



- Agenda Item 2: SAM airspace optimization**
- a) PBN en route
 - b) PBN in terminal areas
 - c) PBN procedures

Progress made in the implementation of the Airspace Optimization Action Plan

(Presented by the Secretariat)

SUMMARY	
The purpose of this working paper is to update the status of implementation of airspace optimization in the Region and assess the progress made by States in PBN implementation in the airspace under their jurisdiction.	
REFERENCES:	
- SAM/IG meetings	
ICAO strategic objectives:	<i>A - Safety</i> <i>B - Air navigation capacity and efficiency</i> <i>E - Environmental protection</i>

1. Background

1.1 The SAM/IG/14 meeting (10-14 November 2014) reviewed the South American Airspace Optimization Action Plan and formulated 7 conclusions to guide PBN implementation in the SAM Region.

1.2 Accordingly, the main objectives of the work to be carried out by the SAM PBN Implementation Group (SAM/PBN/IG) are to follow-up on compliance with the conclusions of the SAM/IG/14 meeting and develop new guides, as needed, to further PBN implementation in the SAM Region.

2. Discussion

2.1 The SAM/IG/14 meeting took note that, out of the 15 goals established in the Bogota Declaration, 5 were directly related and 3 were indirectly related to PBN implementation.

2.2 Thus, the SAM/IG/14 meeting noted that PBN implementation was of high priority in the ATM work programme of the South American Regional Office, and felt that it should also have the proper level of priority within SAM Administrations.

2.3 Taking into account the need to further PBN implementation in the SAM Region, the SAM/IG/14 meeting formulated Conclusion SAM/IG/14-2 (*Meetings and resources required for the conduction of activities under the South American Airspace Optimization Action Plan*), requesting

Regional Project RLA/06/901 to increase the number/duration of activities related to the aforementioned implementation during 2015 and 2016, in order to ensure compliance with the goals established in the Bogota Declaration.

2.4 However, given the budgetary limitations of Project RLA/06/901, it was not possible to secure the necessary economic resources. In this regard, the Eighth Coordination Meeting of Project RLA/06/901 (February 2015) did not approve the following activities:

Activity	Tentative date	Fellowships	Objective	Remarks
Version 03 of the SAM Route Network	16 March / 1 April 2015	-----	Continue the in-depth study of the SAM ATS Route Network, with a view to developing Version 03 of the Route Network.	Hiring of 3 experts for a period of 3 weeks.
Version 03 of the SAM Route Network (final version)	24 August / 11 Sep 2015	-----	Continue the in-depth study of the SAM ATS Route Network, with a view to developing Version 03 of the Route Network (final version).	Hiring of 3 experts for a period of 3 weeks.
ATSRO/8	14 -18 Sep 2015	2 per State	Review the draft Version 03 of the SAM Route Network (final version).	
SAM PBN instrument procedure design workshop	6-17 Sep 2015	1 per State	Train PANS-OPS experts in the drafting and harmonisation of PBN-related instrument procedures.	

2.5 PBN en Route

2.5.1 In order to mitigate the fact that experts had not been hired to continue with the in-depth study of the SAM ATS Route Network with a view to drafting Version 03 of the Route Network, the ICAO SAM Regional Office proposed the conduction of two workshops on the Interface between TMAs and Version 03 of the South American ATS Route Network. The results of the first of these workshops, held on 16-29 March 2015, are shown in working paper SAM/IG/15-WP/07 of this Meeting.

2.5.2 The SAM/IG/14 meeting took note that, in order to support the implementation of Version 03 of the ATS/RO Programme, the SAM/IG/11 meeting (May 2013) had agreed to hire 4 experts for a period of 3 weeks to conduct an in-depth study and prepare the SAM ATS Route Network Optimisation.

2.5.3 Accordingly, the Meeting was informed that, under the auspices of Regional Project RLA/06/901, consultants José Tristão Mariano, Alexandre Luiz Dutra Bastos, Fernando Hermoza Hübner and Héctor Ibarra Martínez, had prepared a preliminary report for the Optimisation of the ATS Route Network of the SAM Region, covering Stage 1 of Version 03, which included proposals for realignment and elimination of routes, as well as the implementation of new RNAV routes, based on the existing

design of the main South American TMAs. The final version (Stage 2) of Version 03 of the Route Network will depend on the PBN redesign of the main TMAs.

2.5.4 The SAM/IG/14 meeting noted that there might be an opportunity for better integration between State plans and SAM route optimisation, or for conducting separate analyses for the main traffic flows in the main homogeneous areas of the Region.

2.5.5 The SAM/IG/14 meeting requested each SAM State to assess the routes in its airspace and advise on a possible AIRAC implementation date. These dates shall be inserted in Stage 1 of Version 03 of the selected ATS/RO programme, shown in **Appendix A** to this working paper.

2.5.6 The SAM/IG/14 meeting felt that the implementation of Stage 1 of Version 03 of the SAM Route Network should be discussed among the States, users and the ICAO SAM Office via teleconferences. These teleconferences would be divided into two types:

- a) implementation teleconferences, for discussing the implementation details of paths agreed among SAM States;
- b) coordination teleconferences, for presenting the proposals developed by the ATS/RO/6 meeting (October 2014) and that involve the States that did not participate at this meeting (Colombia, Guyana, French Guiana and Suriname) and/or the ICAO NACC Office of Mexico in the case of paths involving the CAR Region.

