7 December 2018).
- Report of GREPECAS/20 Meeting (Salvador, Bahía, Brazil, 15 to 18 November2022).

ICAO Strategic Objectives:	- *Capacity and Efficiency* - *Safety* - *Economic development* - *Environmental Protection*

1. Introduction

1.1 The Declaration of Fortaleza signed in September 2018 during the ICAO Fourth World Civil Aviation Forum (IWAF/4), outline a set of general objectives to promote connectivity in the Pan-American field, including; "*to be a region where the growth of air operations is sustainable and remains stable and reduces the contribution of carbon emissions to the environment*."

1.2 It is recognized that the development of ICAO's strategic objective on Air Navigation Capacity and Efficiency supports the sustainable recovery of the industry and connectivity of the Region in the post-pandemic period. The facilitation of optimized operations in airspace and airports, as well as Air Traffic Management (ATM) gifted with a reliable CNS platform, and supported by accurate aeronautical and meteorological information, generates savings in flight distances, fuel consumption and CO2 emissions, while mitigating the effects of possible capacity imbalances (delays in departures/arrivals, congestion, etc.) in airspace sectors and runways.

2. Discussion

2.1 During 2020 and part of 2021, activities inherent to the management of air navigation services (ANS), such as aeronautical publications, mapping and design of flight procedures, flight inspections, quality re-certifications, training of personnel with aeronautical licenses, CNS facilities/implementation, etc. were affected by the sanitary restrictions implemented. The implementation of improvements in the capacity and efficiency of air navigation in the Region had to be adapted to the context of the aforementioned restrictions and the temporary decrease in air operations.

2.2 SAM Region kept the implementation of ANS and Aerodromes within the framework of the Implementation Plan of the performance-based air navigation system – SAM PBIS. The various Working Groups for Planning and Implementation continued their activities assisted by the Regional Office and many technical support forums, based on virtual work, teleconferences and electronic communication.

2.3 At the same time, the Region deployed a pilot project to promote performance-based ANS planning within the framework of the GANP, developing Volume III of the Regional Plan – ANP CAR/SAM, in connection with Mexico Regional Office. Progress in the preparation of Volume III of the ANP is set out in a separate working paper.

2.4 In 2022, the activities of ANS service providers, aerodromes, as well as regulators have been restoring in the Region, sustaining the progressive recovery of air operations, which have reached the level of domestic demand of 2019, even though the challenges to recover international operations remain.

2.5 In this context, progress has been made in the implementation of improvements in air navigation capacity and efficiency, however, the Meeting should identify and propose actions to address the priorities of the execution of facilities, strengthening of services and allocation of resources to sustain the aforementioned implementation, as set out in the following paragraphs.

2.6 The efficiency of services and airspaces contributes directly to the recovery of aviation in the Region, facing the difficult global economic context. The extensive implementation of PBN and other on-route initiatives allow to generate this efficiency, and at the same time benefits to the environment. Airport and airspace capacity should be monitored and the demand-capacity imbalance managed through the ATFM service and ACDM. Consequently, improvements in efficiency and capacity are crucial to drive the restoration of air connectivity in the Region.

Air space Optimization

2.7 The implementation of PBN in approach, departure/arrival and en route segments has slowed down due to the departure or reassignment of personnel in charge and other limitations in the ANSPs. Some implementation projects in TMAs were postponed to this year 2023. The tasks of reviewing IFP procedures every 5 years are delayed in several States.

2.8 Between 2021 and 2022, improvements have been implemented in spaces in Argentina, Brazil, Chile, Colombia, Paraguay, Uruguay and Venezuela, continuing with the implementation of RNAV 5 on regional CAR/SAM routes. The implementation of APV/Baro-VNAV approximation procedures reached 92.8% Appendix A shows the progress of GNP between 2019 and 2022.

