



South American Office

**Second Meeting of Air Navigation and Flight Safety Directors of
the
SAM Region**

(Lima, Peru, 14 to 16 September 2015)

Agenda Item 1: Declaration of Bogota: Follow-up to the implementation of air navigation priorities

Follow-up to the implementation goals on PBN

(Presented by the Secretariat)

SUMMARY

This working paper presents a report on the evolution of implementation activities related to the projects “*PBN implementation*” and “*Air navigation system in support of PBN*” under the PBN Programme, and the implementation goals of the Bogota Declaration for the SAM Region.

References:

- Doc 9750, Global Air Navigation Plan;
- Doc 9613, ICAO PBN Manual, 4th Edition;
- Doc 9993, Continuous Climb Operations;
- Doc 9931, Continuous Descent Operations;
- GREPECAS/16 and GREPECAS/17 meetings reports;
- Report of the Third Meeting of the Programmes and Projects Review Committee (PPRC/3) - (Mexico, 21 to 23 July 2015);
- Report of the RAAC/13 Meeting (Bogota, Colombia, 4 to 6 December 2013).

ICAO Strategic Objectives:

A - Safety
E - Environmental protection

1. Introduction

1.1 During the First Meeting of Air Navigation and Flight Safety Directors of the SAM Region (Lima, Peru, 21 and 22 October 2013), the status of PBN implementation in the optimisation of routes, terminal areas (TMAs), instrument approach procedures (IAPs) and the application of continuous climb operations (CCO) and continuous descent operations (CDO), was discussed among other issues. On that occasion, implementation goals to be achieved by the SAM Region States for the 2014-2016 period, which were subsequently approved by RAAC/13 Meeting (Bogota, Colombia, 4 to 6 December 2013) through the Bogota Declaration (Conclusion RAAC/13-8 - *Implementation of air navigation and safety oversight priorities*), were also analysed.

1.2 The purpose of this meeting is to continue with the analysis of the status of implementation of air navigation priorities related to PBN Programme associated to ASBU blocks (ASBU B0-APTA, B0-FRTO, B0-CDO, B0-CCO), while assessing as well the goals expected by end of 2016.

2. Discussion

2.1 The South American Implementation Group (SAM/IG) Meetings have verified that activities related to PBN implementation in the SAM Region have become more complex, considering the need of inclusion of the tasks related with the *En-route*, *TMA* and *Approach* phases, to reach PBN goals in accordance with the Bogota Declaration.

2.2 In this respect, the SAM PBN Implementation Group, considered fundamental that a PBN SAM implementation project is established which considers all the activities in a comprehensive manner, to achieve a safe, efficient and harmonized airspace.

2.3 Considering the complexity of this implementation process, it has been convened the importance of project management technics application, to clearly identify deliverables in the *En-route*, *TMA* and *Approach* phases, and the interconnection among them, in order to allow a follow-up to the different implementation activities and provide coherence in their development, establishing the appropriate dependence between them.

National PBN plans and Action Plans update

2.4 In reference with SAM/IG/14-5 Conclusion “*National PBN implementation plans*”, SAM States should present their updated National PBN plans in the SAM/IG meetings. The National PBN Plans submission updated status is shown under **Table 01**. Since GREPECAS/17 meeting, the Regional progress in the PBN National plans has been 35.7%. The goal to achieve in 2015 is 50% and in 2016, 100%.

	ARG	BOL	BRA	CHI	COL	FGY	ECU	GUY	PAN	PAR	PER	SUR	URU	VEN
2015 35.7%	YES	NO	YES	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO

Table 01 – States that have presented their updated National PBN Plans to date

2.5 Complementing the PBN Plans, SAM Region States should present their Action Plan for PBN-based redesign of their selected airspaces using the action plan model approved for that purpose. The status of updated Action Plans is shown under **Table 02**.

	ARG	BOL	BRA	CHI	COL	FGY	ECU	GUY	PAN	PAR	PER	SUR	URU	VEN
2015 78.5%	SI	SI	SI	SI	NO	NO	SI	SI	SI	SI	SI	NO	SI	SI

Table 02 –States that have presented their Action Plans updated for PBN-based redesign in selected airspaces to date

2.6 Since GREPECAS/17, the progress on action plans development for selected airspaces redesign applying PBN has been of 78.5%. Goal of 50% by 2015 has been exceeded and by 2016, the goal is 100% of PBN action plans development.

