



**GREPECAS Programmes and Projects Committee (PPRC) Fourth Virtual Meeting
 (ePPRC/04)
 Online, 21 – 22 April 2022**

- Agenda Item 2: Follow-up on the CAR/SAM Planning and Implementation Regional Group (GREPECAS) Programmes and Projects**
- 2.1 Reviewed GREPECAS Programmes and Projects (Aerodromes and Ground Aids (AGA), Air Traffic Management (ATM), Aeronautical Information Management (AIM), Communications, Navigation and Surveillance (CNS), Meteorology (MET) and Search and Rescue (SAR))**

STATUS OF PBN IMPLEMENTATION IN THE CAR/SAM REGIONS

(Presented by the Secretariat)

EXECUTIVE SUMMARY	
This working paper presents a report on the evolution of ATM implementation activities, related to the projects of the PBN Program for the CAR and SAM Regions	
Action:	Review the activities and status of projects detailed in Appendixes A and B
<i>Strategic Objectives:</i>	<ul style="list-style-type: none"> • Air Navigation Capacity and Efficiency • Economic Development of Air Transport • Environmental Protection
<i>References:</i>	<ul style="list-style-type: none"> • Doc 9631 – Performance-based Navigation (PBN) Manual • Doc 9750 – Global Air Navigation Plan for CNS/ATM Systems • Doc 9971 – Manual on Collaborative Air Traffic Flow Management • Reports of GREPECAS meetings • Reports of CRPP and eCRPP 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 to PBN.

1.2 The progress on the activities of projects comprised in Programme A: *Performance-based Navigation (PBN)*, are detailed below.

2. **Analysis**

2.1 **CAR Region: Project A1 “PBN Implementation”**

2.1.1 The North American, Central American and Caribbean Working Group (NACC/WG) PBN Task Force (renamed Airspace Optimization Task Force in 2021) has been focused on improving and optimizing the airspace in the CAR Region.

2.1.2 In January 2022 the Airspace Optimization Task Force absorbed the Airspace Optimization Team and the Ad hoc Group within the Team was renamed CIIFRA. This name reflects CADENA IATA ICAO Free Route Airspace.

2.1.3 The CIIFRA Ad hoc Group has taken a two-pronged approach on optimization of the region’s airspace. Track one is a quick approach optimizing end-to-end routes. These are called Planned Airways System Alternative routes or PASA. The team has seen positive results with efficiency gains in time, fuel and emissions output. See following graphic, which details six routes that have been in place since the Fall of 2021. There are another six routes in the process.

	Delta Airlines  DELTA		Delta Airlines  DELTA		Caribbean Airlines 	
	KATL↔KPJC		KATL↔SBRG		TTPP↔KMIA	
	Jul 9 - Oct 6, 2021		Jul 27 - Oct 24, 2021		Aug 6 - Nov 3, 2021	
Savings	90-Day	1-Year	90-Day*	1-Year	90-Day	1-Year
Flight min:	515	2,089	235	1,175	256	1,038
Fuel (lb):	145,425	589,779	62,035	310,175	46,780	189,719
CO2 (kg):	208,445	845,360	88,918	444,590	67,052	271,934
Cost (\$):	94,693	384,033	41,925	209,625	39,494	160,170

	United Airlines  UNITED		Delta Airlines  DELTA		Aerolineas Argentinas 	
	KIAH↔MMPR		SAEZ ↔KATL		SAEZ ↔KATL	
	Sep 1 - Nov 29, 2021		Dec 6, 2021-Mar 5, 2022		Dec 6, 2021-Mar 5, 2022	
Savings	90-Day	1-Year	90-Day*	1-Year	90-Day	1-Year
Flight min:	558	2,263	940	5,446	275	1,115
Fuel (lb):	52,841	214,300	175,508	1,016,832	64,673	262,283
CO2 (kg):	75,740	307,168	251,565	1,457,480	92,699	375,944
Cost (\$):	72,993	296,027	146,390	848,135	51,638	209,420

2.1.4 The total savings for these six routes is as follows:

Savings	
Flight min:	13,126
Fuel (lb):	2,583,088
CO2 (kg):	3,702,477
Cost (\$):	2,107,410

2.1.5 The second Track is long term, moving the region towards Free Route Airspace (FRA). The first trial occurred on 24 and 25 February 2022 between Atlanta and Lima. This test even showed improvement over the optimized end-to-end route.