2.9 Together with IATA, the strategic direct routing (EDE) initiative has been implemented and participates in the management of user's preferred routes (UPR) that are being implemented for the NAM-CAR-SAM Regions, having obtained estimates of savings in flight distance, fuels and CO2 emissions, in the latter case of the order of 1400 Tons in one year. See details of estimated benefits in **Appendix A** to this working paper.

2.10 Priorities for the air space optimization:

a) Strengthen flight procedure design and airspace planning services by providing them with resources and qualified full-time personnel. Review of flight procedures as stipulated by ICAO should be addressed.

b) See item a) of ATS priorities, below.

Air Traffic Flow Management -ATFM

2.11 Since 2021, the ATFM – OPSAM Operations Plan has been implemented, which aims to cover the 4 phases of the ATFM service (strategic-pretactic-tactical-post-operations) promoting weekly / monthly Teleconferences (BRISA), the management of a regional dashboard to analyze demand growth and, therefore, identify possible demand-capacity imbalances.

2.12 The ATFM Implementation Guide approved for the Region (based on CONOPS ATFM CAR/SAM) allows to guide the implementation by phases in the States that require it. In this way, in the medium term, the implementation of the cross-border ATFM service is aimed, that is, the evolution from an ATFM service with national-domestic scope to an integrated service between several States, with intra-regional and then inter-regional scope.

2.13 ATFM Priorities:

a) Provide for the development of the ATFM service in the national air navigation plans, oriented on the concepts of the ATFM Regional Implementation Guide and the available technical documentation.
b) Facilitate the sharing of projected demand data for operations for the purposes of the ATFM Regional dashboard. It is essential that the information is delivered by the last Thursday of each month.
c) Allocate resources and permanent staff to ATFM services, as needed, covering the 24-hour ACC. Staff training should be strengthened, as well as their participation in the activities of implantation groups.

d) Verify the validity of the data of runway capacity and ATC sectors in the main headquarters / dependencies of the State and, if applicable, immediately arrange a program for the review of said capacity calculations.

Air Traffic Services – ATS

2.14 Activities have been carried out to update the ATS letters of agreement (LOA) after the pandemic, however, some administrations need to complete the technical work carried out, through the signing of the agreements.

2.15 Through the LOA ATS, the application of the minimum longitudinal separation of aircraft of 40 NM in continental airspaces has been consolidated. This minimum separation affects aircraft transfer procedures between adjacent ACCs and thus the allocation of optimal and efficient flight levels. This allows capacity to be expanded in the on-route operation segment.

2.16 Agreements for the application of longitudinal separations of 20 NM are still limited by gaps in VHF communications and radar coverage in the adjacent airspace sectors between ACCs. It should be noted that in these sectors the subject of operational safety is also presented; large altitude deviations (LHD) events, caused by defects in the ATS coordination cycle.

2.17 In the pandemic period, there were contingencies with ATC ZERO degradations in ACCs of the Region. SAM States have harmonized their ATS contingency plans, adopting the SAM Regional Framework Plan, and are being published in the AIPs (or supplements) in English language for user availability.

2.18 ATS priorities:

a) Evaluate the gaps in ATS communications and surveillance coverage in FIR boundary sectors and transfer points between adjacent ACCs, in order to renew or install VHF extended range equipment and SSR or ADS B facilities, if applicable. It aims to facilitate longitudinal separations of 20 NM and mitigate LHD events, as well as ensure the provision of ATS service for EDE flight plans or user-preferred routes – UPR.
b) Strengthen the State's ATS contingency plans, through training for the operational staff involved, officials and decision-making levels. Provide for the publication in English language and periodic reviews of said Plans. Arrange for periodic drills to be carried out in the ATS.

