Agenda Item 3: SAM airspace optimisation
- **a) En-route PBN**
- **b) PBN in terminal areas**
- **c) PBN procedures**

Status of implementation of the Airspace Optimisation Action Plan

(Presented by the Secretariat)

SUMMARY

The purpose of this working paper is to provide updated information on the status of implementation of airspace optimisation in the Region and assess the progress made by States in the implementation of PBN in the airspace under their jurisdiction.

REFERENCES:	
- SAM/IG meetings	
ICAO strategic objectives:	*A - Safety* *B – Air navigation capacity and efficiency* *E – Environmental protection*

1. Background

1.1 The SAM/IG/10 meeting analysed the SAM Route Network Optimisation Action Plan and deemed it advisable to change its name to South American Airspace Optimisation Action Plan, with a view to integrating en-route, TMA and approach planning phases.

1.2 However, the second meeting of the GREPECAS Programmes and Projects Review Committee (PPRC/2), held on 16-18 July 2013 at the South American (SAM) Regional Office, considered that the name of the PBN programme should not be changed, but accepted the proposal of including airspace optimisation in Project A1, thus extending the scope of the PBN Project.

1.3 Based on the integrated planning mentioned above, several activities have been carried out in 2014 under the auspices of Project RLA/06/901, including the first and second PBN workshops and the ATSRO/6 meeting in support of PBN planning and implementation in the SAM Region.

2. Discussion

2.1 Out of the 15 goals established by the Bogota Declaration, 5 are directly related and 3 are indirectly related to PBN implementation. These goals are listed in **Appendix A**.

2.2 Consequently, high priority is assigned to PBN implementation within the ATM work programme of the South American Regional Office and SAM State Administrations should also assign the proper priority to it.

2.3 Taking into account the need to advance PBN implementation in the SAM Region, Regional Project RLA/06/901 should be requested to increase the number/duration of activities related to the cited implementation during 2015 and 2016, to make sure that the goals established in the Bogota Declaration are attained. The status of the South American Airspace Optimisation Action Plan, including the proposals for inclusion of new activities, is described in **Appendix B**.

2.4 **En-route PBN**

2.4.1 The implementation of en-route PBN is discussed at ATSRO meetings, based on the concept of route network versions, taking into account that airspace structure changes according to air traffic growth, the shifting of air traffic demand from one region or airport to another, and/or available technology, amongst other aspects. The use of route network versions reflects the need for an integrated periodic revision to ensure the best possible airspace structure within an integrated development concept. Route network versions are the result of a broader analysis of the route network, based on air traffic and fleet navigation capacity statistics, seeking to eliminate those routes that are not being used and to exclude or reduce "conventional" routes from a given airspace volume, where a significant majority of users is RNAV5-enabled. Furthermore, SAM route network versions must seek a complete restructuring of the route network by means of a full integration of ATS routes, control sectors, TMAs, etc., through flexible use of the airspace concept. The use of specific "airspace modelling" and fast-time ATC simulation tools should be considered.

2.4.2 In this regard, it is important to remember that implementation of Version 3 of the route network depends on consistent and harmonised implementation in SAM TMAs, and that any project delay in one or more States could affect the other States and the Regional Project as a whole. Studies concerning Version 3 of the SAM Route Network were analysed at the ATSRO/6 meeting, as described in another working paper.

2.5 **PBN in terminal areas**

2.5.1 The SAM/IG/12 meeting (Lima, Peru, 14-18 October 2013) agreed that the strategy for terminal areas would involve three consecutive implementation phases:

a) The first phase consisted on distance training, in which participants had to learn about PBN basics through the ICAO website (http://www.icao.int/safety/pbn/SitePages/PBN%20ikit.aspx) and study the following PBN-related manuals: the PBN Manual (Doc 9613), Manual on the Use of Performance-Based Navigation (PBN) in Airspace Design (Doc 9992), Continuous Descent Operations Manual (Doc 9931), and Continuous Climb Operations Manual (Doc 9993);

b) The second phase consisted in participation in the First workshop on PBN airspace design for a period of two weeks, the purpose of which was to provide theoretical/practical training on PBN design of terminal areas. For the practical exercise, 1 highly complex TMA and 1 less complex TMA were selected (Bogota and Asuncion, respectively);

c) The third phase involved participation in the Second workshop on PBN airspace design, for a period of one week, where all the participants from the first workshop had to submit the preliminary basic design for 1 TMA selected for each State, and the proposed designs were to be harmonised and optimised during the workshop, applying the techniques learned at the first workshop, integrating the points of entry and exit of these TMAs, with a view to developing version 3 of the SAM route network.

2.5.2 The First PBN workshop for the South American Region was attended by 43 experts from 10 States, and 8 experts from the industry (Airbus and IATA), representing aeronautical authorities, air navigation service providers, and civil and military aircraft operators of the South American Region. In general, they were experts in areas such as air traffic control, airspace planning, instrument approach procedure design, airline pilots and operation technicians/engineers, aircraft dispatch, AIS, air navigation inspectors, and aeronautical mapping.

2.5.3 The PBN/1 workshop consisted of 31 theoretical modules, including 20 modules containing presentations by the instructors and 11 with presentations by States and IATA. Furthermore, 43 exercise modules were conducted to put into practice the theory learnt. A total of 61 effective hours of training were provided during the workshop, excluding coffee and lunch breaks. A summary of the first PBN workshop is provided in **Appendix C**.

2.5.4 The second PBN workshop for the South American Region was attended by 34 experts from 11 States, and 9 experts from the industry (IATA and Jeppesen), representing aeronautical authorities, air navigation service providers, and civil and military aircraft operators of the South American Region. A summary of the second PBN workshop is provided in **Appendix D**.

2.5.5 During the second workshop, the preliminary design and action plan were presented for the TMAs selected by each SAM State. Based on these presentations, the participants made specific recommendations for optimising and harmonising each design, which should be assessed by each Administration.

