



**Agenda Item 1: Follow up of air navigation national plans implementation**

**FOLLOW-UP TO PBN IMPLEMENTATION GOALS**

(Presented by the Secretariat)

<b>SUMMARY</b>	
This working paper presents the evolution of PBN implementation activities and other implementations related to SAM airspace optimisation, so that States may identify those activities on which they need to focus their efforts in order to meet the defined goals.	
<b>References:</b>	
– Report of GREPECAS/18 meeting – Reports of SAM/IG meetings – Report of ATS/RO meetings – Reports of PANS-OPS workshops – Report of RAAC/15 Meeting	
<b>ICAO strategic objectives:</b>	<i>A - Safety</i> <i>E - Environmental protection</i>

**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 Description of activities of both projects are presented in **Appendixes A and B** of this working paper.

1.3 The GREPECAS/18 meeting (Dominican Republic, 9-14 April 2018) conducted a detailed analysis of PBN programme implementation in the CAR and SAM Regions, highlighting that a key to the success of projects was compliance with State commitments within the context of actions defined by the working groups, and the participation of decision-makers.

1.4 GREPECAS/18 noted that the commitments assumed under the Declarations of Bogota and Port-of-Spain had been an effective element of integration and commitment towards air navigation implementation in the two Regions, without forgetting that these Declaration had to be seen as a political guide agreed by States in consensus.

## 2. Discussion

2.1 By May 2019, the progress made in the BPN operational implementation, for air space in TMA route, arrival/departure and approximation proceedings, are as follows:

### **PBN in route**

2.2 The implementation of PBN en route is addressed at the ATS route network optimisation (ATSRO) meetings, based on route network versions. In accordance with the activities scheduled by the RLA/06/901 RCC/12 meeting, Version 5 of the route network was developed, containing fifty-one (51) proposals that include:

- a) Elimination of 37 conventional regional routes.
- b) Elimination of 2 RNAV regional routes for purposes of optimisation and harmonisation.
- c) Implementation of 27 new RNAV routes.
- d) Modification of 15 RNAV routes, involving realignment, extension, or reduction of existing RNAV routes.
- e) 21 proposals involve flight mile reductions and, if all of them were implemented, a total reduction of 178 NM of flight would be obtained.

2.3 From the 51 proposals in Version 5 of the SAM route network, 32 correspond to the CAR-SAM route interface and 19 correspond to the SAM Region.

2.4 The CAR ANI/WG (PBN/TF) PBN task force met on 22-25 April at the NACC Office in Mexico. The 37 proposals of version 5 involving CAR/SAM international airspace were analysed. Nineteen proposals were found feasible.

2.5 As the CAR States involved are expected to participate at the ATSRO/10 meeting (Bogota, Colombia, 17-21 June 2019) it is foreseen to consolidate the route implementation plan and improve coordination for effective implementation. Information regarding the Workshop/Meeting can be found at:

[https://www.icao.int/SAM/Pages/ES/MeetingsDocumentation\\_ES.aspx?m=2019-06901-ATSRO10](https://www.icao.int/SAM/Pages/ES/MeetingsDocumentation_ES.aspx?m=2019-06901-ATSRO10)

### **PBN in TMA**

2.6 SAM States continue working to comply with the implementation dates for TMA re-design based on PBN. 57 spaces or Terminal Management Area – TMA in the region are considered in this activity and by May 2019, 26 have been implemented, meaning 45%. Currently in progress, a group of PBN design of Argentina, Bolivia, Colombia, Ecuador, Peru and Venezuela which are foreseen to be completed by 2019. Detailed status of planning and times are presented in the Final Report of the SAM/IG/23, in the following link;

<https://www.icao.int/SAM/Pages/MeetingsDocumentation.aspx?m=2019-06901-SAMIG23>

### **Implementation of SIDs, STARs and CCO/CDO**

2.7 The ICAO iSTARS 3.0 website shows the status of implementation in 13 SAM States. Out of a total of 213 runway thresholds in the Region, PBN SID implementation reaches 66.7%, and PBN STAR implementation reaches 51.2%.