2.5.7 In this regard, the SAM/IG/14 meeting formulated Conclusion SAM/IG/14-7 (*Implementation of Stage 1 of Version 03 of the SAM Route Network*). As a result of the teleconferences mentioned in this conclusion, the Route Network was optimised through amendment SAM 15/01-ATM. In this regard, 13 RNAV routes were added, 7 RNAV routes and 3 conventional routes were realigned, and 6 conventional routes and 1 RNAV route were eliminated.

2.5.8 It is necessary to continue with the implementation of Stage 1 of Version 03 of the SAM Route Network through a strategy to be defined at this Meeting. Furthermore, it is important to highlight that coordination teleconferences were not effective due to the absence of some States that did not attend the ATS/RO/6 meeting, and of the ICAO NACC Office of Mexico. Consequently, it will be necessary to establish a new implementation strategy for the routes that were not coordinated with the parties concerned.

2.6 PBN in Terminal Areas

2.6.1 The SAM/IG/14 meeting was informed about the results of the first and second PBN workshops in the South American Region, aimed at training/planning and design of the main TMAs of the South American Region, respectively. The aforementioned results can be found in the SAM/IG/14 meeting report.

2.6.2 The Third Workshop on PBN Airspace Design in the South American Region was conducted on 9-13 March 2015, with the main purpose of assessing the validation of PBN design of TMAs and/or airspaces selected by the South American States. Workshop results are presented in working paper SAM/IG/15-WP/06 of this Meeting.

2.6.3 It should be recalled that the Bogota Declaration urges States to implement PBN SIDs and STARs at international aerodromes in order to attain the established goals, based on CDO and CCO

techniques. Information collected to date on the status of implementation of PBN SIDs and STARs at international airports is shown in **Appendix B** to this working paper, noting that:

- a) Information highlighted in yellow in Appendix A indicates the goals of the Bogota Declaration and the participation of each State in the attainment of each goal. Information in red shows the status of the SAM Region, which is the main indicator to take into account, considering the regional nature of the goal to be attained.
- b) The information was provided by SAM States, except for Colombia, Guyana, French Guiana and Suriname, whose information had not been received to date and was taken directly from the respective AIP.
- c) RNAV SIDs and STARs lacking navigation specifications were considered as PBN SIDs and STARs.
- d) Airports that had already undergone a complete PBN redesign were considered as airports in which CDOs and CCOs had been implemented.
- e) Consideration was only given to airports with at least one threshold with IFR operations, according to Table FASID AOP-1, which is the official AGA information available at the South American Regional Office. The AGA Section of the SAM Regional Office provided the file used (file: FASID-TABLE AOP-1-SAM_ApprvMaster_Dec2014).
- f) Only thresholds with IFR operations were taken into account, in accordance with Table FASID AOP-1.
- g) It was noted that several States showed inconsistencies in their information concerning their international airports in FASID Table AOP-1, such as:
 - Thresholds appearing as VFR in Table AOP-1 (Table AOP-1 code "NINST") were declared as IFR by PBN coordinators. Furthermore, some of these VFR thresholds have IFR approach, departure and/or arrival procedures.
 - The number of thresholds in Table AOP-1 is different from that provided by the State coordinators of the PBN Project, denoting that Table AOP-1 probably has not been updated in terms of magnetic declination.
 - Airports or airport thresholds declared as international by PBN Project coordinators do not appear in Table AOP-1.
 - Airports and some airport thresholds shown in Table AOP-1 are not declared as international by PBN Project Coordinators.

2.6.4 **Appendix C** to this working paper contains detailed information by State, international airport and IFR threshold, in accordance with that shown in SAM FASID Table AOP-1.

2.6.5 Taking into account inconsistencies between information contained in SAM FASID Table AOP-1 and information provided by PBN Project Coordinators and/or contained in State aeronautical publications, it is essential for each State to carefully review the information contained in the aforementioned Table to properly assess compliance with the goals of the Bogota Declaration. Accordingly, it is recommended that the following draft conclusion be approved:

Draft Conclusion SAM/IG/15-xx Review of data contained in the SAM FASID Table AOP-1

That, in order to ensure proper assessment of compliance with the goals of the Bogota Declaration concerning the implementation of PBN SIDs/STARs/IACs at SAM international airports, SAM States conduct a complete review of SAM FASID Table AOP-1, with a view to identifying the following, among other relevant aspects:

- a) Thresholds shown as VFR in Table AOP-1 (Table AOP-1 code “NINST”) and declared as IFR by PBN Project Coordinators. Furthermore, some of these VFR thresholds have IFR approach, departure and/or arrival procedures.
- b) The number of thresholds shown in Table AOP-1 is different from that supplied by PBN Project Coordinators, denoting that probably Table AOP-1 has not been updated with regards to magnetic declination.
- c) Airports or airport thresholds declared as international by PBN Project Coordinators that do not appear in Table AOP-1.
- d) Airports and some airport thresholds shown in Table AOP-1 that are not declared as international by PBN Project Coordinators.

2.7 PBN approach procedures

2.7.1 It should be noted that another commitment of States with respect to PBN implementation is the attainment of the goals established in ICAO Assembly Resolution A37-11. In addition to approaches comprised in the redesign of TMAs selected by States, the SAM/IG/14 meeting acknowledged the need to make an effort to also meet the goals of the Bogota Declaration. Accordingly, the goals to be attained by States are: 70% of thresholds with APV approaches by 2014, and 100% by 2016. Information collected to date on the status of implementation of approach procedures at international airports is also contained in Appendices B and C to this working paper.