2.5.6 It is important to highlight that, to date, only two TMAs have been considered sufficiently mature to start the validation process: Asuncion and Santiago. The other States are in different stages of the planning and design process, at different levels of development, and each administration will have to make a greater or lesser effort in order to be ready to demonstrate, at the third PBN workshop (scheduled to be held in Lima, Peru, on 9-13 March 2015), that the proposed design is appropriate, especially from the safety and efficiency point of view.

2.5.7 In order to give continuity to the PBN implementation process in the selected TMAs, it should be noted that, as agreed, each State must meet the following requirements:

a) Develop an action plan for the implementation of the PBN airspace concept in the selected ATM/airspace, as an input for the SAM PBN project;

b) Complete data collection and processing, in order to achieve a consistent PBN design of the TMA and/or airspace selected by the State;

c) Develop, as necessary, a new PBN airspace concept, based on the collected and processed data, and on the recommendations of the second PBN workshop;

d) Perform the validation of the preliminary design, taking into account the minimum requirements listed in Appendix D;

e) Review the airspace concept as needed, based on validation results, until a satisfactory PBN design is obtained for implementation, which shall be submitted at the third PBN workshop;

f) Send the PBN design of the selected TMA and/or airspace to the SAM Regional Office (icaosam@icao.int) before 20 February 2015;

g) Participate in the preparatory teleconferences of the third PBN workshop, to be carried out on the following tentative dates:

- 2 October 2014 (already conducted)
- 23 October 2014 (already conducted)
- 19 November 2014
- 18 December 2014
- 5 February 2015
- 25 February 2015

2.5.8 The purpose of these teleconferences is to resolve any doubts and seek preliminary harmonisation of validated designs and action plans to be submitted to the SAM Regional Office.

2.5.9 Furthermore, the Bogota Declaration urges States to implement PBN SIDs and STARs at international aerodromes, with a view to attaining the established goals, based on CDO and CCO techniques. The data collected to date on the status of implementation of PBN SIDs and STARs at international airports is shown in **Appendix E**.

2.6 PBN approach procedures

2.6.1 Another commitment of States concerning PBN implementation concerns the attainment of the goals established in ICAO Assembly Resolution A37-11. In addition to the approaches included in the redesign of the TMAs selected by the States, it is also necessary to make an effort to attain the goals of the Bogota Declaration. The goals to be attained by States are: 70% of thresholds with APV approaches by 2014 and 100% by 2016. The data collected to date on the status of implementation of approach procedures at international airports is shown in Appendix E.

2.7 Fuel and CO_2 savings

2.7.1 In addition to figures on implementation of routes, SIDs, STARs, and approach procedures, it is essential that States submit estimates of fuel and CO_2 savings to be obtained from PBN implementation, using the IFSET tool, which is the metrics that will show the efficiency of said implementation.

2.7.2 During the post-implementation phase, it would be important for States that deem it feasible, to calculate actual fuel and CO_2 savings, based on tools that get data from "Flight Operations Quality Assurance" and/or other means that might provide actual fuel consumption information.

2.8 NAM/CAR/SAM Workshop on PBN Instrument Procedure Design

2.8.1 The PBN instrument procedure design workshop will be held at the ICAO NACC Regional Office in Mexico City, on 17-28 November 2014.

2.8.2 It is expected that pilots, air traffic controllers, and specialists with basic knowledge of PBN airspace design and/or instrument approach procedure (IAP) design from the States and Territories of ICAO NAM/CAR and SAM Regions will participate, as well as representatives of guest international organisations. Work languages will be English and Spanish, and simultaneous interpretation will be provided if a sufficient number of participants of both languages register in due time.

2.8.3 During the second PBN workshop held in Lima, Peru, on 8-12 September 2014, various comments and suggestions were made regarding PANS-OPS training needs of SAM experts, some of which are listed below:

- *"It is important for ICAO to urge States to send the group of designers to all events related to this great PBN project, since many times they only send one or two and exclude other procedure designers who are also involved in the work."*

- *"Conduct frequent meetings of procedure design personnel to exchange design criteria, in view of altitude differences amongst the States."*

- *"Conduct periodic refresher and update courses on Doc 8168."*

- *"Through the Regional Office, and within the context of Project RLA 06/901, a meeting of procedure designers working in the TMA project of each country should be scheduled before or after the workshop to harmonise concepts, especially between adjacent States."*

- *"Promote meetings of procedure design experts once or twice a year."*

- *"A meeting of procedure designers (PANSOPS) should be organised once or twice a year to exchange experiences within the context of the SAM Region."*

2.8.4 Taking into account the need for SAM States to have PANS-OPS experts knowledgeable of PBN instrument procedures, and the comments made during the second PBN workshop, the SAM/IG/14 meeting should assess the requirement to replicate the course to be held at the Mexico NACC Office, whose syllabus is shown in **Appendix F.**

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

2.9.1 The SAM/IG/1 meeting drafted the terms of reference and work programme of the SAM PBN Implementation Group (SAM/PBN/IG), which were never reviewed by SAM/IG meetings. Consequently, these terms of reference and work programme must be re-assessed based on the proposals developed by the Secretariat and shown in **Appendix G**.

2.10 **PBN points of contact**

2.10.1 **Appendix H** contains an updated list of PBN focal points, which was developed based on information provided by States and the list of participants of the first and second PBN workshops. Focal point information must be kept up to date to ensure effective participation in PBN teleconferences and the updating of the SAM PBN Project. Accordingly, States are requested to update this information, as applicable.

