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WORKING PAPER

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Salvador, Brazil, 16 – 18 November 2022

Agenda Item 2: Global and Regional Developments
2.3 Programmes and Projects Progress Report

PERFORMANCE-BASED NAVIGATION (PBN) AND AIR TRAFFIC FLOW MANAGEMENT (ATFM) PROGRAMMES

(Presented by the Secretariat)

SUMMARY

This paper presents a report on the evolution of GREPECAS ATM implementation activities, related to the PBN Programme, as well as the evolution of ATM implementation activities related to the ATFM Programme projects.

Action:	As indicated in Section 4
Strategic objectives:	• Air navigation capacity and efficiency • Economic development of air transport • Environmental protection
References:	• Doc 9613 — Performance-based navigation manual (PBN) • Doc 9750, GANP. • Doc 9971 - *Manual on collaborative management of ATM.* • Reports of GREPECAS, PPRC and ePPRC meetings.

1. Introduction

1.1 In follow-up to GREPECAS Decisions 16/45 and 16/47, the "Performance-Based Navigation (PBN)" Programme was structured with the following associated projects:

a) PBN implementation; and
b) Air navigation systems in support of PBN.

1.2 In turn, the ATFM Programme was structured with the following associated projects:

a) Improve the balance between demand and capacity, in the CAR and SAM Regions; and
b) Implementation of flexible use of airspace, in the CAR Region

2. Analysis

2.1. CAR Region: Project A1 “Implementation of Performance Based Navigation (PBN)”

The progress report of the Airspace Optimization Task Force (AO/TF) of NACC/WG is presented in WP/19**.** Conclusions and recommendations are included in the named paper.

2.2. CAR Region: Projects B1“Improve the balance between demand and capacity” y B2 “Implementation of flexile use of airspace (FUA)”

The progress report by the Air traffic flow management - ATFM task force (ATFM TF) of NACC/WG is presented in WP/41. Conclusions and recommendations are included in the named paper.

2.3. SAM Región: Project A1 “ PBN Operational implementation”

2.3.1. The Meetings of the Implementation Group of the South American Region (SAM/IG) concentrate their actions for the Enroute, SID/STAR Standard Route and TMA PBN airspace phases, as well as PBN approach procedures.

2.3.2. Since 2019, the SAM Airspace Study and Implementation Group (GESEA) has been established, which aims to increase the efficiency of the work promoted by the SAM/IG. GESEA has been working since its creation on the basis of teleconferencing and electronic communication.

2.3.3. It is noted that during the pandemic period, airspace design personnel and/or PANS OPS in most administrations were assigned to remote work. This generated a severe limitation to the work of designing flight procedures, due to the limited access to the tools and software that is installed in the ANSP offices. Topography and obstacles surveying, was not facilitated.

2.3.4. Regarding the training activities of flight procedure designers, basic and refresher courses were also limited in the Region, however, some PANS OPS course options appeared by virtual means, offered by public and private instruction centers. In several States, the number of designer specialists has been reduced, due to retirement processes or reassignment in operational functions.

2.3.5. The progress of the project for the period 2019 – 2022 is shown in **Appendix A** to this paper. ICAO's iSTARS application considers 224 instrument runway thresholds currently in the SAM Region (international airports) then, 9 thresholds were added to the 2019 baseline. See the following Tables:

2.3.6. SAM/IG/27 (Virtual, June 2022) adopted the SAM Airspace Performance Optimization Roadmap 2022-2026, which updates PBN deployment metrics and timelines. This document is presented in the respective Report, available at the following link:

https://www.icao.int/SAM/Documents/2022-RLA06901-SAMIG27/SAMIG27%20Report.pdf

2.3.7. The details of the main activities of the PBN SAM Implementation Project are attached as **Appendix B** to this paper.

2.4. SAM Región: Project A2 - Air Navigation systems in support of PBN

2.4.1. The improved version of the SAM Region Autonomous Receiver Integrity Monitoring (RAIM) Availability Prediction Service (SATDIS) software is in the process of being implemented by the Member States of the RLA 06 901 Project. Since June 2022, the focal points of each State have been assisted and trained to facilitate access for air space users and operators.

2.4.2. Regarding the implementation of GBAS technology studied by Brazil, there has been no progress. The experimental activities of the National Civil Aviation Administration (ANAC) of Argentina in conjunction with the technology company INVAP S.E. for a precision approach and landing system Ground-Based Augmentation System (GBAS) at Bariloche International Airport, are suspended due to the incidence of other priorities in the Administration.

2.4.3. The description of the activities of this Project is shown in **Appendix C** to this paper.

2.5. Región SAM: Proyecto B1 “Mejorar el equilibrio entre la demanda y la capacidad”

2.5.1. Since June 2021, Sub Group 3 – ATFM (SG3), of the SAM Airspace Study and Implementation Group (GESEA), was constituted, which defined the necessary deliverables to boost the activity of ATFM services. The Report of the SAMI/IG/27 meeting contains details of the progress of SG3.

2.5.2. SG3 worked on the preparation of an ATFM Operations Plan (OPSAM) with the aim of structuring actions that allow, during the recovery phase of operations in the SAM region, to adjust ATC and Airport capacity to the gradual demand increase. As well, contribute to the recovery and sustainability of the air transport system at regional and global level in the new projected scenario.