Aeronautical Information Management– AIM

2.19 Aeronautical Information Management seeks to change the focus of the aeronautical information service, concentrating on the management of aeronautical data in an electronic environment, quality assured, interoperable and based mainly on Database

2.20 The priority of the States should focus on the retraining of AIS personnel, especially in the change of the profile of the AIS professional, with emphasis on a professional who contemplates the knowledge of a traditional AIS but combined with knowledge of information technology (IT). It will enable to electronic data management and work with computer programs that manage "Databases". This conversion should be planned in the context of the implementation of a quality management system for AIM (QMS/AIM).

2.21 Additionally, all aeronautical information should be organized as a set of digital data, aligned with Annex 15 and ICAO Doc. 10066. Digital datasets refer to:

a. AIP datasets;
b. field data sets;
c. obstacle data sets;
d. aerodrome mapping data sets; and
e. instrument flight procedure data sets.

2.22 Finally, having a system that manages this information and allows the exchange of information with other States and with other air navigation service providers in a fully automated environment is the ultimate goal of AIM. This would allow the construction of an electronic AIP and its access by users/stakeholders through a website.

2.23 If the States of the SAM Region complete the processes of implementation of DDS and the acquisition of systems that electronically manage all the Databases, they could have an AIP in electronic format, in addition to being able to exchange NOTAM, in digital format, building in this way, a part of the enablers of the "Information Management of the entire system – SWIM".

Meteorological Service – MET

2.24 The provision of air navigation services is mainly based on airport weather messages, aerodrome forecasts and weather alert messages for the Aeronautical Information Region and for aerodromes.

2.25 In the same context of aeronautical information, meteorological information to support air navigation should be delivered with assured and interoperable quality.

2.26 As a priority for States, it is imperative to ensure that MET personnel working at the Aeronautical Meteorological Station (EMA), Bureau of Aeronautical Meteorology (WCO) and Bureau of Meteorological Watch (LMO) comply with the training requirements of the World Meteorological Organization (WMO) indicated in WMO Publication 1083.

2.27 States, in order to fulfill their mission of providing meteorological information for air navigation, should equip airports with automated meteorological observation systems with the support of Conventional Stations. When working with instruments, having a preventive and corrective Maintenance Program is essential in the planning of meteorological services, mainly to ensure quality information and continuity of services.

2.28 It is also essential to provide equipment for the reception of images and meteorological products, as well as software that allows these elements to be superimposed, to the WCO and LMO. This will make it possible to raise the levels of meteorological monitoring and the preparation of weather forecasts and weather alert messages with a high level of accuracy. It should be considered to provide these offices with telecommunications systems that allow the distribution of the information they originate with the promptness that ensures the availability of this information to the user at the right time.

2.29 For all the facts mentioned, continuous improvements must be managed and planned, in the context of a quality management system applied to the MET processes (QMS / MET).

2.30 Consistent with interoperability, States should consider the implementation of operational meteorological information exchanges (OPMET) in a digital and interoperable format, for which it is necessary to code it in the ICAO Meteorological Information Exchange Model (IWXXM).

Communication, navigation, surveillance - CNS

Regional Infrastructure of Aeronautical Communications (REDDIG II)

2.31 In 2020, the contract with the terrestrial segment telecommunications provider (MPLS) of the SAM Region Digital Network (REDDIG II) was renewed, increasing the numbers of MPLS nodes in the network. Currently, the network has 17 full nodes (VSAT + MPLS) and 11 nodes with MPLS link (no redundancy).