3. **Suggested action:**

3.1 The Meeting is invited to:

3.1.1 Recommend that the Coordination Committee of Project RLA/06/901 approve the following activities of the South American Airspace Optimisation Action Plan, as shown in Appendix B:

Activity	Tentative date	Fellowships	Objective	Remarks
Third PBN workshop	9-13 March 2015	2 per State	Validate the airspace concepts of TMAs and/or airspaces selected by States.	
Fourth PBN workshop	17-21 Aug 2015	2 per State	Verify the tasks for the implementation of the airspace concepts of TMAs and/or airspaces selected by States.	
Version 3 of the SAM route network	16 Mar-1 Apr 2015	--------	Give continuity to the detailed study of the SAM ATS route network, with a view to developing Version 3 of the route network	Hiring of 3 experts for a period of 3 weeks.
Version 3 of the SAM route network (final version)	24 Aug-11 Sep 2015	--------	Give continuity to the detailed study of the SAM ATS route network, with a view to developing Version 3 of the route network (final version)	Hiring of 3 experts for a period of 3 weeks.
ATSRO/7	13-17 April 2015	2 per State	Review draft Version 3 of the SAM route network	
ATSRO/8	14-18 Sep 2015	2 per State	Review draft Version 3 of the SAM route network (final version)	
SAM PBN instrument procedure design workshop	6-17 Sep 2015	1 per State	Train PANSOPS experts in the development and harmonisation of PBN instrument procedures	

3.1.2 Approve the following draft conclusion:

Draft Conclusion SAM/IG/14-xx: PBN implementation in SAM TMAs

That the States meet the following requirements with a view to giving continuity to PBN implementation in the selected TMAs:

a) develop an action plan for the implementation of the PBN airspace concept in the selected TMA/airspace, as an input for the SAM PBN project;
b) complete data collection and processing to support PBN design of the TMA and/or airspace selected by the State;
c) develop, as necessary, a new PBN airspace concept, based on collected and processed data, and on the recommendations of the second PBN workshop;
d) validate the preliminary design, taking into account the minimum requirements listed in Appendix D to this working paper.
e) review the airspace concept as needed, based on validation results, until a satisfactory PBN design is obtained for implementation, which shall be presented at the third PBN workshop;
f) send the PBN design of the selected TMA and/or airspace to the SAM Regional Office (icaosam@icao.int) before 20 February 2015;
g) participate in the preparatory teleconferences of the third PBN workshop, to be carried out on the following tentative dates:

- 19 November 2014
- 18 December 2014
- 05 February 2015
- 25 February 2015

3.1.3 Approve the following draft conclusion:

Draft Conclusion SAM/IG/14-xx: Follow-up to PBN goals of the Bogota Declaration

That, in order to follow up on the attainment of PBN goals set forth in the Bogota Declaration, SAM States:

a) fill the template contained in Appendix E to this working paper**;**
b) calculate and/or collect data on fuel and CO_2 savings (estimated and actual), using the IFSET tool for estimates.
c) submit the data mentioned in a) and b) to the SAM Regional office before 30 June and 31 December each year.

3.1.4 Analyse and propose changes as deemed appropriate, and approve the terms of reference and work programme of the SAM/PBN/IG contained in Appendix F**.**

3.1.5 Update, as necessary, the list of focal points shown in Appendix G**.**

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APPENDIX A

GOALS OF THE BOGOTA DECLARATION RELATED TO PBN IMPLEMENTATION

Indirect relation

2. Accidents

Reduce the SAM regional accident rate gap in 50% with regard to the global accident rate.

3. Runway excursions

Reduce runway excursions in 20% with regard to the average rate of the Region (2007 – 2012).

11. ATFM

100% of the area control centre (ACCs) providing air traffic flow management (ATFM).

Direct relation

6. PBN terminal

Full compliance with goals established in ICAO Assembly Resolution A37-11 regarding approach procedure with vertical guidance (APV).

7. PBN enroute

- 60% of the international aerodromes with standard instrument departure (SID) / standard instrument arrival (STAR) PBN.
- 60% of the routes/airspaces with performance based navigation (PBN).

8. CDO

40% of the international aerodromes / terminal control areas (TMA) with continuous descent operation (CDO).

9. CCO

40% of the international aerodromes / TMAs with continuous climb operations (CCO).

10. Estimated fuel savings / $C0_2$ emissions reduction based on the ICAO fuel savings estimation tool (IFSET)

Reach 40,000 tons of regional CO_2 emissions reduction per year in en-route PBN implementation.

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APPENDIX B

ACTION PLAN FOR THE OPTIMIZATION OF THE SOUTH AMERICAN AIRSPACE
(B0-5, B0-10, B0-20, B0-65)

Activity	Start	End	Responsible party	Observations
1. **Implementation of Version 2 of the SAM ATS Route Network / PBN implementation of main South American TMA**				
Activity	**Start**	**End**	**Responsible party**	**Observations**
1.1 Airspace concept				
1.1.1 Collect traffic data to understand traffic flows.	SAM/IG/11	TBD	SAM/PBN/IG (Project RLA/06/901) States	The Secretariat sent a State letter: Response date: September 2011 Chile, Colombia, Paraguay and Uruguay sent traffic data on time. Another traffic data collection was conducted in August 2012. Bolivia, Chile, Colombia, Paraguay, Peru, Venezuela and Uruguay sent data. Data collected for CARSAMMA will be used for future works related to the action plan. Next collection will be done in December 2014, including from FL 250 to 410. To be sent to Regional Office before February 2015.
1.1.2 TMA				

~~1.1.3~~ 1.1.2.1 Conduct a Seminar/Workshop/Work Meeting on airspace planning.	ATSRO/3	April 2013	Project RLA/06/901	Request the support of Project RLA/06/901. The purpose is to train airspace planners of the States of the Region. This task was fulfilled with the conduction of a Course/Workshop on PBN design of CAR/SAM airspace and terminal areas on 11-22 March 2013, where IATA provided the instructors, CANSO the translation, and Project RLA/06/901 contributed with LAN Chile and LAN Peru designers to support the experts during the workshops. Argentina, Brazil, Colombia, Paraguay, and Peru participated from the SAM Region, together with two experts from Project RLA/06/901. A total of 8 experts from the SAM Region were trained. A practical exercise related to the Lima TMA was conducted.

