Summary of the Third PBN Workshop

The Third Airspace PBN Design Workshop was held in Lima, Peru, on 9 to 13 March 2015 under the auspices of the ICAO South American Office and the support of Regional Project RLA/06/901 - "*Assistance in the implementation of an ATM regional system according to the ATM operational concept and the corresponding technological CNS support",* pursuant to ICAO Assembly Resolution A37-11, in which the global implementation of Performance-Based Navigation (PBN) was approved.

In accordance with Conclusion SAM/IG/11-1 (*Support to SAM States for the redesign of their TMAs*), it was deemed advisable to plan the activities of Project RLA/06/901 for 2014 and 2015, in order to identify training requirements and provide enhanced training of SAM ATM experts, so as to support and expedite the Regional PBN implementation plan, raising awareness of PBN implementation among participants.

Furthermore, taking into account the need to advance PBN implementation in the SAM Region, the SAM/IG/14 meeting (November 2014) concluded that Regional Project RLA/06/901 should be requested to increase the number/duration of activities related to the aforementioned implementation during 2015 and 2016, with a view to ensuring compliance with the goals established in the Bogota Declaration.

In view of the above, the SAM/IG/14 meeting reviewed the South American Airspace Optimisation Action Plan, and approved the proposals to incorporate new activities, including the PBN/3 and PBN/4 workshops, in accordance with Conclusion SAM/IG/14-2 "*Meetings and resources required for the conduction of activities under the South American Airspace Optimisation Action Plan*."

The Third SAM PBN Workshop was attended by 26 experts of 10 States, 8 experts of IATA and one expert of ALTA. The participating States were the following: Argentina, Bolivia, Brazil, Chile, Ecuador, Guyana, Panama, Paraguay, Peru and Uruguay. The participants were representatives of aeronautical authorities, air navigation service providers and aircraft operators of the South American Region, with expertise in areas such as air traffic control, airspace planning, instrument approach procedure design, airline pilots/operation engineers.

During the opening session of the PBN workshop, the Regional ATM/SAR Officer of the ICAO South American Office, Mr. Julio Pereira, explained the objectives and work methodology of the workshop. He also acknowledged the aeronautical authorities of SAM States for the effort made to send their experts to this important event, which falls within the regional strategy for achieving the goals of the Bogota Declaration, also recognising the importance of user collaboration in these processes.

During the presentation of the preliminary design and action plan of each SAM State, the following aspects were highlighted:

Results of the PBN/3 Workshop

Positive Aspects

In general, although some progress was noted in the PBN project in the States attending the meeting, as described below, the level of maturity that was expected for the validation stage was not attained.

Participation of leading operators in the process

The workshop recognised that the participation of one or more leading operators in the different PBN implementation phases could significantly help advance the planning, design and validation processes. This has observed more clearly in the projects presented by Chile, Panama and Peru.

Investment in training

Another positive aspect to be highlighted is the investment made in personnel training, mainly in the PANS-OPS area. Examples of this are the Basic PANS-OPS and PBN course conducted in Ecuador, the process underway for conducting PANS-OPS PBN and RNP AR courses in Argentina, as well as the strategy of Peru to send its experts to courses at ENAC in France. Also noteworthy is the strategy of Guyana to send an expert for training in Airspace planning at the Singapore Academy. The structuring of procedure design sectors, including the acquisition of procedure design software in Argentina and Peru, as well as the existing structure of Brazil, were also highlighted during the workshop.

Successful implementation of the methodology in the PAMPA and PROESA Projects

The feasibility of the PBN implementation methodology proposed by PBN workshops, starting with the initial workshop held in Miami in March 2013, has already been confirmed by successful implementations at the Lima and Santiago TMAs under the PROESA and PAMPA Projects, respectively.

Use of SMS for the validation phase

Note was taken of proper implementation by several States of SMS for safety validation of the proposed PBN designs.