2.5.3. This mechanism includes the creation of a DASHBOARD with a single database format to allow the exchange of information on demand and support the establishment of two Operational Teleconferences ATFM SAM (BRISA), one pre-tactic and one Strategic/Post-operations, with the participation of ATFM services and airlines (IATA).

2.5.4. Currently, the DASHBOARD (IATA Winter 22 season data) has the schedule of flights from Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Panama and Peru, to be used in the organization of the BRISA. As the post-operations information provided by the States is analyzed, the management of KPIs referring to punctuality, flight efficiency, etc. is being initiated. See the DASHBOARD in the following link:

https://app.powerbi.com/view?r=eyJrIjoiMDZiNjU0MzktOGQ1Yy00ZWJkLTgwMGUtZTQ0NTU2MzVjOGQ0IiwidCI6IjI2MjI4ZGNhLTcwZDMtNDkxNy04MjMzLTA4M2FjMzY1NWE5MSJ9

2.5.5. The daily dissemination of the ATFM Daily Plans (PDA) is maintained on time, via mail and / or web by six SAM States. COCESNA also shares its information on this initiative, which favors the regional and interregional CDM process.

2.5.6. The SAM/IG has approved the Guide for the implementation of the ATFM service in the SAM Region and the Manual for Calculating Runway Capacity and ATS Sector. SAM/IG/28 has provided for the development of cross-border ATFM studies based on current collaborative practices between Argentina, Brazil, Chile and Uruguay services.

2.5.7. The details of the main activities of the ATFM SAM Implementation Project are attached as **Appendix D** of this paper.

3. Conclusions

3.1 Sponsored by Project RLA/06/901, direct assistance has been provided to the States of the SAM Region for the implementation of PBN in selected airspaces. The conditions and/or requirements to be able to address PBN implementation in the following period are listed below:

- The SAM Region maintains the progress of the deployment. 90.6% was reached in PBN (APV- BARO VNAV) in 2022.
- The productivity of flight procedure design and airspace services have been affected by sanitary measures. PANS OPS staff have been re-assigned or retirement retirements have occurred, reducing the human resources of the services. The needs for refresher courses for design personnel should be analysed, as well as the renewal of specialized equipment/software and updating work plans.
- Horizontal cooperation between States and, at the same time, with Industry should be emphasized to promote PBN implementation.
- The SATDIS tool has been delivered to the States of Project RLA/06/901, and will be made available so that users and operators in the Region can have prediction of RAIM availability.

3.2 The implementation of ATFM in the Region has been strengthened through data management activities and demand-capacity analysis. Studies on ATFM crossborder are being promoted.

3.3 Appendices to this paper show the description of the progress of implementation of the Projects for the SAM Regions respectively, based on the programme approved by GREPECAS.

4. Suggested action

4.1 Meeting is invited to:

a) take note of the information in this paper; and to review the activities and status of the projects detailed in Appendices A, B, C and D; and
b) to formulate such other actions as the meeting deems appropriate.

— END —

APPENDIX A

Progress of the project for the period 2019 – 2022. ICAO's iSTARS application considers 224 instrument runway thresholds currently in the SAM Region (international airports) then, 9 thresholds were added to the 2019 baseline. See the following Tables:

Note. - The PBN statistics presented by iSTARS cover 13 SAM States; does not include French Guyana

Table 1.- Progress in the implementation of PBN in Regional SAM 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
2022A	160	20	140	87.50

A On December 1, 2022 changes will be implemented between Colombia and Panama
Prepared by RO SAM

Table 2.- Progress in the implementation of PBN in departures/arrivals.

Date iSTARS	*SAM States	TOTAL THR Intl.	% SID PBN	% STAR PBN
DEC 2019	13	215	66.0	50.7
DEC 2020	13	217	67.7	52.5
DEC 2021	13	222	68.9	51.8
OCT 2022	13	224	68.8	53.1

Source iSTARS

Table 3.- Advances in PBN implementation in Approximation

Date iSTARS	*SAM States	THR PBN	TOTAL THR Intl.	% approaches implemented
DEC 2019	13	189	215	87.9
DEC 2020	13	192	217	88.5
DEC 2021	13	201	222	90.5
OCT 2022	13	203	224	90.6