~~1.1.4~~ 1.1.2.2 Conduct the First Workshop on PBN airspace design in the SAM Region.	May 2014	May 2014	Project RLA/06/901 States	Objective: complete the training of experts of the SAM Region, taking into consideration that not all States participating in the Project could attend the Course/Workshop held in Miami. 2 weeks/2 fellowships by State. A practical exercise in Bogota and Asuncion TMAs will be carried out. This task has been completed. A SAM course/ workshop on PBN airspace design and terminal areas was carried out from 12 to 23 May 2014, with the support of the Colombian Civil Aviation Authority and RLA/06/901 Project. 43 experts from 10 States and 8 experts of the Industry (Airbus and IATA) participated. A practical exercise on Asuncion and Bogota TMAs was carried out. **COMPLETED**

~~1.1.5~~ 1.1.2.3 Conduct the Second Workshop on PBN airspace design.	July 2014	July 2014	Project RLA/06/901	1 week. During this Workshop, States will present a preliminary PBN design on one of their State's TMAs, in order to be evaluated by the Workshop. Two fellowships per State will be requested for this Workshop. This task has been completed. A SAM course/ workshop on PBN airspace design and Terminal Areas was carried out from 08 to 12 September 2014, with the support of RLA/06/901 Project. 34 experts from 11 States and 9 experts of the Industry (IATA and Jeppesen) participated. 10 PBN designs were evaluated on TMAs selected by SAM States. **COMPLETED**
1.1.2.4 Conduct the Third Workshop on PBN airspace design	SAM/IG/14	March 2015	RLA/06/901 Project	Objective: Validate airspace concepts of TMAs and/or airspaces selected by States. States should: a) Develop an Action Plan for the implementation of the PBN airspace concept in the selected airspace, as an input for the SAM PBN project.

				b) Complete data collection and processing in order to achieve a consistent PBN design of the TMA and/or airspace selected by the State. c) Develop, as necessary, a new PBN airspace concept, based on the collected and processed data and on the recommendations of the PBN/2 workshop. d) Perform the validation of the preliminary design, taking into account the minimum requirements specified in PBN/2 workshop. e) Review the airspace concept as needed, based on validation results, until a satisfactory PBN design is obtained for implementation, which shall be submitted at the PBN/3 workshop. f) Send the PBN design of the selected TMa and/or airspace to the SAM Regional Office before 20 February 2015. g) Participate in the preparatory teleconferences of the PBN/3 workshop to be carried out on the following tentative dates:

				- 02 October 2014 - 23 October 2014 - 19 November 2014 - 18 December 2014 -05 February 2015 25 February 2015 Tentative date: 9 to 13 March 2015
1.1.2.5 Conduct the Fourth Workshop on PBN airspace design	SAM/IG/14	Aug 2015	RLA/06/901 Project	Objective: Verify the tasks for the implementation of the airspace concepts of TMAs and/or airspaces selected by States. Tentative date: 17 to 21 August 2015
~~1.1.5.1~~ 1.1.2.6 Detail the planning of the optimization of the main SAM Region TMA, taking into account the base design developed by States, defining among other relevant aspects, the gateways of the main TMAs of the SAM Region.	SAM/IG/12	SAM/IG/14	States	During PBN/2 workshop it was not possible to obtain consistent entry and exit points. It is expected to obtain same during PBN/3 workshop, aiming to progress on Version 3 of the route network.
~~1.1.6~~1.1.3 SAM routes network.				
~~1.1.6.1~~1.1.3.1 Conduct a detailed study of the SAM ATS route network, with a view to preparing Version 03 of the route network, including: • Identification of the tools required for conducting the study mentioned (aeronautical charts, specific software). • Identification of ATS routes that should be eliminated based on their utilization. • Description of the interface between the SAM route network and the CAR route	SAM/IG/12	SAM/IG/14	SAM/PBN/IG (Project RLA/06/901)	Two experts will be hired for a period of 3 weeks on August 2014. Project RLA/06/901 will be requested to hire 2 experts for 3 weeks, to initiate works for the development of Version 03 of the SAM route

network. • Presentation of an initial proposal of amendment to the CAR/SAM ANP. • Development of planning criteria to be used by States and airspace users in this implementation process (see paragraph 2.13 of the ATSRO/03 report).				network, based on the preliminary PBN design of TMAs which were developed during the two workshops on PBN airspace design. 4 experts were hired during varied periods between 15 September and 03 October. Study presented during ATSRO/6. **COMPLETED**
1.1.3.2 Give continuity to the detailed study on SAM ATS route network, aiming to develop Version 03 of the route network, including: • Identification of tools required for conducting the study mentioned (aeronautical charts, specific software). • Analyse traffic data to understand traffic flows. • Develop Version 03 of the SAM route network including ATS routes, control sectors, interface with TMA, etc., considering following aspects: • Entry and exit points of main TMA in the SAM Region. • ATS routes which should be eliminated according to its use. • Volume of excluding airspace for application of RNAV-5. • "Conventional" ATS routes which should be eliminated or substituted by RNAV routes according to excluding RNAV-5 airspace volume. • RNAV routes which should be realigned, according to entry and exit points of main SAM TMA. • Interface between SAM and CAR route network. • Use of orientation material for the application of				