PBN en-route

2.7 PBN en-route implementation is discussed in the ATS/RO meetings, grounded on the route network versions concept. The usage of the route network versions reflects the need of a periodical review, in a comprehensive manner, in order to guarantee the best possible airspace structure within a comprehensive development concept.

2.8 In this regard, the implementation of Route Network Version 03 depends on a consistent and harmonized implementation in the SAM TMAs and any delay on projects of one or more States affects the rest of the States and the Regional Project as a whole.

2.9 Considering that the complete redesign process of the main SAM TMAs has not yet achieved the required maturity level for a comprehensive implementation, SAM Region States have decided to split the implementation of SAM Routes Network Version 03 in two stages. Stage 1 includes realignment and removal of routes proposals, as well as new RNAV routes implementation based on the current main South American TMAs design. Stage 2 of Routes Network Version 03 includes routes depending on PBN redesigns of main TMAs, which establish the new gateways. This implementation process is being performed in the SAM PBN workshops.

2.10 Since GREPECAS/17 up-to-date, the progress on RNAV routes implementation in the upper airspace has been 20%, reaching 60% and achieving the goal of 60% established in the Bogota Declaration. For a clearer display, **Table 03** below shows the number of upper airspace conventional and PBN regional routes, as well as the percentage of PBN routes achieved.

Upper airspace total ATS routes	Conventional routes	PBN routes	% of PBN routes implemented	Bogota Declaration indicator: % PBN ROUTES
165	66	99	60%	60%

Table 03 –Upper airspace ATS routes (conventional and PBN)

PBN in TMA

2.11 The processes of complete redesign with PBN application in the main South American TMAs are being performed through PBN workshops, under the support of Regional Project RLA/06/901. Since GREPECAS/17 meeting, four PBN workshops were already carried out, focusing on planning, design, validation and implementation phases, respectively.

2.12 These workshops were focused on design phases and validation of required processes for effective implementation.

2.13 Considering the PBN optimisation impact in the east-west flows among Argentina, Brazil and Uruguay, a series of teleconferences have been started with the Regional Office support and it is

expected to carry out a trilateral coordination meeting to establish requirements and procedures that will be applied taking into account the new design. These activities have required longer time in coordination for PBN implementation in said airspaces.

2.14 In the PBN workshops, it has been recognized that one or more leader operators' participation in diverse PBN implementation phases helps collaborative decision-making processes and to improve planning, design and validation phases' results. This has been demonstrated, in a practical way, in the projects presented by Chile, Panama and Peru.

2.15 Another positive aspect was the personnel training investment, mainly in the PANS-OPS area, example PANS-OPS Basic course and PBN held in Ecuador, and PANS-OPS PBN and NRP AR courses held in Argentina, as well as Peru strategy in sending their experts to the ENAC, France courses. Additionally, Guyana strategy has been distinguished in sending an expert to Airspace Planning training at Singapur's Academy. Procedures design sectors structuring, including the acquisition of logic support for procedures design in Argentina and Peru, as well as currently existent structure in Brazil, also were highlighted during the workshops.

2.16 PBN implementation methodology feasibility proposed during PBN workshops, since initial workshop held in Miami, March 2013, was confirmed by the successful implementations in TMAs Lima and Santiago with PROESA and PAMPA projects, respectively.

2.17 SMS appropriate application was observed by several States, in order to carry out safety validation process of proposed PBN designs.

2.18 It was also verified that Flight Operations Quality Assurance (FOQA) data usage is a resourceful tool for design, and mainly for post-implementation PBN airspace concept assessment, because it offers real data on achieved benefits.

2.19 PBN implementation in terminal areas continues well under way in Brazil, Chile, Panama and Peru and out of 34 selected TMAs, there are already 6 terminal areas with PBN application implemented. In order to progress in this application, major commitment and support from air navigation authorities is needed to complete on time the tasks required for the implementation.