2.8 Fuel savings and CO₂ emissions

2.8.1 The SAM/IG/14 meeting felt that, in addition to figures on the implementation of routes, SIDs, STARs, and approach procedures, States should report on fuel savings and CO₂ emissions estimated using the IFSET tool.

2.8.2 During the post-implementation phase, wherever feasible, it would be important for States to also calculate actual fuel and CO₂ savings using tools that extract data from “*Flight Operations Quality Assurance*” and/or other means that may provide real information on fuel consumption.

2.9 Taking into account the various PBN goal follow-up requirements established in the Bogota Declaration, the SAM/IG/14 meeting formulated Conclusion SAM/IG/14-4 (*Follow-up of PBN goals established in the Bogota Declaration*). Pursuant to the aforementioned conclusion, the States that have not done it yet, are expected to provide updated information on the status of implementation of PBN SIDs/STARs/IACs, and on the achievements in terms of fuel savings, as a contribution to the attainment of the goals established in the Bogota Declaration. Accordingly, with a view to obtaining information as precise as possible, it is important that States review the information contained in Appendices B and C to this working paper and advise the Secretariat of any changes they deem appropriate.

2.10 **Terms of Reference and Work Programme of the SAM/PBN/IG**

2.10.1 The SAM/IG/14 meeting reviewed the terms of reference and work programme of the SAM PBN Implementation Group, whose revised contents are shown in **Appendix D** to this working paper.

2.11 **PBN points of contact**

2.11.1 The updated list of focal points for PBN matters is contained in **Appendix E** to this working paper. The Meeting shall update the information on focal points as necessary to ensure effective participation in PBN teleconferences and the updating of the SAM PBN Project.

2.12 **National PBN Implementation Plans**

2.12.1 The SAM/IG/14 meeting took note that 5 years had elapsed since the drafting of the National PBN Implementation Plans, and considered that such plans needed updating based on the strategy applied in the SAM Region.

2.12.2 The National PBN Implementation Plans must be drafted in accordance with the plans of each State for meeting the PBN goals of the Bogota Declaration. The aforementioned plans must take into account the following, inter alia:

- a) TMAs in which a full airspace redesign is to be carried out, based on the methodology established at PBN workshops. In this regard, the TMAs covering the main international airports of each State should be included;
- b) implementation of PBN SIDs and STARs, using the CDO and CCO technique;
- c) implementation of APV approach procedures;
- d) fuel savings and CO₂ emissions.

2.12.3 In order to harmonise the drafting of National PBN Implementation Plans, the Secretariat has developed a model that was submitted and approved at the SAM/IG/14 meeting. This model is shown in **Appendix F** to this working paper.

2.12.4 Taking into account the importance of harmonising national PBN implementation plans with the South American Airspace Optimisation Action Plan and the Bogota Declaration, the SAM/IG/14 meeting formulated Conclusion SAM/IG/14-5 (*National PBN Implementation Plans*), urging SAM States to submit their National PBN Implementation Plans at this Meeting.

2.13 **Project A1 (PBN Implementation)**

2.13.1 The SAM/IG/14 meeting took note that activities related to PBN implementation in the SAM Region were becoming more complex, given the need to integrate tasks related to the en-route, TMA and approach phases, with a view to attaining the PBN goals of the Bogota Declaration.

2.13.2 Accordingly, the SAM/IG/14 meeting considered that it was essential to establish a SAM PBN Implementation Project covering all activities as a whole, with a view to achieving a safe, efficient and harmonised airspace.

2.13.3 Given the complexity of this implementation process, the SAM/IG/14 meeting agreed on the importance of applying project management techniques to clearly identify the deliverables of the en-route, TMA and approach phases and their interrelationships in order to monitor and give consistency to the various implementation activities, establishing the appropriate interdependencies.

2.13.4 In this regard, the SAM/IG/14 meeting took note of, and assessed, the draft SAM PBN Project prepared by the Secretariat, and approved its basic structure and the part concerning en-route PBN implementation. The meeting felt that the States should submit their national projects and/or action plans for PBN implementation in TMAs to complete the SAM PBN Project. It should be noted that, once completed and approved by the PBN Implementation Group, the aforementioned project would replace the South American Airspace Optimisation Action Plan. Accordingly, States are expected to present the required information at this Meeting in order to complete the SAM PBN Project, pursuant to Conclusion SAM/IG/14-6 (*Projects and/or Action Plans for PBN redesign of the main South American TMAs*).

2.14 **PBN phraseology**

2.14.1 Following the presentation of working paper SAM/IG/14-WP/27 by the delegation of Peru, the SAM/IG/14 meeting expressed its concern regarding the differences in ICAO phraseology identified in Doc 4444, Doc 9432 and Doc 9931, and the use of FAA phraseology by some flight crews.

2.14.2 Following an extensive discussion, the SAM/IG/14 meeting felt that the ICAO SAM Office should inform ICAO Headquarters in Montreal of phraseology issues identified during the PBN implementation process in South America, in order to seek global harmonisation of the phraseology used by pilots and controllers.

2.14.3 The SAM/IG/14 meeting also identified a trend towards the use of FAA phraseology by SAM States, which seemed more appropriate for a PBN environment. Thus, the meeting considered that the ICAO SAM Office should study the feasibility of harmonising the use of such phraseology, amending Doc 7030. In this regard, the SAM/IG/14 meeting congratulated the delegation of Peru for submitting the issue on the use of ICAO and FAA phraseology, and formulated Conclusion SAM/IG/14-8 (*ICAO phraseology*).