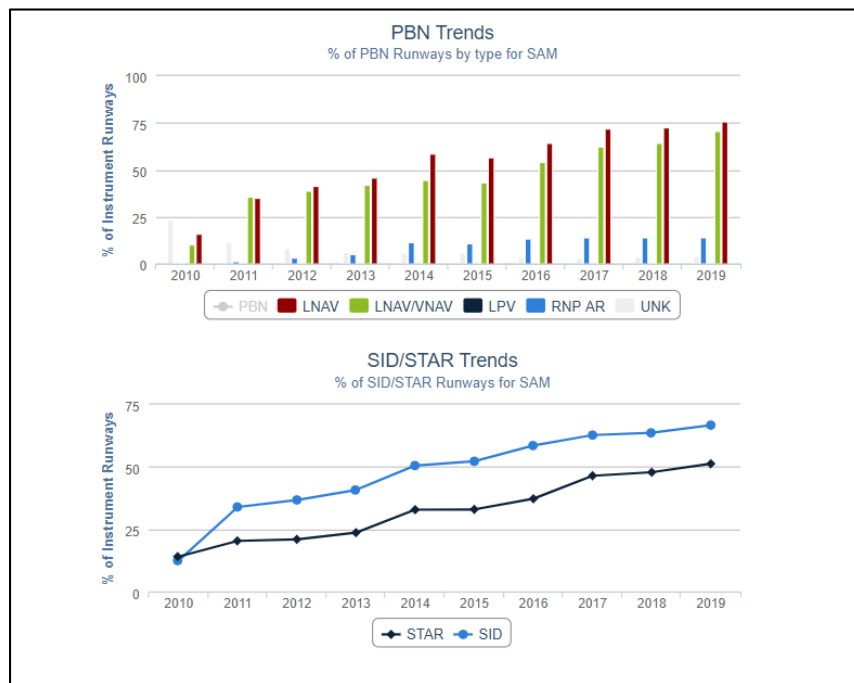
2.8 Associated to the design of arrival and departure procedures is the application of CDO and CCO methods, which have reached the following levels of implementation: CDO 34% and CCO 26%. In this regard, the ICAO SIMS website shows the first vertical efficiency indicators generated for CDO at some airports of the Region.

### PBN approach procedures

2.9 Regarding the implementation of PBN approaches pursuant to Resolution A37-11, out of a total of 213 runway thresholds (international airports), approach procedures with APV vertical guidance and/or LNAV minima only have been implemented in 185, reaching 86.9%, **accounting for 3.2% progress** with respect to 83.7% recorded in November 2018.

2.10 See details of the growing trend (2010-2019) of PBN regional implementation in Graph 1, in the ICAO portal:

<https://portal.icao.int/space/Pages/PBN-Status.aspx>



Graph 1.- PBN implementation trends

### Actions to optimise longitudinal separation of aircraft in route

2.11 A four-day workshop was conducted in November 2017 at the SAM Regional Office, in which an action plan was proposed to promote a reduction from 40 to 20 NM, and coordination took place for the signing and effective implementation of letters of agreement between States to consolidate the 40NM separation.

2.12 In this sense, Brazil has started (unilaterally) the application of the 20NM separation for aircraft entering its FIRs. During SAM/IG/23 States updated the table of follow-up to the implementation, as shown in the final report of the meeting in the following link;

<https://www.icao.int/SAM/Pages/MeetingsDocumentation.aspx?m=2019-06901-SAMIG23>

## Strategy of implementation through GESEA

2.13 The SAM/IG/23 Meeting ratified the creation of the Group of study and implementation of the SAM airspace (GESEA) aim at improving the efficiency of the work promoted by the SAM/IG. GESEA will work through teleconferences and e-mail, and, where applicable, through face-to-face activities under the RLA/06/901 programme.

2.14 Agreement was reached on a list of experts from the States and IATA to be part of the General Coordinating Group (CG) of GESEA, and the Coordinating Group of the two subgroups (CSG). Likewise, the experts to make up the working groups (ET) were presented. The Meeting highlighted that GESEA was an open group and that all experts willing to cooperate and support the initiative would be invited to participate. See the work priorities for the working groups in Table 1.

Table1 - GESEA WORKING GROUPS

<b>GESEA – LIST OF WORKING GROUPS</b>	
<b>WORKING GROUP - ET</b>	<b>Assigned to Subgroup</b>
GESEA/WG	N/A
SAM AIRSPACE CONCEPT WG	SG1
PLANNING STANDARDS WG	SG1
PLANNER TRAINING WG	SG1
CONT PLAN WG	SG1
CIRCULAR 353 WG	SG2
VISUAL RNAV WG	SG2
QUALITY ASSURANCE WG - IFPDS	SG2

2.15 High priority was assigned to the work of a GESEA-WG, which would be responsible for the development of the terms of reference and the organisation. The specific composition of ETs will be defined when task planning is completed.