Date	Flight (B764)	Flight Time (min)			Fuel (lb)			Distance (mile)		
		Base	PASA E2E	UPR	Base	PASA E2E	UPR	Base	PASA E2E	UPR
24-Feb	DAL150(ATL-LIM)	6:18	6:10	6:09	81290	79973	79787	2851	2808	2800
25-Feb	DAL151(LIM-ATL)	6:30	6:27	6:24	83271	82434	82199	2858	2885	2852

Date	Flight (B764)	Flight Time diff vs UPR		Fuel diff vs UPR		Distance diff vs UPR	
		Base	PASA E2E	Base	PASA E2E	Base	PASA E2E
24-Feb	DAL150(ATL-LIM)	0:09	0:01	1503	186	51	8
25-Feb	DAL151(LIM-ATL)	0:06	0:03	1072	235	6	33
	Total	0:15	0:04	2575	421	57	41

2.1.6 The savings from legacy route to Free Route is significant as seen in the following graphic.

	Baseline vs UPR	
Savings	1 Day	1 Year
Flight min:	15	5,475
Fuel (lb):	2,575	939,875
CO2 (kg):	3,691	1,347,173
Cost (\$):	2,269	828,060

	PASA Opt Rt vs UPR	
Savings	1 Day	1 Year
Flight min:	4	1,460
Fuel (lb):	421	153,665
CO2 (kg):	603	220,256
Cost (\$):	526	191,870

2.1.7 The Ad hoc team is now moving forward on both tracks anticipating 20 PASA routes by the end of the year. The movement towards FRA will continue to expand with 3 day, 7 day and finally 90 day trials.

2.2 SAM Region: A1 Project “PBN implementation”

2.2.1 The Meetings of the South American Region Implementation Group (SAM/IG) concentrate their actions mainly on the projected results for the Enroute, SID/STAR Routes phases and TMA PBN airspaces, as well as PBN approach procedures.

2.2.2 On 2019 the SAM Airspace Study and Implementation Group (GESEA) was established, which aims to increase the efficiency of the work promoted by SAM/IG. GESEA worked between 2019-2021 based on teleconferences and electronic communication.

2.2.3 It is highlighted that in 2020 and part of 2021, due to COVID health measures, airspace design and/or PANS OPS staff in most administrations were assigned to remote work. This caused 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. Fieldwork and topography to lift obstacles, was not possible either.

2.2.4 In addition, implementations and publications of AIP amendments on PBN routes and procedures were significantly limited by the sanitary measures, which even affected AIS MAP organizations and navigation database providers worldwide.

2.2.5 Regarding the training activities of the designers of flight procedures, the basic and updating courses in the Region were also limited, however, some options of PANS OPS courses appeared by virtual means, offered by public and private training centers.

2.2.6 The progress of the project for the period 2019 – 2021 is outlined below, through the following Tables:

**Note. – The NCP statistics presented by iSTARS consider 13 SAM States; does not include French Guyana*

Table 1.- Progress made in the 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%

Prepared by SAM RO

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

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

Source iSTARS

Table 3.- Progress made in the PBN implementation in Approaches

Date iSTARS	*SAM States	THR PBN	TOTAL THR Intl.	% Implemented PBN Approach
DEC 2019	13	189	215	87.9
DEC 2020	13	192	217	88.5
DEC 2021	13	201	222	90.5

Source iSTARS

2.2.7 Main activities of the PBN SAM Implementation Project are presented as **Appendix A** to this working paper.

2.3 *SAM Region: A2 Project - Air Navigation Systems in support to PBN*

2.3.1 Regarding the Implementation of a RAIM availability prediction service for the SAM Region, indicated in activities of the A2 project, it is recalled that the service began operation on November 16, 2014, but the contract expired in 2018. Coordination with members of RLA/06/901 Project was led to decide the acquisition of an improved version of the SATDIS software through an international tender.