2.14.4 Based on the aforementioned conclusion, the Secretariat sent an internal memorandum to the ICAO Air Navigation Bureau in Montreal, submitting the issue discussed at the SAM/IG/14 meeting. In this regard, the Bureau has responded as follows:

- a) *A proposal for amendment to Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM, Doc 4444) is currently being developed by the Air Traffic Management Operations Panel (ATMOPSP) to specifically address the issue of the use of phraseology related to the application of restrictions on SID and STAR.*
- b) *The proposal will be presented to the Air Navigation Commission (ANC) for preliminary review during its 199th Session, between 27 April and 26 June 2015.*
- c) *In view of the objective of the amendment, consistent with the resolution of the issue in question, it appears that the issue was identified as a safety concern. The relevance of an amendment to Doc 7030 to address the specific concern should be evaluated in light of the proposed amendments to PANS-ATM related to SID/STAR when they are transmitted to States and international organizations for comments.*

3. **Suggested action**

3.1 The Meeting is invited to:

3.1.1 Take note of the information presented herein.

3.1.2 Establish a new strategy for the implementation of Stage 1 of Version 03 of the SAM Route Network, based on the results obtained to date and what remains to be implemented, according to the template shown in Appendix A.

3.1.3 Analyse the information collected to date on the status of implementation of PBN SIDs, STARs and IACs at international airports, as shown in Appendix B.

3.1.4 Review the updates provided by States on the status of implementation of PBN SIDs, STARs and IACs at international airports, as well as the achievements concerning fuel savings and CO₂ emissions, pursuant to Conclusion SAM/IG/14-4 (*Follow-up of PBN goals established in the Bogota Declaration*), as shown in Appendix C.

3.1.5 Analyse, modify as needed, and approve the draft conclusion contained in paragraph 2.6.5.

3.1.6 Assess, modify as needed, and approve the terms of reference and work programme of the SAM/PBN/IG, as proposed in Appendix D.

3.1.7 Update the list of focal points contained in Appendix E, as needed.

3.1.8 Review the National PBN Implementation Plans to be submitted by SAM States pursuant to Conclusion SAM/IG/14-5 (*National PBN Implementation Plans*).

3.1.9 Assess the information provided by SAM States to complete the SAM PBN Project, pursuant to Conclusion SAM/IG/14-6 (*Projects and/or Action Plans for PBN Redesign of the main South American TMAs*).

3.1.10 Take note of the status of revision of the phraseology related to the use of SIDs and STARs in a PBN environment, propose actions concerning the possibility of considering the current situation as a safety concern, and the adoption of an amendment to Doc 7030.

APPENDIX A

SAM ATS ROUTE NETWORK OPTIMIZATION PLAN

VERSION 03 – STAGE 1

Status of Implementation of PBN procedures – SAM Region

STATES	IAP APV AIRPORT	IAP APV THR	IAP LNAV THR	IAP RNP AIRPORT	IAP RNP THR	SID PBN AIRPORT	SID PBN THR	STAR PBN AIRPORT	STAR PBN THR	CCO	CDO
Argentina	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	28.57%	20.83%	0.00%	0.00%
Bolivia	25.00%	16.67%	33.33%	0.00%	0.00%	25.00%	16.67%	0.00%	0.00%	0.00%	0.00%
Brazil	85.19%	82.76%	89.66%	11.11%	5.17%	85.19%	86.21%	33.33%	39.66%	10.42%	10.42%
Chile	50.00%	60.00%	85.00%	50.00%	30.00%	75.00%	61.11%	87.50%	80.00%	12.50%	12.50%
Colombia	0.00%	8.33%#	75.00%	18.18%	8.33%	54.55%	72.73%	66.67%	66.67%	0.00%	0.00%
Ecuador	0.00%	25.00%#	25.00%	20.00%	25.00%	20.00%	25.00%	20.00%	25.00%	0.00%	0.00%
Guyana	0.00%	0.00%	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
French Guiana	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Panama	50.00%	57.14%#	57.14%	50.00%	57.14%	25.00%	28.57%	25.00%	28.57%	0.00%	0.00%
Paraguay	100.00%	100.00%	100.00%	0.00%	0.00%	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%
Peru	0.00%	33.33%#	11.11%	50.00%	33.33%	12.50%	22.22%	0.00%	77.78%	12.50%	12.50%
Suriname	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Uruguay	0.00%	0.00%	62.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Venezuela	100.00%	100.00%	100.00%	0.00%	0.00%	85.71%	85.71%	0.00%	0.00%	0.00%	0.00%
SAM Region	40.21%	43.27% *56,14%	63.16%	17.35%	11.11%	48.98%	50.60%	32.32%	36.84%	4.49%	4.49%

* Percentage when considering thresholds with IAC RNAV (RNP) and without RNAV (GNSS) with LNAV/VNAV.

Percentage considering in part or in whole the IAC RNAV (RNP) to meet the goals of the implementation of RNAV (GNSS) with LNAV/VNAV procedures.