Use of FOQA data for design purposes

It has also been noted that the use of *Flight Operations Quality Assurance* (FOQA) data is one of the best tools for design, and especially, for post-implementation assessment of a PBN airspace concept, because it offers real data on the benefits derived from implementation.

Use of FUA

The evolution of the Flexible Use of Airspace (FUA) was applied in Ecuador, with the use of SER-4 starting at FL180, which will permit the establishment of a direct route between Guayaquil and Galápagos, applying CDO and CCO criteria, resulting in significant operational gains in terms of fuel savings and thus CO_2 emissions.

Other aspects to be highlighted

The delegations of Paraguay and Uruguay established preliminary contact for the exchange of experts, whereby Paraguay would send PANS-OPS experts to Uruguay to conduct a PANS-OPS course, while Uruguay would offer its ATC simulator and the corresponding experts to Paraguay to conduct a more in-depth assessment of PBN design at the Asuncion TMA.

The Panama project showed significant progress, where the participation of its main operator contributed to collaborative decision-making. In the case of Guyana, which had not attended the previous PBN workshops, significant efforts were being made, and which should continue to be supported by the Administration for successful completion.

Negative Aspects

Validation Phase

The main objective of the PBN/3 workshop was to analyse the validation of PBN designs. The States submitted part of the data required for validation, but full validation had not been achieved, preventing progress to the next implementation phase.

States must double their efforts to complete the validation phase as soon as possible, since this delay has a negative impact on the optimum development of Version 03 of the SAM Route Network, except for TMAs where PBN implementation is already consolidated (Lima, Santiago and Río de Janeiro).

Action Plans and deadlines

Experts have been requested to improve the use of the action plan model so that it may be a true reflection of activities to be performed, based on the resources available in each State.

States are requested to pay special attention to the establishment of deadlines, so that they will take into account the results that may be obtained from each of the activities to be carried out in each phase of the process.

It is important to highlight that, in the case of the Lima TMA, for example, that has a medium/high airspace complexity, the implementation process took 15 months. In most of the cases analysed, deadlines seem to be too long. At present, the dates submitted to the ICAO SAM Office are as follows:

State	Implementation date
Argentina (Baires)	10 November 2016
Bolivia (Santa Cruz)	30 December 2016
Brazil (PBN SUR)	2nd semester 2017
Chile (Santiago)	17 September 2015
Ecuador (Guayaquil)	19 June 2016
Guyana	¿?
Panama (Panama)	02 July 2015
Paraguay (Asuncion)	23 November 2016
Peru	¿?
Uruguay (Carrasco)	¿?

The delegations of Brazil and Peru presented the restructuring of their PBN projects, advising of some delays in the dates foreseen because of the need to pay attention to other priorities set by each State.

Human Resources

The workshop took note that there were still some States where the lack of human resources in the PANS-OPS field prevented follow-up of the PBN implementation project. The most serious case is that of Uruguay, whose only PANS-OPS expert is to retire soon.

Absence of experts from some States

The Meeting regretted the absence of some States at this workshop and the negative impact it had on regional optimisation programmes applied to South American airspace.

Division of operational environments

The workshop identified differences in some aspects that should be taken into account in low traffic and medium/high traffic volume environments.

Low traffic volume

In a low traffic volume environment, it is possible to use more direct horizontal flight profiles; for instance, directly from the initial segment of the STAR to the IAF.

With low traffic volume, it is assumed that current operations are already significantly efficient, especially in areas with ATS surveillance. For this reason, the main challenge for the validation process, in terms of efficiency, is to ensure that fuel consumption and CO_2 emissions are reduced or, in the worst-case scenario, remain the same, generating gains in other strategic objectives, like safety.

Airspace planners must stay focused on aircraft separation rather than on “path spacing”, bearing in mind that a STAR and SID with low traffic volume should be as direct as possible and should not “prevent” other STARs and SIDs from being also as direct as possible.

Low-traffic environments facilitate the implementation of RNP AR APCH procedures to improve efficiency, taking into account that the natural spacing between successive approaches enables ATC to use the RNP AR APCH procedure, in combination with other types of procedures for aircraft not approved for RNP AR APCH.