SID, STAR and PBN Approach Procedures implementation

2.20 Bogota Declaration urges States to implement PBN, SID and STAR in international airports, in order to achieve established goals, based on CDO and CCO techniques. Additionally, said Declaration encourages States to implement APV approach procedures, to attend A37-11 Resolution. The data that support the presented information up-to-date on SID, STAR and PBN IAC implementation status is shown in **Table 04**. Following aspects need to be highlighted:

- a) Data highlighted in yellow shows Bogota Declaration goals and each State's participation to achieve each one of those goals. Red information shows SAM Region status, which is the main indicator to be considered, taking into account that the goal to be achieved is Regional.
- b) IAP APV or RNP AR or LNAV columns consider that the apron counts with an APV procedure, with an IAC APV based in RNP APCH with VNAV or by IAC RNP APCH AR. It is also considered that the apron attends to Bogota Declaration requirements and has a LNAV procedure, in accordance with the ICAO Assembly A37-11 Resolution. Nevertheless, it is expected that States implement APV procedures.

- c) Information was submitted by SAM States and their AIPs. For Colombia, Guyana, French Guiana and Suriname data was collected only from AIP, respectively, taking into account that no direct information from these States has been received up-to-date.
- d) SID and STAR RNAV for which no navigation specification was indicated were considered as SID and STAR PBN.
- e) Only CDO and CCO airports were considered and followed a complete validation process, considering, among other aspects, controllers training, LoAs required changes and operational procedures that avoid aircrafts to unnecessary level during climbing or descent, etc.

Note: SAM States should notify on airports that have followed the implementation process with recommended CDO and CCO.

- f) Airports that have at least one apron with IFR operation, in accordance with FASID AOP-1 Table were considered.
- g) Aprons operating IFR, in accordance with FASID AOP-1 Table were only considered.

ESTADO/ STATE	IAC							SID		STAR		SID O STAR PBN AIRPORT	CCO	CDO
	APV/LNAV							SID PBN AIRPORT	SID PBN	STAR PBN AIRPORT	STAR PBN			
	IAP APV	IAP RNP AR	IAP APV o RNP AR	IAP APV o RNP AR AIRPORT	IAP RNP AR "ONLY" AIRPORT	IAP LNAV	IAP APV o RNP AR o LNAV							
Argentina	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	31,25%	20,83%	31,25%	0,00%	0,00%
Bolivia	20,00%	0,00%	20,00%	33,33%	0,00%	40,00%	40,00%	33,33%	20,00%	0,00%	0,00%	33,33%	0,00%	0,00%
Brasil	82,76%	5,17%	82,76%	85,19%	11,11%	89,66%	89,66%	85,19%	86,21%	33,33%	39,66%	85,19%	10,42%	10,42%
Chile	60,00%	30,00%	75,00%	75,00%	50,00%	85,00%	85,00%	75,00%	61,11%	87,50%	80,00%	87,50%	5,88%	5,88%
Colombia	0,00%	8,33%	8,33%	9,09%	9,09%	75,00%	75,00%	81,82%	83,33%	66,67%	66,67%	83,33%	0,00%	0,00%
Ecuador	0,00%	25,00%	25,00%	25,00%	25,00%	25,00%	25,00%	25,00%	25,00%	25,00%	25,00%	25,00%	0,00%	0,00%
Guyana Francesa /Frc. Guy.	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Guyana	0,00%	0,00%	0,00%	0,00%	0,00%	75,00%	75,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Panamá	28,57%	57,14%	57,14%	50,00%	40,00%	57,14%	71,43%	20,00%	28,57%	20,00%	28,57%	20,00%	0,00%	0,00%
Paraguay	100,00%	0,00%	100,00%	100,00%	0,00%	100,00%	100,00%	50,00%	50,00%	0,00%	0,00%	50,00%	0,00%	0,00%
Peru	0,00%	33,33%	33,33%	37,50%	37,50%	11,11%	44,44%	12,50%	22,22%	87,50%	77,78%	87,50%	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%	0,00%	0,00%	0,00%
Uruguay	0,00%	0,00%	0,00%	0,00%	0,00%	62,50%	62,50%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Venezuela	100,00%	0,00%	100,00%	100,00%	0,00%	100,00%	100,00%	100,00%	100,00%	0,00%	0,00%	100,00%	0,00%	0,00%
Región SAM/SAM Region	43,53%	11,18%	50,00%	47,92%	14,43%	63,53%	65,88%	51,55%	51,79%	38,78%	37,06%	64,29%	4,52%	4,52%

Table 04 – Status of implementation of SID, STAR and IAC PBN

2.21 SIDs/STARs implementation progress since GREPECAS/17 up-to-date is 11% in accordance with SIDs and 5% in accordance with STARs. The total current PBN SIDs/STARs is 64.29% and the Bogota Declaration goal of 60% has been exceeded.