2.32 Figure 1 presents the current topology of REDDIG II

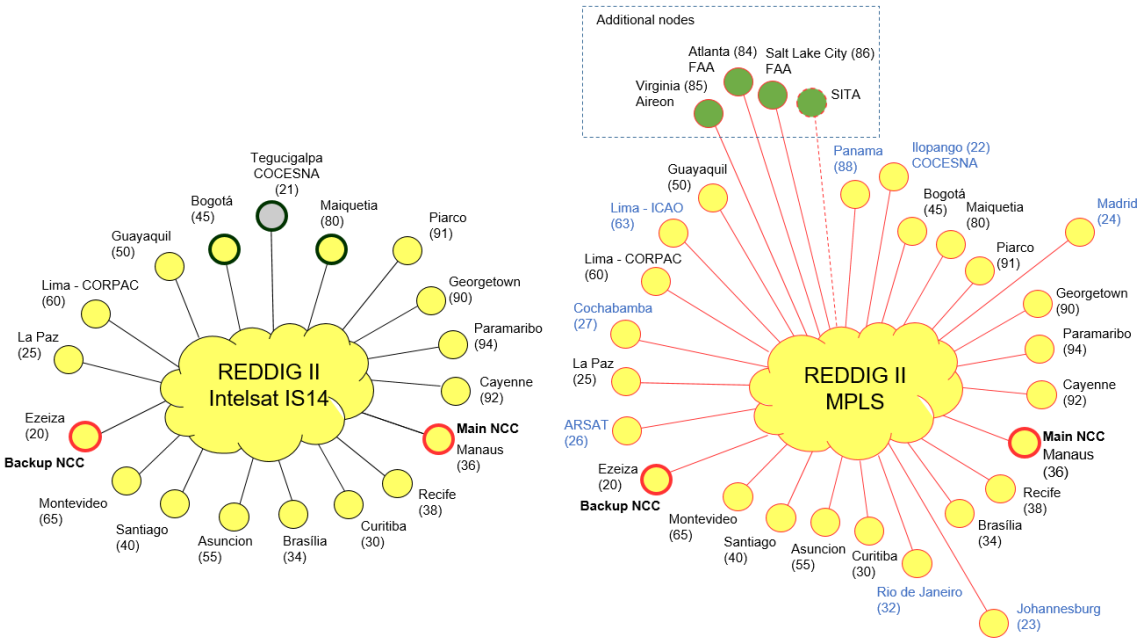

Figure 1 – Current topology of REDDIG II

2.33 The green nodes in the figure are known as "additional nodes" that are implemented by States/Organizations that do not participate in the Regional Technical Cooperation Project RLA/03/901, but particularly contract the services of the REDDIG II telecommunications provider and connect to the regional network, after obtaining authorization from the Network Coordination Committee.

2.34 SITA is in the process of implementing an additional REDDIG II node, with forecast to be implemented in the first half of 2023.

Implementation of automatic dependent surveillance – broadcasting (ADS-B)

2.35 The status of ADS-B implementation in the SAM Region is detailed in **Appendix B** to this working paper.

AMHS Implementation

2.36 As with the restrictions imposed by the pandemic, significant progress was made in the implementation of the Aeronautical Messaging System (AMHS) in the Region. Currently, all SAM States have already implemented AMHS systems in their COM Centers and all planned regional connections have been established.

2.37 Figure 2 presents the status of AMHS implementation in the SAM Region.

2.38 Likewise, extra plan connections were stablished (E1, E4, E5, E6, E7 and E8), expanding intraregional and interregional connections.

2.39 From the planned connections, only interregional AMHS connections between:

- COM Ezeiza (SAEZ) Centre – Centre COM Johannesburgo (FAOR);
- Centre COM Georgetown (SYCJ) – Centre COM Piarco (TTPP); and
- Centre COM Caracas (SVCA) – Centre COM Curaçao (TNCC).