2.16 In view of the above, the Meeting agreed to request Project RLA/06/901 to study the feasibility of supporting two GESEA activities in 2020, based on the activities currently being supported (two SAMIG meetings, one ATSRO meeting, and one PANS OPS workshop), as follows:

- a) Workshop/meeting of the GESEA WG and the SG1-GESEA (5 days) in March; and
- b) Workshop/meeting of the SG2-GESEA (5 days) in July.

### Project A2: Air navigation systems in support of PBN

2.17 No progress has been made in the implementation of GBAS technology under study by Brazil. It was noted that the SLS-4000 station could be configured for use in Brazil for precision approaches only between 6 a.m. and 6 p.m. (local time), using the CONUS (Continental United States) risk model, with possible discontinuities during operation due to satellite layout. It was noted that Brazil was considering this activity for the long term.

2.18 Argentina reported the progress made by ANAC and INVAP S.E. in the development in GBAS technology.

3. **Conclusion**

3.1 Under the sponsorship of Project RLA/06/901, direct assistance continued to be provided to SAM States for PBN implementation in selected airspaces. The tools used for this purpose by the SAM Regional Office have been the PBN workshops and the implementation meetings (SAM/IG).

3.2 GESEA supplements the work of SAM/IG and allows for a flexible organisation of the work of State experts, taking into account the complexity of some implementation issues.

3.3 Furthermore, the factors that hinder the attainment of objectives in the SAM Region have been identified, namely:

- a) scarce training (recurrent, refresher courses, etc.) offered to PANS OPS design and ATM/CNS planning personnel, and difficulty to retain such personnel;
- b) lack of specialised PANS OPS design software in 40% of the States; and
- c) overlap of ATS and airspace improvement activities, new mapping requirements that affect PBN implementation within the foreseen timeframe in some States.

4. **Suggested action**

4.1 The Meeting is invited to:

- a) Take note of the information provided in this working paper;
- b) support the activities of the GESEA group and subgroups which objectives are to improve the efficiency of the work promoted by the SAM/IG and facilitate the contribution of specialists from States; and
- c) review the activities and status of projects detailed in Appendices A and B and formulate other actions that the meeting deems convenient.

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## APPENDIX A

## PROJECT A1 FOR THE SAM REGION – PBN OPERATIONAL IMPLEMENTATION

<i>SAM Region</i>	PROJECT DESCRIPTION (PD)	PD N° A1	
<i>Programme</i>	Project Title	Start	End
<i>SAM airspace optimisation</i>  <i>(Programme coordinator: ATM RO Fernando Hermoza Hübner)</i>	PBN operational implementation  <i>Project coordinator: Julio Cesar de Souza Pereira (IATA)</i>	2011	2019
<b>Objective</b>	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.		
<b>Scope</b>	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.		
<b>Metrics</b>	<ul style="list-style-type: none"> <li>• Reduction of CO<sub>2</sub> emissions per each route optimisation version, in tonnes.</li> <li>• Percentage of international airports with RNAV and/or RNP SIDs/STARs implemented.</li> <li>• Percentage of international airports with continuous descent and climb operations implemented.</li> <li>• Number of RNAV/RNP routes implemented, realigned and/or eliminated.</li> <li>• Percentage of thresholds with APV approaches at international airports.</li> </ul>		

<b>Strategy</b>	<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>
<b>Goals</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Achievement of the goals set forth in the Declaration of Bogota.</li> <li>• PBN-based redesign of 30% of the main SAM TMAs by 2016, 50% by 2018.</li> <li>• Development of Version 4 of the PBN-based ATS route network and design of PBN-based TMAs.</li> <li>• Optimisation of longitudinal separation.</li> </ul>

<p><b>Rationale</b></p>	<p>The 37<sup>th</sup> 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"> <li>1) implementation of RNAV and RNP operations (where required) for en-route and terminal areas according to established timelines and intermediate milestones;</li> <li>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</li> <li>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.</li> </ol> <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>
<p><b>Related projects</b></p>	<ul style="list-style-type: none"> <li>• Flexible use of airspace</li> <li>• Automation</li> <li>• Air navigation systems in support of PBN</li> </ul>

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	
<b><u>SAM Route Network Optimisation</u></b>					
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.

