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South American Office
Fifth Meeting of Air Navigation and Flight Safety Directors of the SAM Region (ANFS/5)
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ANFS/5-WP/02
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Agenda Item 1: Follow-up to the implementation of air navigation priorities

FOLLOW-UP TO PBN IMPLEMENTATION GOALS

(Presented by the Secretariat)

SUMMARY

This working paper presents a report on the activities related to projects under the PBN programme. These activities fall within ASBU blocks B0-APTA, B0-FRTO, B0-CDO and B0-CCO.

References:

- GREPECAS/18 meeting report
- SAM/IG meeting reports
- ATSRO meeting reports
- Reports of PANS-OPS workshops

ICAO strategic objectives	*B – Air navigation capacity and efficiency* *E – Environmental protection*

1. Background

1.1 Pursuant to GREPECAS Decisions 16/45 and 16/47, the *"Performance-based navigation (PBN)"* Programme was structured with the following associated projects:

a) Project A1: PBN operational implementation; and
b) Project A2: Air navigation systems in support of PBN.

1.2 Activities under these projects are described in **Appendices A and B** to this working paper.

1.3 The GREPECAS/18 meeting (Dominican Republic, 9-14 April 2018) conducted a thorough analysis of the progress made by the PBN Programme in the CAR and SAM Regions, stressing that a key element for project success was the fulfilment of commitments by CAR and SAM States regarding the activities defined by the working groups, and the participation of decision-makers.

1.4 GREPECAS/18 noted that the commitments under the Declarations of Bogota and Port-of-Spain had been an effective element of integration and commitment for the progress achieved in the implementation of air navigation in the two Regions, without forgetting that these Declarations should to be considered as a consensual political guide signed by States.

1.5 In this sense, GREPECAS/18 urged towards the strengthening of inter-regional coordination and enhancement of State processes for publication and implementation of new routes or optimised routes within the agreed timelines, which should be aligned with the amendment to the regional e-ANP.

1.6 Likewise, emphasis was placed on the benefits obtained when PBN implementation activities include cooperation initiatives and collaborative decision-making between States and among States, ANSPs, users, and airlines.

2. **Discussion**

Updating of GREPECAS project A1, PBN Implementation

1.7 The GREPECAS/18 meeting emphasised the need for better coordination of efforts and projects between the CAR and SAM Regions. Accordingly, based on a recommendation of the Secretariat, it agreed that both groups (RASG-PA and GREPECAS) should apply a common and mutually recognised project management approach. Based on the guidance provided by GREPECAS/18, project management techniques should be applied to all CAR and SAM projects.

1.8 In this sense, the SAM/IG/21 meeting (Lima, 2-18 May 2018) was presented with a proposal for updating the SAM PBN project, aimed at applying said management techniques and incorporating performance indicators. The meeting also approved the following conclusion:

<table>
<tr><td colspan="2">CONCLUSION
SAM/IG/21-01 REGIONAL AND INTERREGIONAL HARMONISED PBN IMPLEMENTATION GOALS</td></tr>
<tr><td>That:

SAM States, organisations, users, and stakeholders double efforts to meet regional and interregional performance-based air navigation implementation goals, based on GREPECAS projects, and contemplating the strengthening of national PBN implementation plans so that they include performance indicators and the use of recognised project management tools and methods.</td><td>Expected impact:

☐ Political / Global

☒ Inter-regional

☒ Financial

☒ Environmental

☒ Technical/Operational</td></tr>
<tr><td colspan="2">Why: To complete the implementation of the GANP PBN components selected for the SAM Region, taking into account interoperability in the boundaries with the CAR Region.</td></tr>
<tr><td>When: Before 2021</td><td>Status: Adopted by SAM/IG/21</td></tr>
<tr><td colspan="2">Who: ☒ Coordinators ☒ States ☒ ICAO Secretariat ☐ ICAO HQ ☒ Other: Users/Industry</td></tr>
</table>

1.9 The draft of the new project was based on the previous project, which had three main axes: the national PBN implementation plans, the implementation of route network versions, and PBN implementation at the main SAM TMAs, including SID/STAR routes as needed, based on the projects/action plans established by SAM States, and the lessons learned at PBN workshops delivered under the auspices of Project RLA 06/901. See details in Appendix A to WP/05 of the SAM/IG/21 meeting, available at:

https://www.icao.int/SAM/Documents/2018-SAMIG21/SAMIG21_WP05.pdf

1.10 In addition to the three aforementioned axes, the proposed project included the following enhancing elements (initiatives): Coordination between CAR and SAM projects, performance indicators, and longitudinal separation optimisation.

1.11 Regarding national PBN implementation plans the model plan had been approved through Conclusion SAM/IG/14-5 adopted in November 2014. Given the time elapsed, the SAM/IG/21 meeting deemed it advisable to review the model plan shown in SAM/IG/21-WP/05, Appendix B.