BOGOTA DECLARATION GOALS					
Year	IAP APV THR	SID PBN AIRPORT	STAR PBN AIRPORT	CCO	CDO
2014	70%				
2016	100%	60%	60%	40%	40%

Observations:

- 1) Information highlighted in yellow indicates the goals of the Bogota Declaration and the participation of each State in the attainment of each goal. Information in red shows the status of the SAM Region, which is the main indicator to take into account, considering the regional nature of the goal to be attained.
- 2) The information was provided by SAM States, except for Colombia, Guyana, French Guiana and Suriname, whose information had not been received to date and was taken directly from the respective AIP.
- 3) RNAV SIDs and STARs lacking navigation specifications were considered as PBN SIDs and STARs.
- 4) Airports that had already undergone a complete PBN redesign were considered as airports in which CDOs and CCOs had been implemented.
- 5) Consideration was only given to airports with at least one threshold with IFR operations, according to Table FASID AOP-1, which is the official AGA information available at the South American Regional Office. The AGA Section of the SAM Regional Office provided the file used (file: FASID-TABLE AOP-1-SAM_ApprvMaster_Dec2014).
- 6) Only thresholds with IFR operations were taken into account, in accordance with Table FASID AOP-1, which is the official AGA information available at the South American Regional Office. The AGA Section of the SAM Regional Office provided the file used (file: FASID-TABLE AOP-1-SAM_ApprvMaster_Dec2014).
- 7) It was noted that several States showed inconsistencies in their information concerning their international airports in FASID Table AOP-1, such as:
 - Thresholds appearing as VFR in Table AOP-1 (Table AOP-1 code “NINST”) were declared as IFR by PBN coordinators. Furthermore, some of these VFR thresholds have IFR approach, departure and/or arrival procedures.
 - The number of thresholds in Table AOP-1 is different from that provided by the State coordinators of the PBN Project, denoting that Table AOP-1 probably has not been updated in terms of magnetic declination.
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APPENDIX C

PBN PROCEDURES AT INTERNATIONAL AIRPORTS

INFORMATION BY STATE

FASID TABLE AOP-1 SAM

APPENDIX D

TERMS OF REFERENCE AND WORK PROGRAMME FOR THE SAM REGION PBN IMPLEMENTATION GROUP (SAM/PBN/IG)

1. TERMS OF REFERENCE

Coordinate SAM PBN Implementation Project in the en-route, terminal, and approach flight phases, taking into account the performance-based navigation (PBN) concept, according to the ICAO Strategic Objectives, the Aviation System Block Upgrades methodology (B0-APTA, B0-FRTO, B0-CCO, B0-CDO) and the goals established by the Bogota Declaration.

2. WORK PROGRAMME

- a) Evaluate and perform the changes deemed necessary in the PBN Implementation Project, in the portion related to En-Route Operations, with a view to optimising the ATS route structure.
- b) Develop the tasks of the PBN implementation Project in the portion related to en-route operations assigned to the SAM/PBN/IG.
- c) Evaluate, insert and harmonize the activities of SAM PBN Project related to PBN Implementation in the TMA selected by SAM States.
Note: Implementation by SAM States.
- d) Evaluate, insert and harmonize the activities of the Implementation Project related to PBN Implementation for approach operations.
Note: Implementation by SAM States.
- e) Propose workshops and meetings as necessary for the coordination and harmonization of PBN implementation.
- f) Propose the hiring of experts as necessary, for the development of specific tasks of high complexity for the PBN implementation, mainly for en-route operations and its interrelation with operations in major South American TMA.
- g) Follow-up of PBN implementation for en-route, TMA and approach operations to ensure its intra and inter-regional harmonisation.
- h) In coordination with the ICAO NACC Regional Office in Mexico, consider the necessary activities to ensure harmonisation of PBN implementation in the CAR and SAM Regions, in accordance with GREPECAS PBN Programme.

3. COMPOSITION

Argentina, Bolivia, Brazil, Chile, Colombia, French Guiana, Guyana, Ecuador, Panama, Paraguay, Peru, Suriname, Uruguay, Venezuela and IATA.

4. RAPPORTEUR

Alexandre Luiz Dutra Bastos, Brazil

APPENDIX E / APÉNDICE E

LIST OF CONTACTS FOR OPERATIONAL PBN FOCAL POINTS

LISTA DE CONTACTOS PARA PUNTOS FOCALES PBN

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
ARGENTINA*	<p>Carlos Omar Torres Administración Nacional de Aeronáutica Civil (ANAC) Jefe Departamento Programación Técnica Tel: +54 11 5941-3000, Ext. 69193 E-mail: ctorres@anac.gov.ar</p> <p>Víctor Marcelo de Virgilio Jefe del Departamento Gestión del Espacio Aéreo Tel.: +5411 4317-6000, Ext 15130/14105 E-mail: dsna@faa.mil.ar</p>
BOLIVIA (Plurinational State of) / BOLIVIA (Estado Plurinacional de)*	<p>Luis Benjamín Rojas Santa Cruz Dirección General de Aeronáutica Civil (DGAC-BOLIVIA) Especialista Planificación de Espacios Aéreos y Procedimientos de Vuelo Tel.: +591 4 4221696 Cel.: +591 72035429 E-mail: lrojas@dgac.gob.bo</p>
BRAZIL / BRASIL*	<p>Alexandre Luiz Dutra Bastos Jefe de la División de Estudios ATM Instituto de Control del Espacio Aéreo – ICEA Praça Marechal do Ar Eduardo Gomes, 50 São José dos Campos-SP, Brasil Tel: +5512 3947-9320 E-mail: bastosaldb@icea.gov.br</p> <p>Luiz Antonio dos Santos Jefe ATM Departamento de Control del Espacio Aéreo (DECEA) Av. General Justo, 160 – Centro Rio de Janeiro 20.021-130, Brasil Tel: +55 21 2101-6088 E-mail: luizantoniolas@decea.gov.br</p>