2.22 Regarding CDO and CCO operations techniques application progress, since GREPECAS/17 up-to-date same is 4.52%, representing only 10% of the Bogota Declaration, which goal is 40%.

Reduction in CO₂ emissions resulting from PBN implementation in TMA

2.23 As a result of teleconferences held for the implementation of Stage 1 of Version 03, route optimisation network was developed through Amendment SAM 15/01-ATM. In such sense, 13 RNAV routes were added, 7 RNAV routes and 3 conventional routes were aligned as well as 6 conventional and one RNAV routes were removed. During 2014 the goal of 40.000 Tons. established by the Bogota Declaration was exceeded by more than 11.000 Tons. CO₂ reduction. 51.132 Tons. CO₂ reduction was achieved in the South American Region. During 2015 up-to-date, annual savings calculated using the IFSET tool were 2.133 Tons fuel, equivalent to a reduction of only 6.738 Tons. CO₂.

2.24 With reference to the above, the annual goal of 40.000 Tons. CO₂ reduction has been negatively impacted by the delay of several States in the PBN redesign of their terminal areas (TMA), not allowing them to provide timely new gateways to connect the optimised routes that generate such savings. Moreover, some States have not attended the routes optimisation meeting and PBN design workshops where such issues are treated.

2.25 Finally, States that have made calculations on fuel savings resulting from their airspace optimisation are urged to report their CO₂ reduction contributions to the Regional Office, in order to collaborate with the environmental goals established by the Bogota Declaration.

3. Conclusion

3.1 With the support of RLA/06/901 Regional Project, direct assistance has been followed-up to SAM Region States for PBN implementation in the selected airspaces. Tools used to this end by the SAM Regional Office were PBN workshops and implementation meetings (SAM/IG). This strategy has allowed the training of more than 70 State experts, with the cooperation of 17 industry experts (Airbus, Boeing, IATA, Jeppesen), facilitating a collaborative environment in taking decisions among different stakeholders which resulted in the conceptual design of PBN selected airspaces.

3.2 The activities on airspaces redesign in the SAM Region based on PBN application have a positive impact in the efficiency, safety and in the integration of civil aviation authorities, air navigation service providers, air operators, pilots and industry in these processes.

3.3 PBN projects progress in the SAM Region since GREPECAS/17 to date regarding the goals established by the Bogota Declaration, is as follows:

- a) CO₂ annual reduction: 51.132 Tons. in 2014 + 6.738 Tons. in the first semester 2015. This figures exceed in more than 11.000 Tons. the goals established by the Bogota Declaration for 2014; nevertheless, the reduction planned for 2015 has not been reached.
- b) RNAV routes implementation: 22%, reaching 60%, **complying with the goal of 60%** foreseen by the Bogota Declaration for 2016.

- c) SIDs/STARs PBN implementation is 64.29% and **goal of 60% established by the Bogota Declaration has been exceeded.**
- d) CDO and CCO operational techniques application progress is 4.52%, which represents 10% of the goal established by the Bogota Declaration, which intends to reach 40% in the application of such techniques.

3.4 Based on the above it is evidenced that in order to achieve the PBN goals established by the Bogota Declaration, a major commitment regarding processes of TMA design optimisation with PBN application, optimisation of routes, as well as application of validation processes for CDO and CCO techniques applied to STAR and SIDS respectively, is required.

4. **Suggested action:**

4.1 The Meeting is invited to:

- a) take note of the information contained in this working paper;
- b) review the status of development of PBN en-route, terminal areas and approach implementation projects with regard to the goals established in the Bogota Declaration and formulate other actions it may deem appropriate;
- c) encourage those States that have not yet done so, to update their PBN national plans and submit same to the Regional Office;
- d) encourage those States that have not yet done so, to submit their CO₂ reduction calculations as a result of PBN implementation in TMAs; and
- e) that States and air navigation authorities strengthen their commitment and give major support to achieve the goals of the Bogota Declaration, as approved by RAAC/13.