The workshop identified the following TMAs as low traffic environments: Asuncion, Guayaquil, Guyana, Montevideo and Santa Cruz.

Medium/high traffic volume

For medium/high volume environments, the PBN/3 workshop saw the need for a more in-depth implementation of the airspace planning techniques foreseen in Doc 9992.

In these settings, the main challenge is to strike a balance between optimum horizontal and vertical profiles, through direct paths and optimum crossing windows, and ATCO workload.

The workshop identified the following TMAs as medium/high traffic settings: Belo Horizonte, Brasilia, Buenos Aires, Panama, Lima, Rio de Janeiro, Santiago and Sao Paulo.

PBN/4 workshop

In order to continue with the established strategy, the States must complete the validation phase. It should be noted that the PBN/4 workshop focuses on the discussion of the following aspects of the implementation stage:

- ✓ Implementation decision.
- ✓ Pre-implementation review:
  - ATC system update.
  - Training programme.
  - Approach, arrival and departure charts.
  - Area and route charts.
  - Contingency and backup procedures.
  - Letters of Operational Agreement.
  - ATC unit procedures.
  - Preparation of users.

Based on the above, and with a view to ensuring the success of the PBN/4 workshop, States must carry out the following activities:

- ✓ Deliver to the SAM Office a consistent and feasible action plan for its inclusion in, and harmonisation with, the SAM PBN Implementation Plan.
- ✓ Complete the validation of the TMA PBN design (SMS, IFSET, ground validation of procedures).
- ✓ Prepare a training programme for ATCOs.
- ✓ Complete the aeronautical charts (IAC, SID, STAR, ARC, ERC).
- ✓ Prepare a Letter of Operational Agreement model.
- ✓ Complete the "operational model".
- ✓ Participate in project follow-up teleconferences on the following dates:

  - 20 April
  - 20 May
  - 18 June
  - 17 July
  - 03 August
  - 19 August (subject to subsequent confirmation)

- ✓ Deadline for submission of material: **3 August 2015**
- ✓ Participation in the PBN/4 workshop: **31 August to 4 September 2015 (**subject to timely submission of the material requested in the previous paragraph).

SAM PBN Implementation Strategy

Upon conclusion of the PBN/4 workshop, the Second Workshop on the Interface between TMAs/Version 03 of the SAM Route Network has been scheduled, whose main objective is to continue drafting Version 03 of the SAM Route Network, based on the validated PBN designs of the main SAM TMAs. For this event to occur, the aforementioned material to be analysed at the PBN/4 workshop needs to be sent by the target date (3 August 2015), especially the full validation of TMA PBN design (SMS, IFSET, ground validation of procedures). Otherwise, it would be better to postpone the workshop until the work is completed and delivered to the ICAO Office in Lima.

For those States that are undergoing the full validation process, it might be necessary to conduct bilateral or multilateral meetings to adjust implementation details, mainly aspects related to improved air traffic routing and Letters of Operational Agreement.

At SAM/IG meetings, the PBN Project manages PBN implementation, including all flight phases, with a view to meeting the goals of the Bogota Declaration. At SAM/IG meetings, the Group in charge of analysing PBN operations is responsible for providing the necessary implementation guidance and monitor the status of implementation of the SAM PBN.

The purpose of ATS/RO meetings is to assess the results of the analyses conducted by the consultants and by the Workshops on the Interface between TMAs/Version 03 of the SAM Route Network, and to consolidate Version 03 of the SAM Route Network. Furthermore, the ATS/RO analyses the proposals submitted by users to ensure consistency with the implementation strategy of Version 03.