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
	<p>Marcelo Marques Lobo Jefe de Sección del Espacio Aéreo Departamento de Control del Espacio Aéreo (DECEA) Av. General Justo, 160 – Centro Rio de Janeiro 20.021-130, Brasil Tel: +55 21 2101-6752 E-mail: lobomml@decea.gov.br</p>
CHILE*	<p>Alfonso De La Vega Encargado Sección Navegación Aérea Dirección General Aeronáutica Civil (DGAC) Miguel Claro 1314 Providencia, Santiago, Chile Tel: +56 2 439-2952 E-mail: adelavega@dgac.gob.cl</p>
COLOMBIA*	<p>Medardo Arcesio Figueroa Guerrero Jefe Grupo de Procedimientos ATM Edificio CNA – Centro Nacional de Aeronavegación Av. El Dorado No. 112-09 Bogotá, Colombia Tel: +57 1 296-2545 E-mail: medardo.figueroa@aerocivil.gov.co</p>
ECUADOR*	<p>Marcelo Valencia Taco Tel: +593-2-2947400, Ext. 4084 E-mail: marcelo_valencia@aviacioncivil.gob.ec</p> <p>Vicente Navarrete Sarasti Tel: +593-2-2947400, Ext. 4086 E-mail: vicente.navarrete@aviacioncivil.gob.ec</p>
FR. GUIANA / GUYANA FRANCESA	<p>Philippe Rondel E-mail: philippe.rondel@aviation-civile.gouv.fr</p>

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
GUYANA	Chaitrani Heeralal E-mail: dans@gcaa-gy.org
PANAMÁ*	Ana Teresa Montenegro de De León Jefe Planificación de Espacio Aéreo Autoridad Aeronáutica Civil Edif. N° 646 Av. Demetrio Korsi Calle Héctor Conte Bermúdez Albrook, Panamá Tel: +507 315-9834 E-mail: anadeleon@aeronautica.gob.pa
PARAGUAY*	José Luis Chávez Gerente de Tráfico Aéreo Dirección Nacional de Aeronáutica Civil Aeropuerto Internacional Silvio Pettrossi Tel: +59521 6882346 E-mail: atm_gnna@dinac.gov.py
PERÚ*	<p>Sady Orlando Beaumont Valdez Inspector Navegación Aérea Dirección General de Aeronáutica Civil (DGAC) Ministerio de Transportes y Comunicaciones Jirón Zorritos 1203 Lima, Perú Tel: +51 1 615-7880 E-mail: sbeaumont@mtc.gob.pe</p> <p>Tomás Ben-Hur Macedo Cisneros Experto PANS-OPS en el Área de Normas y Procedimientos Controlador de Tránsito Aéreo CORPAC S.A. Callao, Perú Tel: +511 414-1442 E-mail: tmacedo@corpac.gob.pe</p>

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
SURINAME	<p>Tjiettrawatie Akloe Controlador de Tráfico Aéreo Suriname Civil Aviation Department Coesewijnestraat # 1 Zorg en Hoop, Paramaribo Suriname Tel: +597 875 4741 E-mail: cheetra@hotmail.com</p>
URUGUAY*	<p>Rosanna Barú Jefa Dpto. Servicios Aeronáuticos División Navegación Aérea - DINACIA Tel: +5982604 0408 int. 4461 Cel: +598 99204 199 E-mail: rbaru@dinacia.gub.uy rocbb17@gmail.com</p> <p>Carlos Álvaro Acosta Ponasso Director General de Infraestructura Aeronáutica-DINACIA DINACIA Camino Carrasco 5519 Canelones, Uruguay Tel: +5982 604-0408 int. 4401 E-mail: insvuelo@adinet.com.uy</p> <p>Miguel Ángel Miraballes Alonzo Instructor/Asesor Técnico - DINACIA Diag 9 E “C” y “D” Sol y Luna, Parque del Plata Canelones, Uruguay Tel: +5984 375-2405 Cel: +598 96323872 E-mail: doblemaik@gmail.com</p>

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
<p>VENEZUELA (Bolivarian Republic of) /</p> <p>VENEZUELA (República Bolivariana de)*</p>	<p>Omar Enrique Linares Planificador de Espacios Aéreos Instituto Nacional de Aviación Civil - INAC Aeropuerto Internacional Simón Bolívar Edificio ATC, piso 1, Oficina AIS Maiquetía, Vargas República Bolivariana de Venezuela Tel: +58 212 355-2898 E-mail: o.linares@inac.gob.ve ollinaresomar2@gmail.com</p> <p>Pablo Rattia Rodríguez Planificador de Espacios Aéreos Instituto Nacional de Aviación Civil - INAC Aeropuerto Internacional Simón Bolívar Edificio ATC, piso 1, Oficina AIS Maiquetía, Vargas República Bolivariana de Venezuela Tel: +58 426 531-0616 E-mail: p.rattia@inac.gob.ve</p>

* Updated SAM/IG/14 / Actualizados en la SAM/IG/14

APPENDIX F

PBN IMPLEMENTATION PLAN

MODEL

PBN Implementation Plan State XX

PBN Implementation Plan – State XX

1

Table of Contents

1. Objective
2. Background
3. Introduction
4. Strategic Objectives
 - 4.1 En-Route Operations
 - 4.2 Terminal Areas (Arrivals and Departures) and Approach
5. Implementation
 - 5.1 En-Route Operations
 - 5.2 Complete Redesign of Terminal Areas
 - 5.3 Implementation of PBN Arrivals and Departures using CDO and CCO
 - 5.4 Approach (APV)
 - 5.5 Fuel Savings and Reduction of CO2 Emissions

PBN Implementation Plan – State XX

2

1. Objective

This PBN Implementation Plan has the following objectives:

- a) Provide a high-level strategy for PBN implementation in (indicate STATE and/or ANSP). This strategy is based on PBN, area navigation (RNAV), and required navigation performance (RNP) concepts to be applied in aircraft operations in all flight phases: en-route (oceanic and continental), TMA (SIDs and STARs), and IFR approach, in accordance with implementation objectives set forth in ICAO Assembly Resolution A37-11, and based on the Bogota Declaration formulated at the Thirteenth Meeting of Civil Aviation Authorities of the SAM Region.
- b) Avoid unnecessarily imposing the requirement of carrying multiple equipment units on board or having multiple ground equipment.
- c) Avoid the need for multiple aircraft and operator approvals for intra- and inter-regional navigation.