Source iSTARS

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APPENDIX B

PROJECT A1 FOR THE SAM REGION – PBN OPERATIONAL IMPLEMENTATION

SAM Region	**PROJECT DESCRIPTION (PD)**	PD N° A1	
Programme	**Project Title**	**Start**	**End**
SAM airspace optimisation *(Programme coordinator: ATM RO Fernando Hermoza Hübner)*	PBN operational implementation *Project coordinator:* *Julio Cesar de Souza Pereira (IATA)*	2011	2026
Objective	Support the optimisation of the SAM airspace structure through the optimisation of the ATS route structure in terminal airspace (RNAV/RNP SIDs/STARs) and en-route (RNAV/RNP), as well as the implementation of PBN approaches in accordance with ICAO Assembly Resolution A37-11, with a view to attaining the goals set forth in the Declaration of Bogota.		
Scope	The implementation project contemplates the optimisation of the SAM airspace through PBN implementation and the application of the flexible use of airspace (FUA) concept, as well as phased optimisation of the ATS route network of the Region.		
Metrics	• Reduction of CO_2 emissions per each route optimisation version, in tonnes. • Percentage of international airports with RNAV and/or RNP SIDs/STARs implemented. • Percentage of international airports with continuous descent and climb operations implemented. • Number of RNAV/RNP routes implemented, realigned and/or eliminated. • Percentage of thresholds with APV approaches at international airports.		
Strategy	Project activities will be coordinated among Project members, the Project coordinator and the Programme coordinator through SAM/IG meetings, ATS route optimisation (ATS/RO) meetings and other events deemed necessary (PBN workshops, hiring of experts, etc.). The Project coordinator will coordinate with the Programme coordinator the incorporation of additional experts if so required by the tasks and work to be performed. Likewise, States must review their respective national PBN implementation programmes to ensure they are compatible with the SAM PBN project. Activities to review, implement, modify or eliminate routes in the SAM Region have been scheduled in order to continue optimising the ATS route structure.		

Goals	• Implementation of Version 3 of the PBN-based ATS route network in order to respond to current airspace user requirements by the end of 2017. • Achievement of the goals set forth in the Declaration of Bogota. • PBN-based redesign of 30% of the main SAM TMAs by 2016, 50% by 2018. • Development of Version 4 of the PBN-based ATS route network and design of PBN-based TMAs. • Optimisation of longitudinal separation.
Rationale	The 37th ICAO General Assembly formulated Resolution A37-11 (*Performance-based navigation global goals*) in which it took note that the Planning and Implementation Regional Groups (PIRG) had completed regional PBN implementation plans and urged States to implement RNAV and RNP air traffic service (ATS) routes and approach procedures in accordance with ICAO PBN concept laid down in the Performance-based navigation (PBN) manual (Doc 9613), and resolved that States should complete a PBN implementation plan as a matter of urgency to achieve: 1) implementation of RNAV and RNP operations (where required) for en-route and terminal areas according to established timelines and intermediate milestones; 2) implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV-only minima, for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016, with intermediate milestones as follows: 30% by 2010 and 70% by 2014; and 3) implementation of straight-in LNAV-only procedures, as an exception to 2) above, for instrument runways at aerodromes where there is no local altimeter setting available and where there are no aircraft suitably equipped for APV operations with a maximum certified take-off mass of 5 700 kg or more. Furthermore, the Global air navigation plan (GANP), Chapter 2 (implementation) defines performance-based navigation as its main priority. The GANP specifies that "*the introduction of PBN met the expectations of all the aviation community. Current implementation plans should help provide additional benefits, but they are still subject to the availability of proper training, the provision of specialised support by the States, continuing maintenance and development of international standards and recommended practices (SARPs) and closer coordination between States and aviation stakeholders."* Accordingly, this project provides specialised support and close coordination between States and other stakeholders to ensure harmonised PBN implementation in all the corresponding flight phases: en-route, TMA and approach.
Related projects	• Flexible use of airspace • Automation • Air navigation systems in support of PBN

Project deliverables	Relationship with the regional performance-based plan	Responsible party	Status of implementation*	Date of delivery	Comments
Implementation of Version 1 of the ATS route network based on RNAV, with the required PBN values to respond to the current requirements of airspace users.	B0-FRTO	Alexandre Luiz Dutra Bastos	FINALISED	October 2010 FINALISED	
Implementation of RNAV5 in the SAM Region	B0-FRTO	Alexandre Luiz Dutra Bastos	FINALISED	October 2011 FINALISED	
Action plan for the implementation of Version 2 of the ATS route network optimisation programme	B0-FRTO	Alexandre Luiz Dutra Bastos	FINALISED	ATSRO/3 FINALISED	

Traffic data to understand airspace traffic flows	B0-FRTO	ICAO coordinator	FINALISED	SAM/IG/6 FINALISED	
Navigation capacity of the fleet	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos	FINALISED	SAM/IG/9 FINALISED	
List of gateways of the main SAM TMAs	PFF SAM ATM 02	Alexandre Luiz Dutra Bastos	FINALISED	SAM/IG/9	Assistance was provided to States for the redesign of their TMAs in order to expedite PBN implementation, by training their experts in airspace planning. Several States are delayed in their projects.
Letters of agreement and contingency with adjacent States	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos	FINALISED	SAM/IG/10 FINALISED	
Detailed study of the SAM ATS route network with a view to developing Version 2 of the route network	B0-FRTO	Alexandre Luiz Dutra Bastos	FINALISED	April 2012 FINALISED	
Risk analysis for the implementation of Version 2 of the ATSRO programme	B0-FRTO	External consultants	FINALISED	SAM/IG/10 FINALISED	

SAM Route Network Optimisation					
Planning of Version 3 - Stage 1	B0-FRTO	External consultants	FINALISED	SAM/IG/14 FINALISED	
Implementation Version 3 - Stage 1 - Flow 1 (Argentina -Chile - Paraguay)	B0-FRTO	States SAM Regional Office	FINALISED	April 2015 FINALISED	