Other activities

The PBN/3 workshop was briefly informed of the other activities of the SAM PBN Project, which are being carried out by the Regional Office and SAM States. In addition to the complete restructuring of the main SAM TMAs and the drafting of Version 03 of the SAM Route Network, another important process under the SAM PBN Project is the implementation of SID and STAR procedures, based on CCO and CDO, as well as the implementation of APV approach procedures. The table showing the status of these implementations is contained in **Appendix A**. According to Conclusion SAM/IG/14-4 (*Follow-up of the PBN goals established in the Bogota Declaration*), it is expected that States inform on the status of implementation of PBN SIDs and STARs and of APV approach procedures, with a view to informing the SAM/IG/15 meeting on the level of achievement of the Bogota Declaration goals.

The PBN/3 workshop recalled the need for each State to submit its National PBN Implementation Plans to the SAM/IG/15 meeting, in accordance with Conclusion SAM/IG/14-5 (*National PBN Implementation Plans*) and the model shown in Appendix "I" to item 2 of the SAM/IG/14 meeting report.

Workshop assessment

A survey was conducted to measure the degree of satisfaction of participants with respect to the PBN/3 workshop. Survey details are given in **Appendix B**. In summary, the results revealed that 89% of participants rated the workshop as excellent, while 11% rated it as good.

APPENDIX A

STATUS OF IMPLEMENTATION OF PBN PROCEDURES – SAM REGION											
States	**IAP APV AIPORT**	**IAP APV THR**	**IAP LNAV THR**	**IAP RNPAR AIRP**	**IAP RNPAR THR**	**SID PBN AIRP**	**SID PBN THR**	**STAR PBN AIRP**	**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%	0.00%	75.00%	18.18%	8.33%	54.55%	72.73%	66.67%	66.67%	0.00%	0.00%
Ecuador	0.00%	0.00%	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%	28.57%	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%	0.00%	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 considering thresholds with IAC RNAV (RNP) and without RNAV (GNSS) with LNAV/VNAV.

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 Bogota Declaration goals and the participation of each State in the achievement of each goal. The red colour shows the status of the SAM Region, which is the main indicator to be considered, taking into account that the goal pursued is of a regional nature.
2) Information was provided by SAM States, except for Colombia, Guyana, French Guiana and Suriname, whose data was taken directly from the respective AIPs, taking into account that no information had been received from these States.
3) RNAV SIDs and STARs for which there are no navigation specifications are considered as PBN SIDs and STARs.
4) Airports that had already undergone a complete PBN redesign were considered as airports in which CDO and CCO 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 file used was provided by the AGA Section of the SAM Regional Office (file: FASID-TABLE AOP1-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 file used was provided by the AGA Section of the SAM Regional Office (file: FASID-TABLE AOP1-SAM_ApprvMaster_Dec2014).
7) It was noted that several States showed inconsistencies in the information concerning their international airports in Table AOP-1 del FASID, such as:
   - Thresholds appearing as VFR in table AOP-1 (table code: AOP-1 “NINST)” were declared as IFR by PBN coordinators. Furthermore, some of those 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 probably Table AOP-1 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.