2.3.2 To date, the selected provider NAVBLUE is customizing the SATDIS, and the on-site acceptance test cycle (SAT) is expected to take place in the first quarter of 2022, as well as the training activities considered.

2.3.3 On the implementation of GBAS technology being assessed by Brazil, no progress has been made. 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.

2.3.4 Activities of the PBN SAM Implementation Project are presented as **Appendix B** to this working paper.

3 Conclusions

3.1 The optimization of the regions airspace is progressing well. The two-track process will continue in earnest as more routes come online.

3.2 As more routes gain approval, the Ad hoc group will report to the Task Force the metrics regarding these routes. The Task Force will proceed to get the optimized routes published in the respective Aeronautical Information Publication (AIPs) SUP of each State.

3.3 The Task Force will meet in person July 2022 in Miami, United States.

3.4 Under the support of Project RLA/06/901 direct assistance to the States of the SAM Region for the implementation of the NBP in the selected airspaces has continued. The tools used for this purpose by the SAM Regional Office have been the virtual implementation meetings (SAM/IG) and the GESEA Contributing Group.

3.5 This strategy has allowed going along and guide States to the PBN implementation and design of the airspace, however, the sanitary measures due to COVID have affected the pace of the implementation in the period 2019 – 2021, as presented in the previous Tables.

3.6 Listed below are the conditions and/or requirements in the SAM Region to address the PBN implementation in the next period:

- Participation of Region experts in the activities of the GESEA group, based on virtual work, has allowed to maintain the progress of the implementation, however, with a reduced pace due to the conditions of the pandemic. It is highlighted that the implementation of PBN (APV- BARO VNAV) in SAM reached 90.5% in 2021.

- The productivity of flight and airspace procedure design services have been affected by sanitary measures and work from home. In some cases, PANS OPS staff have been reassigned or retirements have occurred, reducing the human resources of the services.
- The needs for refresher courses for design personnel should be considered, 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 encouraged to promote PBN implementation.
- The SATDIS tool is being delivered to the RLA/06/901 Project member States, and will be made available so that users and operators in the Region can have prediction of RAIM availability. It is estimated that the tool will support in this second phase not only commercial aviation, but also general aviation, flight schools, State aircraft, etc. that are already used of PBN.

3.7 Appendixes A and B to this working paper show a description of the progress made in the implementation of A1 and A2 projects for the CAR and SAM regions respectively, based on the PBN programme approved by GREPECAS.

4 Suggested Action

4.1 The Meeting is invited to:

- a) take note of the information provided in this working paper; and
- b) review the activities and the status of projects detailed in Appendixes A and B and suggest the actions that deem appropriate.

APPENDIX A

PROJECT A1 FOR THE SAM REGION – PBN OPERATIONAL IMPLEMENTATION

<i>SAM Region</i>	PROJECT DESCRIPTION (PD)	PD N° A1 Rev. for e-CRPP/4 april 2022	
<i>Programme</i>	Project Title	Start	End
<p><i>SAM airspace optimisation</i></p> <p><i>(Programme coordinator: ATM RO Fernando Hermoza Hübner)</i></p>	<p>PBN operational implementation</p> <p><i>Project coordinator:</i> <i>Julio Cesar de Souza Pereira (IATA)</i></p>	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	<ul style="list-style-type: none"> • Reduction of CO₂ 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	<p>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.</p>
Goals	<ul style="list-style-type: none"> • 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	<p>The 37th ICAO General Assembly formulated Resolution A37-11 (<i>Performance-based navigation global goals</i>) 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:</p> <ol style="list-style-type: none"> 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. <p>Furthermore, the Global air navigation plan (GANP), Chapter 2 (implementation) defines performance-based navigation as its main priority. The GANP specifies that “<i>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.</i>”</p> <p>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.</p>

Related projects	<ul style="list-style-type: none"> • Flexible use of airspace • Automation • Air navigation systems in support of PBN
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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	

Project deliverables	Relationship with the regional performance-based plan	Responsible party	Status of implementation*	Date of delivery	Comments
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.