Implementation Version 3 - Stage 1 - Flow 2 (Argentina –Brazil - Uruguay)	B0-FRTO	States SAM Regional Office	FINALISED	March 2017 FINALISED	The optimisation of this traffic flow is delayed.
Implementation Version 3 - Stage 1 - Flow 3 (Panama - CENAMER - Caribbean)	B0-FRTO	States SAM Regional Office	FINALISED	March 2017 FINALISED	Coordination started with CAR States. The optimisation of this traffic flow is delayed. Panama will start the TMA and FIR airspace optimisation process. Improvements between Panama – Jamaica were coordinated at ATSRO/8.
Implementation Version 3 - Stage 1 - Flow 3 (Brazil -Guyana – French Guiana - Suriname - Venezuela - Caribe)	B0-FRTO	States SAM Regional Office	FINALISED	October 2016 FINALISED	The optimisation of the main flows has been coordinated.
Airspace concept Version 3 – Stage 2	B0-FRTO	States SAM Regional Office	FINALISED	ATSRO/7 FINALISED	The validated PBN airspace concept of the main SAM TMAs was agreed upon
Implementation Version 3 – Stage 2	B0-FRTO	States SAM Regional Office	FINALISED	November 2017 FINALISED	In October 2016. Routes not directly related to TMA re-structuring were implemented. The remaining initiatives were transferred to Version 4.
Development of the PBN route structure operational concept (ATS routes, SIDs, STARs) for the period 2017-2019	B0-FRTO	States SAM Regional Office	FINALISED	November 2016 FINALISED	Hiring of experts and invitation to States to contribute with human resources. The CONOPS has been presented at the SAM/IG/19 and ATSRO/8 meetings

Regional strategy and work programme for the implementation of the flexible use of airspace through a phased approach, starting with an increasingly dynamic sharing of reserved airspace.	B0-FRTO	States SAM Regional Office		2013-2024	The flexible use of airspace is being enhanced through route optimisation. SAMIG/26 has programmed a workshop on FUA by November 2022
Reduction of conventional longitudinal separation from 80 to 40 NM for GNSS-equipped aircraft.	B0-FRTO	States SAM Regional Office		2016-2024	Significant progress has been made in this task, which is expected for completion on time. Some States like Venezuela depend on action taken by adjacent CAR States. A regional workshop was held in November 2017, where activities were designed to consolidate implementation. Implemented since 2019 in continental airspace. On going, activities in oceanic airspace and CAR SAM interfaces.
Reduction of conventional longitudinal separation from 40 to 20 NM for GNSS-equipped aircraft.	B0-FRTO	States SAM Regional Office		2017-2024	A proposal of Action Plan for the implementation of 20-NM separation minima was agreed at the regional workshop held in November 2017. Brazil started applying this minimum ONLY for aircraft ENTERING its FIRs, on continental airspace. In the SAM SUR (September 2022) and SAM NORTE (October 2022) Workshops, agreements on the application of 20NM have been signed and included in the LOA ATS.
Reduction of conventional longitudinal separation from 20 to 10 NM for scenarios in which ATS surveillance systems are used that cover the boundaries of the FIRs under consideration.	B0-FRTO	States SAM Regional Office		2020 - 2026	

Updating of the status of implementation of RNAV5 Regional Routes	B0-FRTO	States SAM Regional Office		On-going task	
Integration within eANP VOL III management project	B0-FRTO	GREPECAS		4Q - 2023	

PBN TMA					
Updating of action plans. PBN implementation in the main TMAs	PFF SAM ATM 02	States	FINALISED	May 2017 FINALISED	. Conclusion SAM/IG/14-6. 100% of States have updated their action plans.
Updating of the status of implementation of PBN SIDs/STARs	PFF SAM ATM 02	States		On-going task	Yearly update prior to 30 June and prior to 31 December, in accordance with Conclusion SAM/IG/14-4. Tables were updated at the ATSRO/08 meeting. No information is available for French Guiana. December 2021; iSTARS has updated data of implementation, information of Thresholds in international airports has been harmonized. iSTARS presents updated data.
Updating of Table AOP-1	PFF SAM ATM 02	States		On going	Conclusion SAM/IG/15-3.
Integration within eANP VOL III management project	PFF SAM ATM 03 B0 APTA	GREPECAS		4Q - 2023	

Approach					
Updating of the status of implementation of APV IAC	PFF SAM ATM 03 B0 APTA	States		On-going task	Yearly update prior to 30 June and prior to 31 December, in accordance with Conclusion SAM/IG/14-4. Implementation of RNP APCH procedures with Baro-VNAV vertical guidance or RNP AR APCH must be reported. Tables were updated at the ATSRO/8 meeting. No information is available for French Guiana. December 2021; iSTARS has updated data of implementation, information of Thresholds in international airports has been harmonized. iSTARS presents updated data. SAM Region implementation 90.5% October 2022, implementation 90.6%
Integration within eANP VOL III management project	PFF SAM ATM 03 B0 APTA	GREPECAS		4Q - 2023	

Meetings/Workshops					
SAM/IG/07	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2011	SAM PBN implementation group
SAM/IG/08	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2011 FINALISED	SAM PBN implementation group