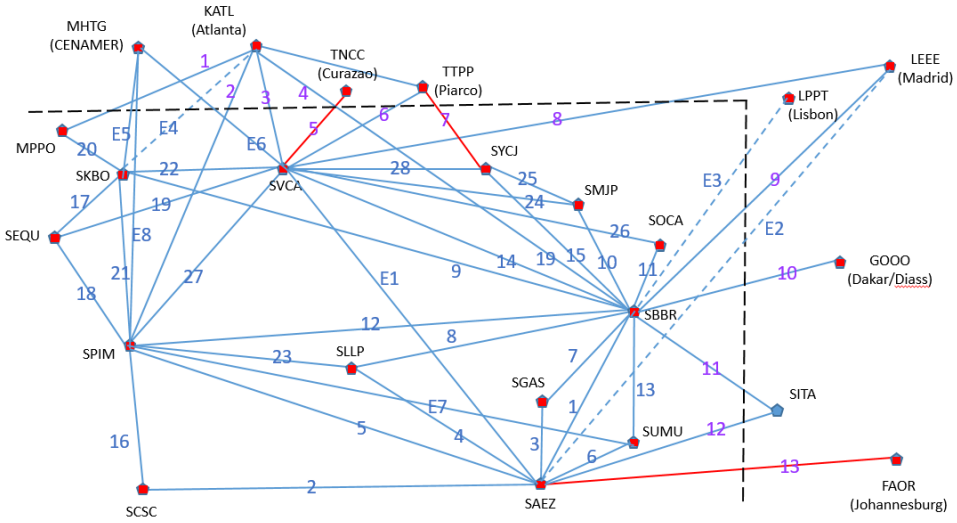

Figure 2 –AMHS Implementation in SAM Region

AIDC Implementation

2.40 The restrictions due to the pandemic have affected the implementation of communications by data link between aeronautical agencies (AIDC), which continue with the same progress of December 2019.

2.41 The States that managed to establish AIDC connections are: Brazil (9 out of 25 planned), Chile (2 out of 11 planned), Colombia (4 out of 13 planned), Ecuador (3 out of 3 planned), Panama (1 out of 6 planned) and Peru (3 out of 6 planned).

2.42 Although new connections were not established, it was found that there was some progress with the identification and solution of several aspects of interoperability between the systems of Brazil, Colombia, Peru and Venezuela.

Airport/Airdrome Operations

Airdromes certification

2.43 As part of Member States' commitment in the context of regional air navigation planning, States should ensure that all aerodromes published as international in the AOP tables of the regional air navigation plan comply with ICAO recommended standards and methods, transgressed in the relevant national legislations. To achieve this, aerodromes must be certified by the State through a process specified in ICAO guidelines. By carrying out this process, not only is the regulatory requirement met, but the minimum conditions (basic building blocks) are guaranteed for the construction of operational improvements at the airport level.

2.44 As of February 2023, 53% of the international aerodromes published in the AOP table of the regional air navigation plan have been certified, so it remains a challenge for several States to continue with these certification efforts, under the umbrella of the F1 project of GREPECAS. A breakdown of the airfields certified by State can be found in **Appendix C**.

Airport Planning

2.45 Based on the Declaration to Promote Connectivity through the Development and Sustainability of Air Transport in the Pan American Region - Vision 2020-2035 (IWAF/4), endorsed by the Pan American States in Fortaleza, Brazil in September 2018, the sustainable development of aviation in the Region depends on the availability of capacity and efficiency of its operations, through coordinated actions, aligned with the GANP. Airports are an important link in the process to ensure the capacity and efficiency needed for aircraft operations to take place.

2.46 To ensure sufficient airport capacity to sustain the growth of the ATM system, it is important that States consider airport master planning, from a local context (airport master plan) and a national context (National Airport Use Plan). The F2 project of GREPECAS proposes to develop capacities in the States so that each State has National Planning of airport use, aligned with its CAMP and regional goals. Directors of the AACs are encouraged to consider preparing national airport use plans to ensure that the interests of the travelling public are taken into account in airport developments, especially in environments with concessioned airports.

Collaborative decision-making at airport level A-CDM

2.47 Following the COVID-19 Pandemic, several airports in the region were severely impacted by the reduction in traffic. However, being the region with the fastest traffic growth compared to 2019 numbers, it is important that States ensure that this growth is used for the benefit of the traveling public. Due to the fact that infrastructure bottlenecks at airports will not be solved in the short term, it is important to operate as efficiently as possible with current facilities. The efficiency of the air transport system in the SAM region depends largely on traffic predictability.