1.12 The new model should be used for submitting national PBN implementation plans to SAM/IG/22, including, if applicable, initial proposals for performance indicators.

1.13 In this regard, the SAM/IG/21 meeting agreed that national PBN plans should be aimed at identifying and addressing the actual needs of States, based on collaborative decisions with the users, and at defining implementation priorities. It also highlighted the value of these plans, taking into account that several SAM States had not yet completed or updated their national air navigation plan (ANP), where the national PBN plan could constitute the PBN chapter of the national ANP.

1.14 The status of implementation of project A1: PBN operational implementation, by June 2018 is as follows:

PBN operational concept

1.15 The SAM PBN Concept of Operations (CONOPS) was developed to support compliance with the Declaration of Bogota while providing a conceptual frame of reference for the SAM Performance-Based Air Navigation Implementation Plan (SAM-PBIP).

1.16 The first text of the CONOPS was examined at the SAM/IG/19 meeting, which agreed to its content and defined its period of application for the 2018-2020 triennium.

1.17 The CONOPS contains a table with metrics and performance indicators to measure the degree of continuity and the results of PBN implementation. At present, the CONOPS is contained in Attachment H to the SAM-PBIP (Version 1.5), which is available at the following link, as part of SAM/IG/20 meeting final report (Lima, 16-20 October 2017):

https://www.icao.int/SAM/Documents/2017-SAMIG20/SAMIG20_Final%20Report.pdf

PBN en Route

1.18 Implementation of PBN en route is addressed at ATS route network optimisation (ATSRO) meetings, based on route network versions, to ensure the best possible airspace structure at all times within an integrated development concept.

1.19 The Region has made progress in the optimisation of the SAM route network, with 65% of total upper airspace routes, exceeding by 5% the goal established in the Declaration of Bogota.

1.20 Activities started in September 2017 to implement Version 4 of the optimised SAM route network. The ATSRO/9 meeting, held on the third week of July 2018, agreed to publication in the AIP and effective implementation of 24 proposals of said version, thus increasing the use of RNAV-5 in regional and interregional airspace.

PBN in TMAs

1.21 In August 2017, the new PBN airspace became effective at the Asunción FIR and TMA and the International Airport Silvio Pettirossi. Likewise, on 12 October 2017, Aerocivil of Colombia implemented the new Bogota TMA with RNAV/RNP approach procedures and standard routes for El Dorado airport, which included the realignment of the main flows to/from Medellin and to/from the Colombian Caribbean region.

1.22 PBN optimisation of East-West flows between Brazil, Argentina and Uruguay is still under way. Through the SUL PBN project, which became effective on 12 October 2017, significant improvements have been made in the Curitiba FIR, resulting in the optimisation of several main TMAs (Curitiba, Florianopolis, Santa Maria, Porto Alegre, etc.) and major airports in the southern part of Brazil, creating a set of realigned routes that were coordinated with Uruguay.

1.23 PBN procedures have already been implemented at the Argentinian airports of Aeroparque, Cordoba, Salta and Iguazu, inter alia. It is expected that the implementation of Version 4 of the route network will create the conditions for connecting the airspaces serving flows between Curitiba, Montevideo and Buenos Aires, and vice versa. Likewise, the Baires TMA design and respective ATS reorganisation, which includes ATC personnel training, are to be completed by the first semester of 2019. Panama is currently defining a process to implement airspace improvement and redesign activities at the TMA of the Tocumen airport.

1.24 A relevant aspect is the investment made in PANS-OPS training, which has been provided to personnel from the administrations of Argentina, Bolivia, Ecuador, Guyana, Peru, and Uruguay. The lack of PANS-OPS designers is being gradually resolved in the Region.

1.25 93% of the SAM States have submitted their updated action plans for PBN redesign in selected airspaces. Tentative implementation dates are shown in the SAM/IG/20 meeting report, posted at:

https://www.icao.int/SAM/Documents/2017-SAMIG20/SAMIG20_Final%20Report.pdf

Implementation of SIDs, STARs and PBN approach procedures

1.26 The Declaration of Bogota binds States to implement PBN SID and STAR routes at international aerodromes in order to achieve the established goals, based on CDO and CCO methods. The aforementioned Declaration also urges States to implement APV approach procedures, with a view to complying with ICAO Assembly Resolution A37-11.

1.27 Taking into account recent implementations in Argentina, Brazil, Colombia and Paraguay, PBN SID/STAR implementation reached 72.5% as of 12 October 2017. The goal of 60% set in the Declaration of Bogota has been met.

1.28 Associated with the design of arrival and departure procedures is the application of CDO and CCO methods, which has achieved the following implementation percentages: CDO 34% and CCO 26%.