SAM/IG/09	PFF SAM ATM	States SAM Regional Office	FINALISED	Mayo 2012 FINALISED	SAM PBN implementation group
SAM/IG/10	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2012 FINALISED	SAM PBN implementation group
SAM/IG/11	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2013 FINALISED	SAM PBN implementation group
SAM/IG/12	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2013 FINALISED	SAM PBN implementation group
SAM/IG/13	PFF SAM ATM	States SAM Regional Office	FINALISED	Mayo 2014 FINALISED	SAM PBN implementation group
SAM/IG/14	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2014 FINALISED	SAM PBN implementation group
SAM/IG/15	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2015 FINALISED	SAM PBN implementation group
SAM/IG/16	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2015 FINALISED	SAM PBN implementation group
SAM/IG/17	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2016 FINALISED	SAM PBN implementation group
SAM/IG/18	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2016 FINALISED	SAM PBN implementation group
SAM/IG/19	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2017 FINALISED	SAM PBN implementation group

SAM/IG/20	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2017 FINALISED	SAM PBN implementation group
SAM/IG/21	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2018 FINALISED	SAM PBN implementation group
SAM/IG/22	PFF SAM ATM	States SAM Regional Office	FINALISED	November 2018 FINALISED	SAM PBN implementation group
SAM/IG/23	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2019 FINALISED	SAM PBN implementation group
SAM/IG/24	PFF SAM ATM	States SAM Regional Office	FINALISED	Nov 2019 FINALISED	SAM PBN implementation group
SAM/IG/25	PFF SAM ATM	States SAM Regional Office	FINALISED	Nov 2020 FINALISED	SAM PBN implementation group
SAM/IG/26	PFF SAM ATM	States SAM Regional Office	FINALISED	Sep 2021 FINALISED	SAM PBN implementation group
SAM/IG/27	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2022	SAM PBN implementation group
SAM/IG/28	PFF SAM ATM	States SAM Regional Office	FINALISED	Sep 2022	SAM PBN implementation group
SAM/IG/29	PFF SAM ATM	States SAM Regional Office		**May 2023**	
SAM/IG/30	PFF SAM ATM	States SAM Regional Office		**October 2023**	

ATSRO/03	PFF SAM ATM 03	States SAM Regional Office	FINALISED	July 2011 FINALISED	SAM route network optimisation
ATSRO/04	PFF SAM ATM 03	States SAM Regional Office	FINALISED	July 2012 FINALISED	SAM route network optimisation
ATSRO/05	PFF SAM ATM 03	States SAM Regional Office	FINALISED	July 2013 FINALISED	SAM route network optimisation
ATSRO/06	PFF SAM ATM 03	States SAM Regional Office	FINALISED	October 2014 FINALISED	SAM route network optimisation
ATSRO/07	PFF SAM ATM 03	States SAM Regional Office	FINALISED	October 2015 FINALISED	SAM route network optimisation
ATSRO/08	PFF SAM ATM 03	States SAM Regional Office	FINALISED	September 2017 FINALISED	- Held on 11-15 September 2017. Implementation of Version 4 of the route network was begun.
ATSRO/09	PFF SAM ATM 03	States SAM Regional Office	FINALISED	July 2018 FINALISED	SAM route network optimisation
ATSRO/10	PFF SAM ATM 03	States SAM Regional Office	FINALISED	June 2019 FINALISED	SAM route network optimisation Version 10 of ATS routes; Implemented between 2019 – 2021.
Hiring of experts for consolidation of Version 4 of the SAM ATS route network	PFF SAM ATM 03	States SAM Regional Office	FINALISED	June 2017 FINALISED	- Two experts from the Region were hired. The Route Network Version 4 deliverable was developed with 91 route improvement initiatives.
Hiring of experts for consolidation of Version 5 of the SAM ATS route network	PFF SAM ATM 03	States SAM Regional Office	FINALISED	February 2019 FINALISED	SAM route network optimisation

Workshop on PBN airspace planning	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	March 2013 FINALISED	Initial training in the PBN airspace planning process.
PBN/1 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	May 2014 FINALISED	Objective: Preliminary PBN training and design of the Asunción and Bogota TMAs.
PBN/2 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	September 2014 FINALISED	Objective: Preliminary PBN design of the main South American TMAs.
PBN/3 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	March 2015 FINALISED	Objective: Validation of the preliminary PBN design of the main South American TMAs.
PBN/4 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	September 2015 FINALISED	Objective: Guide PBN implementation at the main South American TMAs.
PBN/IMP/1 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	April 2016 FINALISED	Review the status of implementation in States whose implementation date was the first semester of 2016.
PBN/IMP/2 workshop and related PANS-OPS activities	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	September 2016 FINALISED	Review the status of implementation in States whose implementation date is the second half of 2016 and carry out the related PANS-OPS activities.

Others					
Updating and submission of the National PBN implementation plan to the Regional Office	B0 APTA B0 CCO B0 CDO	States	FINALISED	SAM/IG/15 FINALISED	93% of States have completed the task. French Guiana is still pending. Headquarters has requested the delivery of the national PBN implementation plans. 2012: PBN PLAN of France is available.
Resources needed	Designation of experts for completion of some of the deliverables.				