2.48 To support States in increasing predictability at their airports, the GREPECAS F3 Project proposes that States work with their Airport Operators so that certain airports that meet the conditions for this (traffic mix, type of operation, etc.) implement the A-CDM in a harmonized and scalable manner. The main objective of the implementation of this ASBU element is to generate a common situational awareness, which encourages better decision-making within the aerodromes, through the exchange of relevant surface operations data between local stakeholders involved in aerodrome operations.

3. Suggested actions

3.1 The meeting is invited to:

a) Take note of the information provided ; and

b) propose actions to address, at the level of the States, the priorities indicated on the execution of facilities, strengthening of services and allocation of resources to sustain the implementation of improvements for the capacity and efficiency of air navigation.

- - - - -

APPENDIX A

Progress made in the air space optimization

**Note 1. – The PBN statistic presented by iSTARS considers 13 SAM States; does not include French Guyana*

***Note 2.- In 2022, there are 224 international track thresholds in the Region, compared to 215 in 2019*

Table 1.- Progress made in PBN implementation in SAM regional routes.

Year	Total SAM Regional routes - Upper	Conventional routes	PBN routes	% Implemented PBN routes
2019	163	25	138	84.66
2020	163	25	138	84.66
2021	160	22	138	86.25
2022	160	20	140	87.50

Made by RO SAM

Table 2.- Progress made in PBN implementation regarding departures/arrivals.

Date iSTARS	*SAM States	THR PBN	**TOTAL THR Intl.	% SID PBN	% STAR PBN
2019	13	189	215	66	50.7
2020	13	192	217	67.7	52.5
2021	13	201	222	68.9	51.8
2022	13	205	221	68.8	54.8

Source iSTARS

Table 3.- Progress made in PBN implementation regarding approximation

Date iSTARS	*SAM Estados	THR PBN	**TOTAL THR Intl.	% approximation PBN implemented
2019	13	189	215	87.9
2020	13	192	217	88.5
2021	13	201	222	90.5
2022	13	205	221	92.8

Source iSTARS

Table 4 .- Estimated benefits of the implementation of the EDE, for the FIRs of Brasilia, Curitiba, Bogota, Barranquilla, Guayaquil, Maiquetía, Lima and Panama.

ESTIMATION OF 1 YEAR SAVINGS BASED ON 1 WEEK DATA		
SAVINGS	1 WEEK	1 YEAR
FLIGHT DIST.	1,926 NM	100,177 NM
FUEL	8.6 Tons.	447.3 Tons.
CO 2	27.2 Tons.	**1,413.5 Tons**.

APPENDIX B

ADS-B IMPLEMENTATION IN SAM REGION

Argentina

ANAC approved the Modernization Project of the Air Traffic Surveillance System consisting of the technological update of the 22 secondary radars of INVAP manufacture currently operational incorporating mode S and ADS-B, the replacement of primary and secondary radars A / C / S with ADS-B and meteorological channel for Baires, Córdoba and Mendoza terminals, 2 new secondary radars mode A / C / S and ADS-B to be installed in FIR Comodoro Rivadavia and 5 ADS-B stations to expand aeronautical surveillance coverage. The planning contemplates that these implementations will be ready in 2025.

Brazil

Brazil has developed an implementation of ADS-B to support, mainly, air operations in the TMA-Macaé, a place of interest for oil activity that is characterized by the movement of helicopters between the continent and the platforms or vessels anchored in that Basin, in the oceanic zone, for the transport of people and cargo.

To serve the Campos Basin, in the airspace corresponding to the TMA-Macaé, 6 ADS-B stations were installed: four stations on offshore platforms and two on the continent. This infrastructure, integrated with the current radar network that sustains air traffic control in that region, enables surveillance throughout TMA's airspace at 500 feet and beyond.