1.29 Pursuant to Resolution A37-11, concerning the implementation of PBN approaches, States are still making efforts to achieve the 100% goal that should have been attained in 2016. As of 12 October 2017, implementation has reached to 78.6%.

PANS-OPS workshops

1.30 PBN and PANS-OPS workshops are aimed at improving the skills of flight procedure designers applying ICAO criteria and other international methods, as well as strengthening collaborative ties with experts and airline pilots in order to receive valuable feedback on user requirements.

1.31 The GREPECAS/18 meeting was provided with high-level information on the transition plan being developed by ICAO for feedback from the Regions. ICAO Regions will be requested to consider the transition from RNAV to RNP in the regional plans and make sure that sufficient time is assigned to this task in order to successfully implement the new charts. ICAO will refer the matter to the regional groups in charge of GREPECAS Programme A for the development of a regional implementation strategy as a matter of priority.

1.32 In this regard, GREPECAS Decision 18/12 - RNAV to RNP charting transition, was adopted so that the task forces in charge of GREPECAS Programme A could develop a Regional implementation strategy for the transition from RNAV to RNP charts as a matter of priority. The PANS-OPS/3 workshop for the SAM Region, to be held during the course of the week of 24 September 2018, will address the initial planning of these activities.

Actions for the optimisation of longitudinal separation of aircraft en route

1.33 There is a set of letters of agreement or memoranda of understanding that consolidates the commitments assumed at the SAM/IG/17 meeting (Lima, Peru, 9-13 May 2016) for reducing the longitudinal separation minima from 80 NM to 40 NM. Although the Paramaribo FIR and Atlantico FIR (managed by Brazil) apply oceanic separation, the implementation process has been positive in the SAM Region. Coordination still needs to be strengthened with adjacent CAR States.

1.34 Furthermore, a four-day workshop was held on 6-10 November 2017 under Regional Project RLA/06/901, to propose an action plan to encourage the reduction from 40 to 20 NM, and to coordinate the signing and effective implementation of letters of agreement between States to consolidate the 40NM separation. In this context, Brazil has started standard application of a 20 NM separation for aircraft entering its FIRs. The executive summary of the workshop is posted at:

https://www.icao.int/SAM/Pages/MeetingsDocumentation.aspx?m=2017-OPTSEPLONG

Project A2 - Air navigation systems in support of PBN

1.35 Of the activities under this project, the one that is still pending is the review of the practical guide for the implementation of GBAS systems. The review of the practical guide for the implementation of GBAS systems will be carried out once a risk model capable of supporting ionosphere behaviour in low altitudes has been completed. This activity is being undertaken by Brazil, in collaboration with universities and Honeywell.

1.36 Currently, the existing risk model only applies to mid-latitudes. It is expected that the risk model will be completed by the last quarter of 2018.

2. Conclusion

2.1 Under the auspices of Project RLA/06/901, direct assistance continued to be provided to SAM States for PBN implementation in selected airspaces. The tools used to this end by the SAM Regional Office have been PBN workshops and implementation meetings (SAM/IG). Through this strategy, guidance has been provided to the States of the Region for PBN implementation and airspace design improvement.

2.2 With regard to the PANS OPS design activities required for airspace and route optimisation in the Region, collaboration among experts has been generated and mutual assistance between States has been strengthened in order to achieve bilateral and/or multilateral implementation as, for example, among Argentina, Brazil, Paraguay and Uruguay.

2.3 Likewise, the following factors hindering achievement of SAM objectives have been identified:

a) Lack of specialised software for PANS OPS design in 40% of the States; and

b) Overlapping of ATS improvement activities in ATS, airspace and aerodromes, which, in some States, affects progress in PBN implementation as scheduled.

2.4 Appendices A and B to this working paper describe the progress made in the performance of activities under Projects A1 and A2 for the SAM Region.

3. Suggested action

3.1 The Meeting is invited to:

a) take note of the information contained in this working paper; and

b) review the activities and the status of projects listed in Appendices A and B, and take any other action it may deem appropriate.

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APPENDIX A

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	2019
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		October 2010 FINALISED	
Implementation of RNAV5 in the SAM Region	B0-FRTO	Alexandre Luiz Dutra Bastos		October 2011 FINALISED	
Action plan for the implementation of Version 2 of the ATS route network optimisation programme	B0-FRTO	Alexandre Luiz Dutra Bastos		ATSRO/3 FINALISED	

Traffic data to understand airspace traffic flows	B0-FRTO	ICAO coordinator		SAM/IG/6 FINALISED	
Navigation capacity of the fleet	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/9 FINALISED	
List of gateways of the main SAM TMAs	PFF SAM ATM 02	Alexandre Luiz Dutra Bastos		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		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		April 2012 FINALISED	
Risk analysis for the implementation of Version 2 of the ATSRO programme	B0-FRTO	External consultants		SAM/IG/10 FINALISED	
SAM Route Network Optimisation					
Planning of Version 3 - Stage 1	B0-FRTO	External consultants		SAM/IG/14 FINALISED	