*

Grey ***Task not started yet***
Green ***Activity being implemented as scheduled***
Yellow ***Activity started with some delay, but will be implemented on time***
Red ***Activity not implemented on time; mitigation measures are required***

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APPENDIX C

PROJECT A2 – AIR NAVIGATION SYSTEMS IN SUPPORT OF PBN

SAM Region	**PROJECT DESCRIPTION (DP)**	**DP N° A2**	
Programme	**Project Title**	**Start**	**End**
PBN (*Programme coordinator: ATM RO Fernando Hermoza)*	Air navigation systems in support of PBN *Project coordinator:* *Julio César de Souza Pereira Pereira (IATA)* *Experts contributing to the Project: Alessander Santoro, Andre Jansen, Fabio Augusto Andrade (Brazil), Paulo Vila, Tomas Macedo (Peru) and SAM/IG SAM PBN Group*	January 2011	December 2021
Objective	Develop guides, conduct analyses and implement services in support of PBN implementation in the SAM Region.		
Scope	Support to PBN implementation in the SAM Region, initially consisting of: • Practical guide for the implementation of GBAS systems. • Analysis of DME/DME coverage to support PBN procedures. • Implementation of a RAIM availability prediction service.		
Metrics	• Drafting of a practical guide for the implementation of a GBAS system. • DME/DME coverage in the SAM Region. • Availability of a RAIM availability prediction service. • % States providing the RAIM availability service.		
Strategy	• All activities will be conducted by experts designated by SAM States and organisations participating in the project entitled "*Air navigation systems in support of PBN"*, under the management of the project coordinator and the supervision of the programme coordinator. Communications among project members, and between the project coordinator and the programme coordinator shall be done through teleconferences and the Internet. Likewise, the programme coordinator, the project coordinator and the contributing experts can meet at the SAM/IG implementation meetings. • Once the studies have been completed, the results will be sent to the ICAO programme coordinator as a final consolidated document, and to the GREPECAS PPRC for analysis, review and approval.		

Goals	Guide for the implementation of a GBAS system, by October 2012. (Revision November 2016). • Assessment of DME/DME coverage to support PBN procedures, by May 2011. • RAIM availability prediction service in the SAM Region implemented by September 2014. • 11 SAM States with RAIM availability prediction service available by February 2014. • 3 SAM States and one territory with the service available by the end of 2014.
Rationale	• The implementation of PBN procedures for approach, terminal and en-route operations requires the implementation of air navigation systems, services and infrastructure studies, such as the proper installation of DME to support the DME/DME navigation required in the event of failure of the GNSS system, the RAIM availability prediction service to enable the user to know what is RAIM availability for en-route, terminal and approach operations, and the implementation of GBAS systems to support precision landing procedures. • This project contributes to the implementation of SAM PFF CNS 03, ATM 01, ATM 02, and ATM 03 of the *SAM Performance-based navigation system implementation plan (SAM PBIP).*
Related projects	• Implementation of PBN operational aspects.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
Develop a practical guide for the implementation of the GBAS system					
Review of practical guide for the implementation of GBAS systems	SAM PFF CNS 03 ANRF B0-APTA (65)	Alessander Santoro (Brazil)		December 2018	The practical guide for the implementation of GBAS systems was presented for review at SAM/IG/8 meeting. It was circulated to all States of the Region for review and final version was presented at SAM/IG/11 meeting. In order to measure the real impact, joint work was undertaken using the SLS-4000 station and other 110 GPS L1 and L2 stations installed in Brazil. Data was collected over a period of maximum solar activity, although it was the lowest in the last 100 years. From the data obtained, Brazil concluded that so far, the SLS-4000 station may not be used in full for CAT I operations in low latitude regions. Accordingly, ICEA (*Instituto de Control del Espacio Aéreo*) will continue research in cooperation with the FAA and the supplier (Honeywell), seeking to develop a risk model capable of withstanding ionosphere behaviour in low latitudes. The Workshop on the implementation of the navigation Infrastructure in support of the PBN in NAM/CAR/SAM Regions held in august 2016 continued analysis on this matter. Technical papers are available at the link: https://www.icao.int/SAM/Pages/MeetingsDocumentation.aspx?m=2016-GBAS As of December 2017, the SLS-4000 station does not meet ICAO's integrity and availability requirements.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
					Brazil continues research in collaboration with universities and Honeywell, seeking to develop a risk model applicable to the SAM Region. A review of the practical guide for the implementation of the GBAS system will follow after completing the development of a risk model capable of withstanding ionosphere behaviour at low latitudes. This is to be completed by the last quarter of 2018. SAMIG/23 meeting, may 2019, updated the information In 2021 Brazil and Argentina has decommissioned the projects due new priorities on air navigation implementation.