Flexible Use of Airspace concept, including the use of Conditional routes (CDR-Eurocontrol). • Evaluate the feasibility/necessity to evaluate preliminar design in "airspace modelling" tools and ATC simulation in accelerated time. • Propose first draft for proposal of amendment to CAR/SAM ANP. • Perform an optimization plan for restricted, prohibited, dangerous and reserved use areas in the SAM Region. • Develop calculation methodology for fuel/CO_2 saving using IFSET for the validation of preliminary design of SAM airspace structure, encompassing SID/STAR routes. • Prepare working paper for the ATSRO/7 meeting.				
1.1.3.3 Continue with the detailed study of SAM ATS routes network, aiming to develop Version 03 of the routes network, including: • Identification of tools required for conducting the study mentioned (aeronautical charts, specific software). • Analyse traffic data to understand traffic flows. • Analyse fleet navigation capacity. • Develop Version 03 of the SAM route network including ATS routes, control sectors, interface with TMA, etc., considering following aspects: • Entry and exit points of main TMA in the SAM Region. • ATS routes which should be eliminated according to its use. • Volume of excluding airspace for application of RNAV-5. • "Conventional" ATS routes which should be eliminated or substituted by RNAV routes according to excluding RNAV-5 airspace volume.	SAM/IG/14	Sept. 2015	SAM/PBN/IG (RLA/06/901 Project)	3 experts will be hired for a period of 3 weeks. Tentative date: 24 August to 11 September 2015

• RNAV routes which should be realigned, according to entry and exit points of main SAM TMA. • Interface between SAM and CAR route network. • Use of orientation material for the application of Flexible Use of Airspace concept, including the use of Conditional routes (CDR-Eurocontrol). • Evaluate the feasibility/necessity to evaluate preliminar design in "airspace modelling" tools and ATC simulation in accelerated time. • Propose first draft for proposal of amendment to CAR/SAM ANP. • Perform an optimization plan for restricted, prohibited, dangerous and reserved use areas in the SAM Region. • Develop calculation methodology for fuel/CO_2 saving using IFSET for the validation of preliminary design of SAM airspace structure, encompassing SID/STAR routes. • Develop FINAL document "Version 03 of the SAM routes network". • Prepare working paper for the ATSRO/8 meeting.				
~~1.1.6.2~~ 1.1.3.4Conduct the Sixth Workshop/Meeting for the Optimization of the SAM ATS Route Network (SAM ATSRO/6), for the purpose of reviewing Version 03 of routes.	SAM/IG/10	~~September 2014~~October 2014	Project RLA/06/901 States	Objective: Review draft of Version 03 of SAM routes network
1.1.3.5 Conduct the Seventh Workshop/Meeting for the Optimization of the SAM ATS Routes Network (SAM/ATSRO/7), for the purpose of reviewing Version 03 of routes.	SAM/IG/14	Sept. 2015	Project RLA/06/901 States	Objective: Review draft of Version 03 of SAM routes network. Tentative date: 13 to 17 April 2015
1.1.3.6 Conduct the Eighth Workshop/Meeting for the Optimization of the SAM ATS Routes Network (SAM/ATSRO/8), for the purpose of reviewing Version 03 of routes.	SAM/IG/14	Sept. 2015	Project RLA/06/901 States	Objective: Review draft of Version 03 of SAM routes network. Tentative date: 14 to 18

				September 2015
~~1.1.7~~1.1.4 Training				
~~1.1.7.1~~1.1.4.1 Basic PANS/OPS Procedure Design Course.	May 2013	June 2014	RLA/06/901 Project SAM Regional Office States	Project RLA/06/901 will study the feasibility of responding to the request of Ecuador to conduct a basic PANS-OPS procedure design course in Quito, taking into account that Ecuador would cover 50% of the cost and provide 2 assistant instructors. Ecuador has assumed the total cost of the course. The course will be developed in a period of 8 weeks, in two phases: Phase 1: 22 Sept. to 17 Oct. Phase 2: 10 Nov. to 05 Dec.
~~1.1.8~~1.1.5 Safety assessment				
~~1.1.8.1~~ 1.1.5.1 Prepare the required safety assessment, applying a qualitative methodology using the SMS.	31/07/12	SAM/IG/11	Project RLA/06/901 States	**COMPLETED** An expert needs to be hired for 2 weeks to carry out this task. (This task has been completed.)
~~1.1.8.2~~ 1.1.5.2 Prepare the safety assessment required in their airspaces (route and TMA).		SAM/IG/12	States	States shall conduct a safety analysis of changes in their terminal areas (TMAs).
~~1.1.8.3~~ 1.1.5.3 Conduct the third Workshop/Seminar/ Meeting on risk analysis of Version 02 of the SAM ATS route network.	September 2012	SAM/IG/11	RLA/06/901 Project States	**COMPLETED**

1.1.5.4 Conduct the Third Workshop/Seminar/Meeting for the risk analysis of Version 02 of the SAM ATS route network.	SAM/IG/14	March 2016	RLA/06/901 Project States	Hiring of one expert for 2 weeks is required to perform this task

APPENDIX C

FIRST WORKSHOP ON PBN AIRSPACE DESIGN IN THE SAM REGION

Summary

The First Workshop on PBN Airspace Design in the SAM Region was held in Bogota, Colombia, from 12 to 23 May 2014, under the sponsorship of the Unidad Administrativa Especial de Aeronautica Civil of Colombia and the support of RLA/06/901 Regional Project – *"Assistance in the implementation of an ATM regional system according to the ATM operational concept and the corresponding technological CNS support"*, in response to ICAO Assembly Resolution A37-11, adopting the global implementation of Performance Based Navigation (PBN).

Taking into consideration Conclusion SAM/IG/11-1 (*Support to SAM States in the redesign of their TMA*), it was deemed advisable to plan activities of RLA/06/901 Project for 2014, in order to identify needs and extend training to ATM experts in the SAM Region, to support and facilitate PBN regional implementation plan, by increasing participants knowledge regarding application of PBN.

During the SAM/IG/12 Meeting (Lima, Peru 14 to 18 October 2013), it was concluded that the most beneficial would be to conduct the required training in three consecutive phases:

The **first phase** consists of on-line training obtaining basic PBN concepts through the ICAO website (*http://www.icao.int/safety/pbn/SitePages/PBN%20ikit.aspx*) and the study by each one of the participants of the following PBN-related manuals: PBN Manual (Doc 9613), Manual on the use of PBN in airspace design (Doc 9992), Continuous Descent Operations Manual (Doc 9931) and Continuous Climb Operations Manual (Doc 9993).