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 - 2022	

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 - 2022	

Approach

<p>Updating of the status of implementation of APV IAC</p>	<p>PFF SAM ATM 03 B0 APTA</p>	<p>States</p>		<p>On-going task</p>	<p>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.</p> <p>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%</p>
<p>Integration within eANP VOL III management project</p>	<p>PFF SAM ATM 03 B0 APTA</p>	<p>GREPECAS</p>		<p>4Q - 2022</p>	

<u>Meetings/Workshops</u>					
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	Estados Oficina Regional SAM	FINALISED	Sep 2021 FINALISED	SAM PBN implementation group

SAM/IG/27	PFF SAM ATM	Estados Oficina Regional SAM		May 2022	SAM PBN implementation group
SAM/IG/28	PFF SAM ATM	Estados Oficina Regional SAM		Sep 2022	SAM PBN implementation group
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
<u>Workshop on PBN airspace planning</u>	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.

<u>Others</u>					
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.				

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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*

APPENDIX B

PROJECT A2 – AIR NAVIGATION SYSTEMS IN SUPPORT OF PBN

SAM Region	PROJECT DESCRIPTION (DP)	DP N° A2	
<i>Programme</i>	Project Title	Start	End
PBN <i>(Programme coordinator: ATM RO Fernando Hermoza)</i>	Air navigation systems in support of PBN <i>Project coordinator: Julio César de Souza Pereira Pereira (IATA)</i> <i>Experts contributing to the Project: Alessander Santoro, Andre Jansen, Fabio Augusto Andrade (Brazil), Paulo Vila, Tomas Macedo (Peru) and SAM/IG SAM PBN Group</i>	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: <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • All activities will be conducted by experts designated by SAM States and organisations participating in the project entitled “<i>Air navigation systems in support of PBN</i>”, 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	<p>Guide for the implementation of a GBAS system, by October 2012. (Revision November 2016).</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 <i>SAM Performance-based navigation system implementation plan (SAM PBIP)</i>.
Related projects	<ul style="list-style-type: none"> • 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	<p>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.</p> <p>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.</p> <p>Data was collected over a period of maximum solar activity, although it was the lowest in the last 100 years.</p> <p>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.</p>

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
					<p>Accordingly, ICEA (<i>Instituto de Control del Espacio Aéreo</i>) 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.</p> <p>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:</p> <p>https://www.icao.int/SAM/Pages/MeetingsDocumentation.aspx?m=2016-GBAS</p> <p>As of December 2017, the SLS-4000 station does not meet ICAO's integrity and availability requirements.</p> <p>Brazil continues research in collaboration with universities and Honeywell, seeking to develop a risk model applicable to the SAM Region.</p> <p>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.</p> <p>This is to be completed by the last quarter of 2018.</p> <p>SAMIG/23 meeting, may 2019, updated the information</p> <p>In 2021 Brazil and Argentina has decommissioned the projects due new priorities on air navigation implementation.</p>

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments

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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 <i>DME/DME coverage study</i> 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 <i>Google Earth</i> . The study only supports the RNAV-5 procedure.
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Development of guidance on the use and availability of GNSS performance forecast/validation tools.

<p>Implementation of a RAIM availability prediction service</p>	<p>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)</p>	<p>Project coordinator SAM/IG PBN Group</p>		<p align="center">4Q 2022</p>	<p>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.</p> <p>All focal points received from the service provider the respective user name and password to access SATDIS as administrators.</p> <p>The SATDIS website in three languages (Spanish, Portuguese and English), became operational on 17 September 2014.</p> <p>The SATDIS FSAT was conducted on 18 November 2014.</p> <p>The RAIM availability prediction service is operating since 16 November 2014.</p> <p>NOTE.- FIRST SEMESTER 2019, A BID PROCESS IS BEING PREPARED FOR MAINTAIN SATDIS TOOL AVAILABLE.</p> <p>1Q 2022.- SAT acceptance test of the delivered SATDIS (NAVBLUE) is on-going.</p>
<p>Monitor activities for the implementation of air navigation systems in support of PBN</p>	<p>SAMPFF CNS/03 SAM PFF ATM/01 ATM/02 ATM/03 ANRF</p>	<p align="center">ICAO</p>		<p align="center">On-going task</p>	

	B0-APTA (65), B0-FRTO(10) B0-CDO(05) and B0-CCO(20)				
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

— END —