Analyse DME/DME and GNSS infrastructure and coverage needed to support PBN implementation					
Analysis of the DME/DME and GNSS infrastructure required to support PBN implementation in the SAM Region	SAM PFF CNS/03 SAM PFF ATM/01 ATM/02 ATM/03 ANRF B0-APTA(65) B0-FRTO(10), B0-CDO(05) and B0-CCO(20)	Fabio Augusto Andrade and Andre Jansen (Brazil) Paulo Vila and Tomás Macedo (Peru)	FINALISED	Coverage study to support RNAV-5 completed (SAM/IG/8, October 2011)	A *DME/DME coverage study* was presented and reviewed at the SAM/IG/7 meeting (Lima, Peru, 23-27 May 2011). The coverage study was conducted using the EMACS tool and the results were delivered in a KMZ file clearly showing DME/DME coverage over the geographical map of the SAM Region, using *Google Earth*. The study only supports the RNAV-5 procedure.

Development of guidance on the use and availability of GNSS performance forecast/validation tools.					
Implementation of a RAIM availability prediction service	SAMPFF CNS/03 SAM PFF ATM/01 ATM/02 ATM/03 ANRF B0-APTA (65), B0-FRTO(10) B0-CDO(05) and B0-CCO(20)	Project coordinator SAM/IG PBN Group		In the process of delivery to States and user access (October 2022)	Two web-based remote courses were conducted on 15 and 16 September 2014, one in English and the other in Spanish, mainly including explanation of the tools contained in the SAM RAIM availability prediction service website (SATDIS), the code assignment procedure, data import and export, and the query and failure resolution procedure. The course was attended by all focal points nominated by the States, as well as by other participants designated by the States. All focal points received from the service provider the respective user name and password to access SATDIS as administrators. The SATDIS website in three languages (Spanish, Portuguese and English), became operational on 17 September 2014. The SATDIS FSAT was conducted on 18 November 2014. The RAIM availability prediction service is operating since 16 November 2014. In 2019, the SATDIS service contract expired via the web. RLA 06 901 has supplied the second version of SATDIS at the end of June 2022. The focal points of each State are being trained to assign access to air operators and users. The new version has more access facilities and new tools.

Monitor activities for the implementation of air navigation systems in support of PBN	SAMPFF CNS/03 SAM PFF ATM/01 ATM/02 ATM/03 ANRF B0-APTA (65), B0-FRTO(10) B0-CDO(05) and B0-CCO(20)	ICAO		On-going task	
Resources needed	Implementation of the RAIM availability prediction service.				

Grey *– Task not started*
Green *– Activity underway as scheduled*
Yellow *– Activity started with some delay but expected to be completed on time*
Red *– I has not been possible to implement this activity as scheduled; mitigating measures are required*

APPENDIX D

SAM REGION; PROJECT B1 – IMPROVE DEMAND-CAPACITY BALANCING

SAM Region	**PROJECT DESCRIPTION (DP)**	DP N° B1	
Programme	**Project Title**	**Start**	**End**
Air traffic flow management (ATFM) *(Programme coordinator: ATM RO Fernando Hermoza Hubner)*	*Improve demand-capacity balancing* *Project coordinator: Ricardo David Benedictis (Brasil)*	2012	2026
Objective	Avoid overloading the ATC and airport systems, strengthening safety, taking into consideration the reduction in the number of delays caused by meteorological and traffic conditions, thus reducing fuel consumption and contaminating emissions. Likewise, improve prediction and management of surplus demand for services in ATC sectors and aerodromes.		
Scope	The scope of this project establishes that ATFM implementation should start with airport and airspace monitoring in order to identify significant increases in ground delays and in-flight holding, as well as bottlenecks (ATC sector, runway, apron, and airport facilities). Furthermore, capacity calculation and air traffic demand analysis are important elements to improve demand/capacity balancing.		
Metrics	• % States that have calculated runway and ATC sector capacity • % States that have implemented ATFM in flow management units (FMUs) or flow management positions (FMPs) • % States complying implementation by Phases, according ATFM implementation regional guidance.		
Strategy	Project activities define ATFM implementation in the SAM Region through an airspace demand and capacity analysis, taking into account that States that are in the process of implementation shall coordinate with the ATM community to define the actions required for ATFM implementation. The infrastructure and the database, as well as the policy, standards, and procedures, are important components for the execution of this Project.		

Goals	• SAM States with experts trained in runway and airspace capacity (ATC sector) calculation • ATFM performance oversight plan • CAR/SAM inter-regional coordination
Rationale	GREPECAS considered that early ATFM implementation should ensure optimum air traffic flow to or through certain areas during periods in which demand exceeded or was expected to exceed the available capacity of the ATC system. Therefore, the ATFM system should reduce aircraft delays, both in flight as well as on the ground, and avoid system overload.
Related projects	• Automation.

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
1. Assess the progress made in the ATFM implementation work programme	B0-NOPS	Programme coordinator		2026	On-going task
2. Calculation of airspace (ATC sector) capacity	B0-NOPS	Juarez Franklin Gouveia	FINALISED	SAM/IG/9 FINALISED see ITEM 9	Brazil and Colombia submitted their studies.
3. List of airspace sectors that have periods in which demand exceeds the existing capacity, including, if necessary, simulations by the States	B0-NOPS	Juarez Franklin Gouveia	FINALISED	SAM/IG/9 SAM/IG/10 FINALISED see ITEM 9	Brazil and Colombia submitted their studies.
4. List of operational factors affecting demand and airspace capacity for the optimisation of existing capacity, including simulations, if necessary.	B0-NOPS	Juarez Franklin Gouveia	FINALISED	SAM/IG/9 FINALISED see ITEM 9, 14 y 15	Brazil and Colombia submitted their studies. Brazil, Paraguay, and Peru presented data at the SAM/IG/11 meeting.
5. Definition of the common elements of situational awareness	B0-NOPS	Paulo Vila	FINALISED	2012 FINALISED see ITEM 14	The States that exchange information are: Chile, Colombia, Paraguay, and Venezuela.