<p>Development of the PBN route structure operational concept (ATS routes, SIDs, STARs) for the period 2017-2019</p>	<p>B0-FRTO</p>	<p>States SAM Regional Office</p>		<p>November 2016 FINALISED</p>	<p>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</p>
<p>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.</p>	<p>B0-FRTO</p>	<p>States SAM Regional Office</p>		<p>2013-2018</p>	<p>The flexible use of airspace is being enhanced through route optimisation.</p>
<p>Reduction of conventional longitudinal separation from 80 to 40 NM for GNSS-equipped aircraft.</p>	<p>B0-FRTO</p>	<p>States SAM Regional Office</p>		<p>2016-2017</p>	<p>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.</p>
<p>Reduction of conventional longitudinal separation from 40 to 20 NM for GNSS-equipped aircraft.</p>	<p>B0-FRTO</p>	<p>States SAM Regional Office</p>		<p>2017-2019</p>	<p>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.</p>
<p>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.</p>	<p>B0-FRTO</p>	<p>States SAM Regional Office</p>		<p>2019 2020 - 2021</p>	

<b><u>PBN TMA</u></b>					
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.
<b><u>Approach</u></b>					
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.

<b><u>Meetings/Workshops</u></b>					
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
SAM/IG/20	PFF SAM ATM	States SAM Regional Office		October 2017 FINALISED	SAM PBN implementation group
SAM/IG/21	PFF SAM ATM	States SAM Regional Office		May 2018 FINALISED	SAM PBN implementation group
SAM/IG/22	PFF SAM ATM	States SAM Regional Office		November 2018 FINALISED	SAM PBN implementation group
SAM/IG/23	PFF SAM ATM	States SAM Regional Office		May 2019 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 FINALISED	SAM route network optimisation
ATSRO/10	PFF SAM ATM 03	States SAM Regional Office		June 2019 FINALISED	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		February 2019 FINALISED	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.
<b><u>Others</u></b>					

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.
<b>Resources needed</b>	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	
<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 2018
<b>Objective</b>	Develop guides, conduct analyses and implement services in support of PBN implementation in the SAM Region.		
<b>Scope</b>	Support to PBN implementation in the SAM Region, initially consisting of: <ul style="list-style-type: none"> <li>• Practical guide for the implementation of GBAS systems.</li> <li>• Analysis of DME/DME coverage to support PBN procedures.</li> <li>• Implementation of a RAIM availability prediction service.</li> </ul>		
<b>Metrics</b>	<ul style="list-style-type: none"> <li>• Drafting of a practical guide for the implementation of a GBAS system.</li> <li>• DME/DME coverage in the SAM Region.</li> <li>• Availability of a RAIM availability prediction service.</li> <li>• % States providing the RAIM availability service.</li> </ul>		
<b>Strategy</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> </ul>		

<b>Goals</b>	<p>Guide for the implementation of a GBAS system, by October 2012. (Revision November 2016).</p> <ul style="list-style-type: none"> <li>• Assessment of DME/DME coverage to support PBN procedures, by May 2011.</li> <li>• RAIM availability prediction service in the SAM Region implemented by September 2014.</li> <li>• 11 SAM States with RAIM availability prediction service available by February 2014.</li> <li>• 3 SAM States and one territory with the service available by the end of 2014.</li> </ul>
<b>Rationale</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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>.</li> </ul>
<b>Related projects</b>	<ul style="list-style-type: none"> <li>• Implementation of PBN operational aspects.</li> </ul>

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
<i>Develop a practical guide for the implementation of the GBAS system</i>					
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. Data was collected over a period of maximum solar activity, although it was the lowest in the last 100 years.</p>

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
					<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. 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>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. This is to be completed by the last quarter of 2018.</p> <p>SAMIG/23 meeting, may 2019, updated the information</p>

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
<i>Analyse DME/DME and GNSS infrastructure and coverage needed to support PBN implementation</i>					
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 <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.
<i>Development of guidance on the use and availability of GNSS performance forecast/validation tools.</i>					

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	<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><b>NOTE.- FIRST SEMESTER 2019, A BID PROCESS IS BEING PREPARED FOR MAINTAIN SATDIS TOOL AVAILABLE.</b></p>

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