Brazil also has a project to implement 66 ADS-B stations to provide coverage of all continental airspace, which will be developed in phases.

Chile

In 2013, a feasibility study was conducted to provide low-level surveillance between the Cochrane area and Puerto Montt. Secondary radars, multilateration (MLAT) and ADS-B were considered. As a result, the installation of ADS-B equipment was mainly proposed and it was concluded that a total of 14 ADS-B stations are required.

Chile is also considering the use of the Space-based ADS-B (ADS-B) service, using REDDIG as one of the service provision links.

Colombia

Colombia has installed a total of 25 ADS-B receiving stations and 2 Fusions from three manufacturers: INDRA of Spain in the following airports and aeronautical stations namely: (Tumaco, Bogota, Barranquilla, Santa Helena, San Jose del Guaviare, Mitú, Tasajero, Monteria, San Andres, Riohacha and Florencia), COMSOFT from Germany (Araracuara, Leticia, Puerto Inírida, Puerto Carreño, Puerto Leguizamo, Carepa, Santana and Fusionador Bogotá) and GECI from Spain (Neiva, Arauca, Cartagena, Yopal, Bucaramanga, Pasto, Quibdó, Fusionador Bogotá).

At present these sensors are integrated in the different centers and surveillance rooms, according to the operational requirement with version 0.23 of Asterix category 21.

France (French Guiana)

French Guiana has installed 5 ADS-B stations in the following locations: Rochambeau, Mont Matoury, Maripasoula, Mana and Saint Georges. Likewise, the possibility of using the satellite ADS-B service is evaluated. (Space-based ADS-B).

Guyana

Guyana has installed 4 ADS-B stations: Port Kaituma (SYPK), Kamarang (SYKM), Kaieteur (SYKA) and Annai (SYAN).

Panama

Panama has installed 4 ADS-B stations in Cerro Jefe, Volcan Baru; Cerro Cana Agua and El Porvenir. Panama is also evaluating the possibility of using the ADS-B satellite service (Space-based ADS-B).

Paraguay

Paraguay has installed 6 ADS-B stations at the M. R. Alonso Unified Control Center, Guaraní Airport, Concepción Airport, San Juan Baptista, Mariscal Estigarribia Airport and Bahía Negra Airport.

Peru

Peru has completed a modernization process of its automated Area Control Center system that allows the integration of all signals from its combined SSR, ADS-B and MLAT surveillance sensors. In the last two years, the repowering of the 8 Secondary Radars has been completed, which has included the installation of 8 integrated dual ADS-B receivers, in addition to having an independent ADS-B system currently installed in Pisco.

Uruguay

Uruguay divided the implementation of ADS-B into three phases: Phase 1 contemplates ADS-B as a backup or contingency of the SSRs in Carrasco and Durazno. Phase 2: Gap Filler for areas without SSR coverage for the period 2019-2023. Phase 3: Installation of 5 ADS-B/MLAT ground stations (to configure a WAM) in the period 2023-2025.

Venezuela

Venezuela is in the process of acquiring ADS-B systems for Lagunazo, Santa Elena de Uairen, Cerro Los Colorados Station, Cerro Catire Station, Puerto Ordaz Airport, Margarita Airport and La Chinita Airport.

APPENDIX C

Status of Aerodrome Certification in the SAM Region to February 2023

STATE	No. of international airdromes in the CARSAM Regional Plan	Certified Airdromes	% of Certified Airdromes in the State
Argentina	16	2	13%
Bolivia	3	3	100%
Brazil	29	22	76%
Chile	8	5	63%
Colombia	11	6	55%
Ecuador	4	2	50%
French Guiana	1	1	100%
Guyana	2	2	100%
Panama	6	0	0%
Paraguay	2	0	0%
Peru	8	8	100%
Suriname	1	0	0%
Uruguay	2	2	100%
Venezuela	11	2	18%
Total	**104**	**55**	**52.88%**

- END -