The **second phase** consists of participation in the Workshop I on PBN Airspace Design, during two weeks, which objective is to provide theoretical/practical training on PBN Terminal Area design, selecting for the practical exercise one high complexity TMA and one medium/simple TMA. Terminal Areas selected to conduct such exercise were Bogota and Asuncion, respectively.

The **third phase** includes the participation in Workshop II on PBN Airspace Design, during one week, where the participants of the First Workshop present the basic preliminary design for one TMA selected for each State, so that it may be harmonized and optimized during the workshop using the techniques of the First Workshop, pursuing as well an integration of entry and exit points of these TMAs with a view to elaborate Version 3 of SAM ATS Route network.

The First Workshop on PBN Airspace Design in the SAM Region was attended by 43 experts of 10 States and 8 experts of the industry (Airbus and IATA). Participants were representatives of aviation authorities, air navigation services providers as well as civil and military air operators of the South American Region. Overall, participants were experts in specialties such as air traffic control, airspace planning, instrumental approach procedures, pilots, airline operations technicians/engineers, aircraft dispatch, AIS experts, air navigation inspectors and aeronautical cartography.

During the opening of the PBN Workshop, the Director of the Unidad Administrativa Especial de Aeronáutica Civil (UAEAC), Dr. Gustavo Lenis Steffens, welcomed the participants. Mr. Julio Pereira, ATM/SAR Regional Officer of the ICAO South American Regional Office briefly explained the objectives of the workshop, thanking the aviation authorities of Colombia for their efforts made to carry out this important event, which is part of the regional strategy for achieving the goals of the Declaration of Bogota.

The instructors of the Workshop were the following:

Mr. Julio de Souza Pereira, ICAO ATM/SAR Regional Officer;
Mr. Roberto Arca Jaurena, ICAO ATM/SAR/AIM Regional Officer;
Mr. Jorge Fernández Demarco, former ICAO ATM/SAR Regional Officer, ATM Advisor;
Mr. Fernando Hermoza Hübner, Technical Coordinator of Air Navigation, DGAC Peru;
Mrs. Mariela Valdés Piña, Chief Airspace Project, LAN Airlines, LAN base of maintenance.

The first activity of the Workshop was to identify the level of knowledge of participants, with an initial test which roughly assessed several of the topics which would be delivered during the workshop. In this regard, the Group achieved an average of 75%, 87% of them ranging between the concept of good and regular.

The Workshop was developed on **31 Modules**, which contemplated the theoretical part, including 20 modules with presentations made by instructors and 11 intended for submissions from States and IATA. Moreover, **43 Modules** of exercises were given, where each one of the theoretical classes were practiced. For the development of the Workshop, 61 effective hours of training were given, excluding coffee breaks and lunch time.

In **Module 1 – General overview of the Workshop**, the prospects of the workshop were explained, deeply analyzing the scope and objectives of same, especially emphasizing those related to the use of PBN in airspace design, review of the main points in ICAO relevant documentation (Doc. 9613, Doc. 9931, Doc. 9992 y Doc. 9993), share lessons learned, train experts to develop and apply PBN action plans in their States, as well as participate appropriately in the regional PBN implementation processes, train participant experts for them to replicate the knowledge in their States as well as develop preliminary PBN designs of Asuncion and Bogota TMAs.

Module 2 – SAM implementation strategy, reviewed SAM implementation strategy for the PBN implementation, explained the vision and mission of ICAO, especially emphasizing the optimization of operations in all phases of flight, in order to take advantage of these features to improve efficiency and safety. ASBU concerning PBN implementation was briefly analyzed.

Module 3 – Overview of PBN and airspace concept, was focused in the relationship between PBN and airspace concept, explaining the application of navigation specifications and air navigation infrastructure and how a specification should be selected according to its use, either in ATS, SID/STAR routes and/or approach procedures. The meaning of an airspace concept as well as the reasons for its development was also recalled. Through such concept a structured and systematic way is provided to determine what should be achieved in an airspace and how should it be achieved to help ensuring that the objectives and expected benefits for the new structure of airspace are clearly established, the objectives in the change in airspace are achieved as well as the means to achieve the objectives are appropriate and feasible with the available resources.

Module 4 - Manual on the use of performance-based navigation (PBN) in the airspace design (Doc. 9992), referred to the use of performance-based navigation (PBN) in the airspace design, Doc. 9992, explaining in detail the four phases of the implementation process: Planning, Design, Validation and Implementation, as well as the 17 macro activities to achieve the

established objectives. The importance of initiating a project of airspace structuring for the application and use of PBN, maintaining a strong coordination with the whole ATM community and particularly, with the users of airspace was stressed, as such coordination would allow an early explanation of what would be the scope and objectives of PBN implementation project. Afterwards, all activities described in Doc 9992 were explained one by one.

In **Module 5 - CDO Manual (Doc. 9931)** and **Module 6 - CCO Manual (Doc. 9993)**, implementation processes of continuous descent operations (CDO) and continuous climb operations (CCO) encompassed in Documents 9931 and 9993 respectively, were explained. Both manuals and therein contained designs were reviewed, assessing the techniques for their application as well as the specific requirements for this kind of operations. Particularly, a review was made on the main benefits to be obtained from its application, identifying in the case of continuous descent operations, the increase in flight predictability, airspace efficiency and safety, while reducing fuel consumption, CO_2 emissions, pilot/ATC workload and CFIT. On the other hand, the implementation of CCO techniques offer advantages such as operations with improved fuel performance, reduced pilot/ATCO workload, reduced communications, cost savings and environmental benefits (lower consumption, noise mitigation) and, if applicable, authorizations for operations which otherwise, may be restricted by noise.