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
6. Training of personnel in strategic ATFM airspace measures	B0-NOPS	Project RLA/06/901		2022	In 2010, an ATFM/CDM course was conducted in Brazil with the participation of several States. In March 2009, a course on runway and ATC sector capacity calculation was conducted in Brazil. In 2012, a course for instructors on runway and ATC sector capacity calculations was conducted in Lima. An ATFM seminar has been delivered in June 2018. A Workshop/Meeting on ATFM Regional Data Management and Indicators is scheduled for 2022
7. List of factors affecting the implementation decision	B0-NOPS	Programme coordinator	FINALISED	2010 FINALISED see ITEM 15	The following causes were identified at the SAM/IG/11 meeting: - States that do not have the requirement or the need to implement ATFM; - Budgetary and organisational reasons; - Lack of personnel specifically devoted to ATFM activities; - The personnel responsible for ATFM are involved in other functions.

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
8. Updating of runway capacity calculations	B0-NOPS	Programme coordinator		2024	2018: 85% of States have updated runway capacity calculations. Guyana and Suriname are still lacking capacity calculations. Due to the pandemic, in the period 2020-2021 the capacities and characteristics of demand have evolved throughout the Region. An update on runway capacity calculations is required in all States. The draft of the ATC Sector and runway Capacity Calculation Manual is being updated for 2022, it is expected to be adopted in May 2022. A Workshop/Meeting on Capacity Calculation Methodology for the ATFM is scheduled for 2022
9. Updating of airspace (ATC sector) capacity calculations	B0-NOPS	Programme coordinator		2024	2018: 6 States of the Region have performed ATC sector capacity calculations prior to implementation, 5 have not performed the activity, and information is still to be received from 3 States. Due to the pandemic, in the period 2020-2021 the capacities and characteristics of demand have evolved throughout the Region. An update on airspace capacity calculations is required in all States. The draft of the ATC Sector and runway Capacity Calculation Manual is being updated for 2022, it is expected to be adopted in May 2022. A Workshop/Meeting on Capacity Calculation Methodology for the ATFM is scheduled for 2022

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
10. Airspace monitoring processes Traffic demand analysis processes Standards on FMU/FMP procedures Implementation of preliminary ATFM measures Implementation of TMIs ATFM messaging Coordination of special events Civil/military exemptions and coordination	B0-NOPS	CGNA course Project RLA/06/901	FINALISED	November 2014 FINALISED	Completed on time
11. Replication of ATFM courses at national level	B0-NOPS	States	FINALISED	15/05/2015 FINALISED	The States replicated ATFM courses at national level.
12. ATFM measures during the Rio 2016 Olympic and Paralympic Games in Brazil	B0-NOPS	Brazil	FINALISED	13/05/2016 FINALISED	Details of the AIC of Brazil can be found in: http://publicacoes.decea.gov.br/?i=publicacao&id=4339
13. CONOPS ATFM CAR SAM updated and approved by GREPECAS	B0-NOPS	Programme coordinator	FINALISED	July 2019 FINALISED	SAMIG/23 (June 2019) reviewed the draft. Approved by CRPP/5 meeting
14. ATFM operations Plan	B0-NOPS	Programme coordinator	FINALISED	September 2021 FINALISED	Plan adopted at SAMIG/26 Meeting, September 2021
15. Guide for the implementation of the ATFM in the SAM Region 2022- 2026	B0-NOPS	Programme coordinator	FINALISED	September 2021 FINALISED	Guide adopted at SAMIG/26 Meeting, September 2021 Stipulates implementation by phases

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
16. Manual for calculating Runway Capacity and ATC Sector for the SAM Region	B0-NOPS	Programme coordinator	FINALISED	May 2022 FINALISED	Manual was adopted SAMIG/27. A workshop was released in august 2022.
17. PHASE ATFM I implementation	B0-NOPS	Programme coordinator		On going	
18. PHASE ATFM II-A implementation	B0-NOPS	Programme coordinator		On going	
19. PHASE ATFM II-B implementation	B0-NOPS	Programme coordinator		31 December 2022	
20. PHASE ATFM III implementation	B0-NOPS	Programme coordinator		31 December 2023	
21. PHASE ATFM IV implementation	B0-NOPS	Programme coordinator		31 December 2025	
22. Integration within eANP VOL III management project	B0-NOPS	GREPECAS		4Q - 2023	
Resources needed	Designation of experts for the execution of some of the deliverables.				

*Status of implementation; according colors in fourth column

Grey **Task not started**
Green **Activity underway as scheduled**
Yellow **Activity started with some delay but expected to be completed on time**
Red **It has not been possible to implement this activity as scheduled; mitigation measures are required**

— END —