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Appendix B

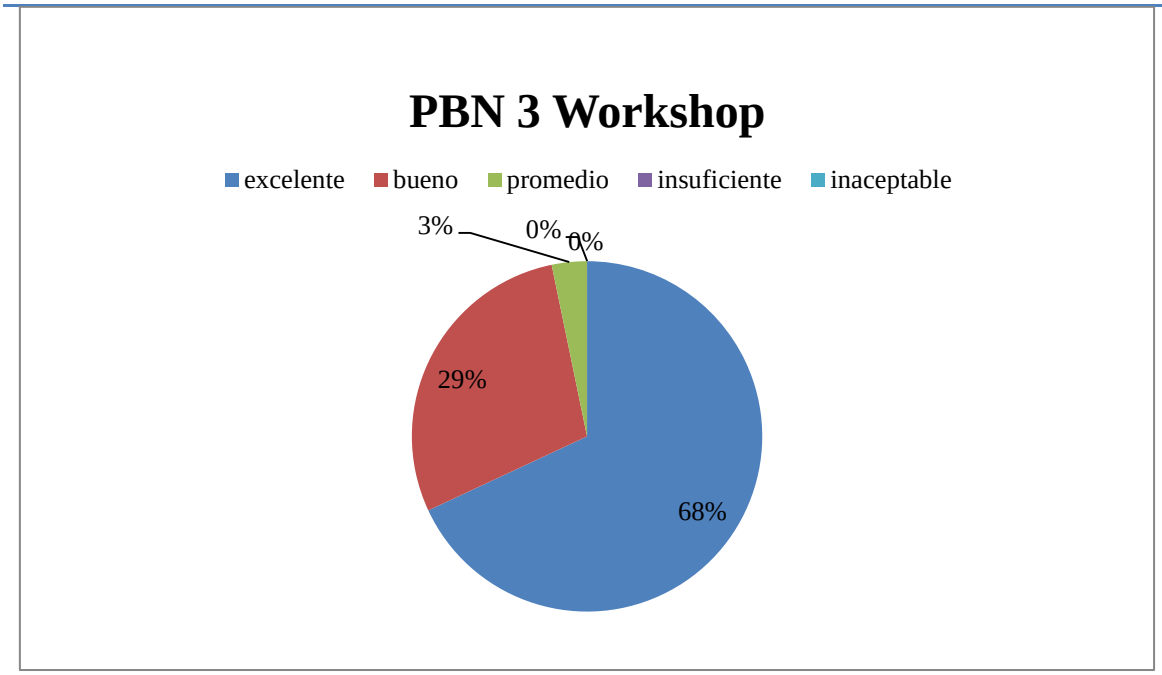
THIRD WORKSHOP ON THE USE OF PBN IN AIRSPACE DESIGN IN THE SAM REGION

SURVEY RESULTS

ASSESSMENT OF COURSE CONTENTS

(**Rating:** **5** = *Excellent* / **4** = *Good* / **3** = *Fair* / **2** = *Inadequate* / **1** = *Unacceptable*)

	Average
a) How relevant were the topics discussed?	4.96
b) How do you rate the training programme of the PBN workshop?	4.63
c) How do you rate the training material?	4.5
d) Is theory reinforced with exercises and practices?	4.58
e) Are topics related to reality and/or applicable to real cases?	4.79
f) How do you rate the level of information?	4.67
g) Has the workshop met your expectations?	4.88
h) Is the information provided sufficient to carry out the PBN implementation plan in your State or company?	4.58
i) Would the material and information provided in the workshop permit the conduction of a course/workshop in your State or company?	4.46
General average	4.67



What would you suggest to improve the workshop?

- Create an Internet forum for queries, suggestions, etc., so as not to wait for teleconferences to make them.
- More information should have been provided to better understand the validation stage.
- The summary of each presentation can be made and included in the final report, with corresponding notes to improve where necessary.
- Have an updated database among States so they can identify areas of improvement between adjacent TMAs or city pairs.
- Stay focused on the development of topics.
- Monitor and give continuity to activities.
- Continued participation of airlines/IATA. Feedback by users is very important.
- The schedule was a little too long.
- Allow Julio to continue participating at the next workshop.
- More participation by the representatives of the operators.
- Urge States to send the documentation duly in advance to the meeting.
- All presentations should be posted on the ICAO website in order to be able to follow the conference.
- All the material was excellent and posted on the website on a timely basis.

Comments

- The workshop was well organized and set out. I learnt a lot of new concepts.
- The true value of the workshop lies not only on the theoretical knowledge shared but also on the transfer of experiences and lessons learned by States in the different PBN implementation phases.
- Congratulations to the participating States, ICAO officers, experts and Office staff.
- Thanks to the States for sharing their experiences.
- Excellent opportunity for sharing our reality with the States of the Region, and make it possible to introduce the necessary improvements, developing and sharing material to further PBN implementation at regional level.
- Excellent assistance provided by ATM officers.
- Continue with this type of events, since they help experts to share experiences that benefit States that are just starting to develop new procedures.
- Very timely workshop that enabled the exchange among States and training for PBN implementation in the CAR/SAM Regions.

13 March 2015

-END-