Module 7 – Designing routes-Route spacing, encompassed aspects related to the design and route spacing. Regarding the design, an evaluation was made on the type of specification that should be used, depending of the phase of flight, which would be the requirements of airspace concept and under which circumstances it would be necessary or not, to carry out an on board performance monitoring and alert, particularly taking into account that navigation specifications not include all airspace requirements needed for the operation in an airspace, route or procedure in particular. Applicable procedures must be inserted in AIP and/or Regional Supplementary Procedures or other documents of the State and States must conduct a safety assessment in accordance with the provisions of Annex 19 and PANS-ATM. It was also clarified that the PBN Manual is not a document of certification/approval. Its purpose is to harmonize, so each State must publish its own document, reminding at this point that the SAM Region counts with the Advisory Circulars of the Regional Safety Oversight Cooperation System, for aircraft approval in the different navigation specifications to be applied. Regarding route spacing, the generic model to determine separation and spacing between routes was analyzed, and different types used worldwide were provided for information. Finally, in this module information and explanation was given on the different separations included in Amendment to Doc 4444, which application begins on November 2014.

Module 8 – **Good design practices** had as main objective to explain general PBN good design practices. Regarding the considerations for the design, it was indicated that design should be based on reality, i.e. the location of the airport, terrain and optimal altitudes of aircraft. It was also stressed that the reality is the originator of LOAs and not the other way round, as well as the requirement to determine optimal crossing points concerning routes. On the other hand, always related with the considerations for the design, there was also indicated the need to start with the shortest routes, or with those that occupy less the sector, try to balance the ATC intervention with the required distances and consider links with the structure of conventional routes. It was especially remembered that RNAV/RNP aircraft will require less ATC intervention, that RNAV/RNP routes contribute to safety and that no RNAV/RNP aircraft probably will have to be vectored to assure harmonization and safety within a given airspace. In this same module, different arrival and departure paths that could be applied in the optimization of airspace were largely explained.

Module 9 – **Data required for airspace planning,** covered general aspects related with the data required for airspace planning. In such sense, the need to know the reference scenario, i.e. the present scenario, initially based on TMA dimensions, geographical coordinates, prohibited, restricted and dangerous areas in a radius of 100 NM from the center of main airport,

geographical limitations, total number of airports served by the terminal, etc. was thoroughly explained. It was also encouraged to identify main traffic flows, entries, exits, pairs of cities served and ATS routes, assess aircraft fleet, their characteristics and navigation capacities, see or identify delays and its reasons, etc. Finally, some examples on data processing for terminal areas were delivered.

Module 10 – **Designing airspace volumes and sectors,** aimed at providing an understanding of airspace volumes and sectors, to be considered in the design process. It was indicated that the airspace of one TMA area should be only enough to cover departure and arrival operations. Some rules were presented to define sectors that should be taken into account during planning. Among others, it was stressed on the need that the number of sectors should be the minimum required for different situations and the number of conflicts per sector and time unit should be minimized. Also, the number of sectors crossed by each aircraft and the time of permanence of aircraft in one sector should be the minimum possible. Different ways to establish or define sectors using geographical or functional areas, as well as their advantages and disadvantages, were also presented.

Module 11 - Introduction to exercise and **Module 12 - Generic airspace exercise,** contemplated presentation of basic material to be used on the first exercises. This generic airspace design exercise focused on the Centerville TMA. In order to perform this exercise, fictitious information on TMA, as well as sufficient information to understand the operation of such TMA was provided. The exercise requested to establish concepts and to design a new Centerville TMA, by applying the good design practices for departures, arrivals and holds which were explained on previous module. A description of the case was delivered referring to ATM concepts, airspace, meteorology, aircraft types, major flow paths, existing infrastructure on communications, navigation and surveillance, environmental and social aspects, special use areas, etc. Participants were requested to design a new TMA, define airspace volume as well as sectors related to such TMA. Finally, the Group was invited to show the work carried out in a PPT presentation, applying all the base material provided to this point of the workshop.

From this module, presentations and exercises made by the Group were developed intending that each lecture was followed by a practical exercise, in order to enlarge on what was learned.

Module 13 – **Safety criteria and assumptions**, focused on safety criteria, providing an overview on safety criteria, performance and related policy. In general terms, explanation was given on why to establish safety criteria as well as on the difference between safety qualitative and quantitative assessments. Subsequently, explanation was also given on the 7 steps of a risk analysis and the probability, severity and tolerability matrix proposed by ICAO for the risk analysis, as well as the criteria to be used in each case. The importance in an implementation programme to conduct an analysis before implementation, preferably during the planning phase as proposed by Doc 9992, and after implementation, in order to assure that the system maintains or improves levels of safety, was highlighted.

Module 14 – **Validation and implementation**, focused attention in aspects related to validation of airspace concept and routes (routes themselves / departures / arrivals / approaches) and resulting instrument flight procedures. The objective of this module was to show the importance of validation, which in general terms allow assess whether the ATM objectives will be achieved, check the flyability of instrument flight procedures, identify potential problems and develop mitigations, provide evidences that the design is safe and above all, explain that validation is an ongoing process throughout the project life. Information on the different methods of validation for both, airspace and instrumental procedures, while showing the advantages and disadvantages of each one of these methods, was also delivered.

Module 15 – **Introduction to Asuncion and Bogota case study**, was initiated with the presentation made by the representatives of Paraguay and Colombia, giving details of their

terminal areas Asuncion and Bogota respectively, these being the two case studies to be analyzed by the workshop. Both presentations focused in providing as much information as possible regarding size of the TMA, with geographical coordinates and vertical TMA dimension, prohibited, restricted and dangerous areas in a radius of 100 NM from ARP of main airport, geographical limitations, runways, type of control service provided, radar coverage, main traffic flows based on data collection form, standardized entries and exits, main city pairs served by ATS routes, main airports in TMA (indicating identification, extension, aircraft category allowed, runway capacity), aircraft type operating the airport, navigation capacity of the aircraft fleet operating in the airport. If there are delays, identify reasons (due to ATC, MET conditions, airlines, etc.), indicate potential traffic conflicts within TMA (bottlenecks / points of conflict), maps of ATS routes, number of TMA overflights and any other information which was useful for the analysis of airspace in each case.