PBN Implementation Plan – State XX

3

2. Background

Resolution A37-11: The global performance-based navigation goals require States to develop a PBN implementation plan, as a matter of urgency, with a view to:

- a) implementing RNAV and RNP operations (where required) for en-route and terminal areas, in accordance with the established deadlines;
- b) implementing by 2016 approach procedures (Baro-VNAV and/or augmented GNSS) with vertical guidance (APV), including minima for LNAV only, for all instrument flight runway ends, whether as main approach or in support of precision approach, with the following intermediate milestones: 30% by 2010 and 70% by 2014; and
- c) implementing direct LNAV procedures only, as an exception to b) above, for instrument flight runways at aerodromes lacking local altimeter facilities and where there are no aircraft properly equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more.

Pursuant to Resolution A37-11, SAM States have signed the Bogota Declaration. Out of the 15 goals established in said declaration, 5 are directly related and 3 are indirectly related to PBN implementation. These goals are:

Indirectly related

- Accidents – Reduce the SAM regional accident rate gap by 50% with respect to the global accident rate.
- Runway excursions – Reduce runway excursions by 20% with respect to the average rate of the Region (2007 – 2012).
- ATFM - 100% of area control centres (ACCs) providing air traffic flow management (ATFM) services.

Directly related

- Performance-based navigation (PBN) terminal – Compliance with goals established in ICAO Assembly Resolution A37-11 regarding approach procedures with vertical guidance (APV).
- En-route PBN
 - 60% of international aerodromes with PBN standard instrument departures (SIDs) / standard instrument arrivals (STARs).
 - 60% of routes/airspace with PBN.
- CDO - 40% of international aerodromes / terminal control areas (TMAs) with continuous descent operations (CDO).
- CCO - 40% of international aerodromes / TMAs with continuous climb operations (CCO).
- Estimation of fuel savings / reduction of CO₂ emissions based on the ICAO fuel savings estimation tool (IFSET) - Reach 40,000 tonnes of regional CO₂ emission reduction per year in en-route PBN implementation.

PBN Implementation Plan – State XX

4

Thus, PBN implementation is assigned high priority within the ATM Work Programme of the South American Regional Office and of (indicate the State and/or ANSP).

3. Introduction

(AT THE DISCRETION OF THE STATE)

The success of PBN implementation will depend on effective participation by the ATM community to ensure that the operational requirements of the various airspace users, as well as those of service providers are met.

4. Strategic Objectives

4.1 En-route operations

The implementation of PBN for en-route operations in continental airspace within the jurisdiction of **(INDICATE THE STATE)** will be done in accordance with the SAM regional strategy to meet the following strategic objectives:

- a) Safety – The implementation of RNAV-5 has enabled formal and harmonised use of RNAV in new and existing RNAV routes, and created the necessary conditions for a complete restructuring of the route network. Consequently, it will be possible to develop a less complicated route network, reducing the controller workload and thus, increasing safety.
- b) Capacity – Taking into account reduced airspace complexity and the resulting reduction in controller workload, there will be an increase in ATC capacity of sectors, allowing a larger number of aircraft to fly at the same time.
- c) Efficiency – The implementation of RNAV-5 will increase operational efficiency, since it will permit:
 - Airspace management improvements through the repositioning of intersections.
 - Better use of available airspace through a route structure that allows for the establishment of:
 - More direct routes (double and parallel, if necessary) to accommodate more air traffic.
 - “Bypass” routes for aircraft overflying highly dense TMAs.
 - Alternate or contingency routes.
 - Optimum in-flight holding positions.
 - Optimised feeder routes.
 - Reduction of distances flown, resulting in fuel savings.
 - Reduction in the number of navigation radio aids.
- d) Environmental protection – As a result of increased efficiency and fuel savings, there will be a reduction of harmful gas emissions into the atmosphere.

4.2 Terminal control areas (SIDs and STARs) and approach

The implementation of RNP1 and/or RNAV1 at the main TMAs, and of RNP APCH with Baro-VNAV at all thresholds used for IFR and/or RNP AR APCH operations where

PBN Implementation Plan – State XX

7

operational benefits (safety, efficiency, and access) can be obtained will mainly satisfy the following strategic objectives:

- a) Safety – The implementation of RNP1 and/or RNAV-1 at the TMAs will permit segregation of arrival and departure paths, avoiding conflicts between aircraft. Use of RNP APCH with APV/Baro-VNAV and/or RNP AR ACPH will reduce the risk of controlled flight into terrain (CFIT).
- b) Capacity – Use of RNAV-1 and/or RNP1 SIDs/STARs will permit reduced use of radar vectors and, thus, a reduction in airspace complexity and controller workload, increasing ATC capacity of sectors and allowing a larger number of aircraft to fly at the same time.
- c) Efficiency – The implementation of RNP1 and/or RNAV-1 will improve efficiency, since the establishment of well-defined departure and arrival points will permit the restructuring of the routes arriving to/departing from the TMA, reducing flight time. STAR and approach interaction will create the conditions for the establishment of optimum arrival paths, from the en-route phase to the final approach. Likewise, RNP1 and RNAV-1 navigation precision will make aircraft paths more predictable, facilitating aircraft separation and reducing the need for air traffic controller intervention in case of aircraft deviation from the foreseen paths. STAR and approach integration will also improve predictability.
- d) Environmental protection – Improved efficiency and fuel savings will reduce the emission of harmful gases into the atmosphere. Furthermore, the use of CDO/CCO will help reduce aeronautical noise.
- e) Access – The implementation of RNAV (GNSS) approach with Baro-VNAV and/or RNP AR APCH at airports lacking ILS or whose terrain/obstacles result in high meteorological operational minima, will improve aerodrome access under adverse meteorological conditions.

5. Implementation

5.1 En-route operations

En-route PBN implementation is dealt with at regional level, taking into account that the main traffic flows straddling two or more States.

The regional PBN implementation strategy for en-route operations is based on the route network version concept, taking into account that airspace structure changes resulting from air traffic growth, traffic demand displacement from one Region or airport to another, and available technology, amongst other aspects. The use of route network versions reflects the need for periodic, comprehensive reviews to make sure that the best possible airspace structure is always available within the context of an integrated development concept. Route network versions are the result of a broader route network analysis based on traffic and fleet navigation capacity statistics, seeking the elimination of routes not being used and the exclusion or reduced use of “conventional” routes in a given airspace volume where most users have the capability of conducting RNAV-5 operations.

Furthermore, SAM route network versions must seek a complete route network restructuring through full integration of ATS routes, control sectors, TMAs, etc., using the flexible use of airspace concept. Likewise, the use of specific airspace modelling and fast-time ATC simulation tools should be assessed.

5.2 Complete redesign of terminal areas

5.2.1 TMA XX

5.2.1.1 Preliminary operational requirements

5.2.1.2 Tentative date of implementation

5.2.2 TMA YY

5.2.2.1 Preliminary operational requirements

5.2.2.2 Tentative date of implementation

5.2.3 TMA ZZ

5.2.3.1 Preliminary operational requirements

5.2.3.2 Tentative date of implementation

5.3 Implementation of arrivals and departures, using CDO and CCO

The purpose of the PBN SID and STAR implementation programme is to publish these instrument procedures for all thresholds that operate IFR, with the use of CDO and CCO techniques.

Plans for, and the status of, implementation of PBN arrivals and departures, with or without the use of CDO and CCO techniques, are shown in **Appendix A (example: BOLIVIA)**, and will be updated and delivered to the SAM Regional Office every six months, on 30 June and 31 December each year.

5.4 PBN approach

The purpose of the Aerodrome Approach Implementation Programme is to publish RNAV (GNSS) approach procedures for all thresholds that operate IFR, with the possibility of using vertical navigation (LNAV/VNAV) by using Baro-VNAV. Furthermore, ILS approach procedures will be published for airports with ILS equipment to facilitate arrival and approach interface.

Plans for, and the status of, implementation of PBN approach procedures are shown in **Appendix A (example: BOLIVIA)**, which will be updated and delivered to the SAM Regional Office every six months, on 30 June and 31 December each year.

5.5 Fuel savings and reduction of CO₂ emissions

Fuel savings and the reduction of CO₂ emissions to be achieved through PBN implementation will be calculated using the IFSET tool, with a view to determining the efficiency of such implementation. The aforementioned calculation will be part of the complete redesign of the main TMAs and of the implementation

PBN Implementation Plan – State XX

10

of SIDs, STARs, and APV approach procedures. These calculations of fuel savings and CO₂ emission reduction will be delivered to the SAM Regional Office every six months, on 30 June and 31 December each year.

Calculations of actual fuel savings and reduction of CO₂ emissions will be performed during the post-implementation phase, using tools that retrieve data from Flight Operations Quality Assurance and/or other means that could provide actual information on fuel savings. Once these data are available, they will be delivered to the SAM Regional Office.

PBN Implementation Plan – State XX

Appendix A

Status of implementation of PBN SIDs, STARs, and approach procedures

DATA COLLECTION DATE: 10 OCTOBER 2014											
STATE	CAR/SAM ANP INTERNATIONAL AIRPORTS	IFR thresholds	VFR thresholds	APV IAP	LNAV IAP	RNP IAP	PBN SID	PBN STAR	CCO SIC	CDO STAR	OBS
BOLIVIA	BOLIVIA (5 AIRPORTS)										
	SLCB COCHABAMBA	(1)	(2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)
	SLLP LA PAZ										
	SLVR SANTA CRUZ										
	SLTJ TARIJA										
	SLTR TRINIDAD										

Note: The cited AIRAC dates are tentative, based on the capability of publishing instrument procedures.

- (1) Insert the direction of thresholds that have IFR operations or that are capable of supporting them.
- (2) Insert the direction of thresholds where **only** VFR operations are conducted or that are **not** in a position of supporting IFR operations.
- (3) Insert “yes” if the airport threshold already has the instrument procedure indicated in the title of the column (APV IAP, LNAV IAP, RNAV AR IAP, PBN SID or PBN STAR). Insert the tentative AIRAC date of implementation for the type of procedure, if not yet implemented.
- (4) Insert any relevant remarks. If applicable, provide summarised information on the reason why the threshold does not support IFR operations.