Implementation Version 3 - Stage 1 - Flow 1 (Argentina -Chile - Paraguay)	B0-FRTO	States SAM Regional Office		April 2015 FINALISED	
Implementation Version 3 - Stage 1 - Flow 2 (Argentina –Brazil - Uruguay)	B0-FRTO	States SAM Regional Office		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		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		October 2016 FINALISED	The optimisation of the main flows has been coordinated.
Airspace concept Version 3 – Stage 2	B0-FRTO	States SAM Regional Office		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		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		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		2013-2018	The flexible use of airspace is being enhanced through route optimisation.
Reduction of conventional longitudinal separation from 80 to 40 NM for GNSS-equipped aircraft.	B0-FRTO	States SAM Regional Office		2016-2017	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.
Reduction of conventional longitudinal separation from 40 to 20 NM for GNSS-equipped aircraft.	B0-FRTO	States SAM Regional Office		2017-2019	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		~~2019~~ 2020 - 2021	

PBN TMA					
Updating of action plans. PBN implementation in the main TMAs	PFF SAM ATM 02	States		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		September 2017	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.
Updating of Table AOP-1	PFF SAM ATM 02	States		TBD	Conclusion SAM/IG/15-3.
Approach					
Updating of the status of implementation of APV IAC	PFF SAM ATM 03 B0 APTA	States		30 June 2019	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.

Meetings/Workshops					
SAM/IG/07	PFF SAM ATM	States SAM Regional Office		May 2011 FINALISED	SAM PBN implementation group
SAM/IG/08	PFF SAM ATM	States SAM Regional Office		October 2011 FINALISED	SAM PBN implementation group
SAM/IG/09	PFF SAM ATM	States SAM Regional Office		Mayo 2012 FINALISED	SAM PBN implementation group
SAM/IG/10	PFF SAM ATM	States SAM Regional Office		October 2012 FINALISED	SAM PBN implementation group
SAM/IG/11	PFF SAM ATM	States SAM Regional Office		May 2013 FINALISED	SAM PBN implementation group
SAM/IG/12	PFF SAM ATM	States SAM Regional Office		October 2013 FINALISED	SAM PBN implementation group
SAM/IG/13	PFF SAM ATM	States SAM Regional Office		Mayo 2014 FINALISED	SAM PBN implementation group
SAM/IG/14	PFF SAM ATM	States SAM Regional Office		October 2014 FINALISED	SAM PBN implementation group

SAM/IG/15	PFF SAM ATM	States SAM Regional Office		May 2015 FINALISED	SAM PBN implementation group
SAM/IG/16	PFF SAM ATM	States SAM Regional Office		October 2015 FINALISED	SAM PBN implementation group
SAM/IG/17	PFF SAM ATM	States SAM Regional Office		May 2016 FINALISED	SAM PBN implementation group
SAM/IG/18	PFF SAM ATM	States SAM Regional Office		October 2016 FINALISED	SAM PBN implementation group
SAM/IG/19	PFF SAM ATM	States SAM Regional Office		May 2017 FINALISED	SAM PBN implementation group
ATSRO/03	PFF SAM ATM 03	States SAM Regional Office		July 2011 FINALISED	SAM route network optimisation
ATSRO/04	PFF SAM ATM 03	States SAM Regional Office		July 2012 FINALISED	SAM route network optimisation
ATSRO/05	PFF SAM ATM 03	States SAM Regional Office		July 2013 FINALISED	SAM route network optimisation
ATSRO/06	PFF SAM ATM 03	States SAM Regional Office		October 2014 FINALISED	SAM route network optimisation

ATSRO/07	PFF SAM ATM 03	States SAM Regional Office		October 2015 FINALISED	SAM route network optimisation
ATSRO/08	PFF SAM ATM 03	States SAM Regional Office		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		July 2018	SAM route network optimisation
Hiring of experts for consolidation of Version 4 of the SAM ATS route network	PFF SAM ATM 03	States SAM Regional Office		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		September 2018	SAM route network optimisation
Workshop on PBN airspace planning	B0 APTA B0 CCO B0 CDO	States SAM Regional Office		March 2013 FINALISED	Initial training in the PBN airspace planning process.
PBN/1 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office		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		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		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		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		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		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		SAM/IG/15	93% of States have completed the task. French Guiana is still pending. Headquarters has requested the delivery of the national PBN implementation plans.
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***

APPENDIX B

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 2018
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.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
					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. As of December 2017, the SLS-4000 station does not meet ICAO's integrity and availability requirements. 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.

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

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
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		November 2014	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.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
Monitor activities for the implementation of air navigation systems in support of PBN		ICAO		January 2011 - December 2018	
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*