Continuing with Module 15, a brief summary was made on the topics seen so far, based mainly on the 4 phases of Doc 9992 implementation process. Based on the presentations made by Paraguay and Colombia, clear information was submitted, explaining the Group what was expected and informing that tasks would be divided into 7 different working groups. Task 1 expected to establish operational requirements and its scope. Task 2 asked to undertake a review of the reference data. Task 3 requested for the identification of interferences, enablers and project constraints. On the other hand, task 4 asked for the identification of routes and departure/arrival points to terminal areas. Task 5 focused on the identification of at least two main flows for departure and arrival, as well as a preliminary draft of IFR procedures. Task 6 was related to airspace volumes and sectors. Finally, task 7 requested the groups to perform a final presentation of the result achieved. Before the final presentation, the groups presented the progress made after each task performed.

Module 16 – **Practical effects of path terminations application in procedures and use of FOQA data,** covered the use and meaning of each one of the path terminations usable in RNAV/RNP procedures. It addition, it showed how FOQA data can help monitor post implementation of a procedure. Examples were shown on the use of path terminations that did not achieve the desirable or optimal path and why such paths were not optimal. Likewise the navigation accuracy achieved by aircraft by using this data was observed.

Module 17 – Publications and database - Best practices, presented publications requirements to achieve a good coding in navigation databases. Reference was made to aeronautical data chain and the time required for encoding, the data required in coding tables, RF sections publication, 5LNC and alphanumeric way-points naming, magnetic variation applied to RNAV sections as well as RNP, APCH and RNP AR APCH.

In **Module 18 - RNP AR access and efficiency,** it was discussed about the general characteristics of these approaches and the transition concepts for the application of such approaches, as currently benefits can be obtained on its implementation without being specifically implemented in response to geographical obstacles. Moreover, different examples were shown on implementation and difficulties for its application in congested terminals.

In **Module 19 - IFSET tool,** the ICAO tool for the calculation of fuel saving was presented. Practical examples were submitted. Explanation on access to the tool and its corresponding user guide was also given for its use by experts.

Module 20 – Project management action plan, covered aspects related to the meaning of a project, explaining that it is a temporary effort made to create a unique product or service, or to concrete a certain goal. It was also explained that the project should clearly define the objectives, deadlines and resources, its intention to produce a specific result at a given time, within an established budget, and that same could cross organizational lines. On the other hand, an overall explanation was given on how to manage a project and the importance of identifying

all stakeholders, determine needs, define their requirements, lead and influence them, as well as to balance the scope, time, cost and quality of the project, emphasizing that it is a set of processes that requires expertise in several areas of knowledge. Some critical aspects or factors that could affect a project were identified and the importance of time management in order to achieve expected results was also underlined. Finally, participants were given an example of generic action plan, with possible dates for the development on a PBN airspace implementation project, in order to facilitate the development of national action plans for the design of their airspaces with PBN application

In addition to theoretical/practical workshop activities, participants had the opportunity to receive another 5 presentations, with a view to obtain information on the experiences and lessons learned from other States and IATA during the planning, design, validation and implementation of their respective airspaces. In such sense, Brazil, Chile and Peru made their presentations and delivered the Group valuable information on their experiences, highlighting such aspects to be taken into account that might have affected the implementation in their respective States. On the other hand, IATA presented an analysis of the reports received from international operators regarding incompatibility of ATC gradients in SIDs with aircraft performance. IATA informed that in current FMS, it is necessary to count with accurate models for calculating acceleration segments and configuration changes from take-off. In such sense, IATA recommends operators to carry out a preliminary study considering tools like "climbout" for the path calculation, delivered by the aircraft manufacturers. Moreover, Mr. Mauricio Corredor, member of the delegation of Colombia, offered the participants a detailed presentation on the Fast Time Simulator (FTS) recently acquired by the civil aviation, as well as the on the potential of this tool for airspace optimization in the terminal area of Bogota.

Regarding the exercises developed during the workshop, from the second day on the practical phase began in both, generic aspects of design as in the phase design of Asuncion and Bogota TMA. Participants were divided into two working groups that were maintained throughout the workshop. In such sense, following exercises were developed by each one of the groups:

1. TMA – Generic airspace exercise.
2. Group work – Operational requirements and scope.
3. Group work – Review of reference data.
4. Group work – Interferences, enablers and constraints.
5. Group work – Routes, arrival/departure points and holds.
6. CDO/CCO exercises.
7. Group work – IFR preliminary procedures.
8. Group work – Airspace volumes and sectors.
9. Preliminary design of airspace (Asuncion). Group final presentation.
10. Preliminary design of airspace (Bogota). Group final presentation.

The result was a preliminary design of terminal areas Asuncion and Bogota, which will serve as reference material for the planning, design and implementation of PBN in their respective States, to be presented during the development of the Second Phase of this workshop, to be held in September 2014.

The last day of the workshop, a final test was taken in order to identify the progress of participants in the knowledge obtained during the event. The details of the evaluation are attached as **Appendix A**.

In summary, the results were:

a) Average group qualification: 89.
b) At the end of the workshop, all participants were rated as good (between 70 and 84) or very good (more than 84).

c) No participant obtained a final qualification under 72.
d) The group average increased by 13.5 points (from 75.5 to 89), comparing the initial and final assessments.

Moreover, a survey was conducted to measure the degree of satisfaction of participants with reference to the workshop and the instructors. Details of the survey are attached as **Appendix B**. The summary of the results was as follows:

a) 87% of participants rated the workshop as excellent, while 13% rated it as good.
b) 91% of participants rated the instructors as excellent, while 9% rated them as good.

APPENDIX A

FIRST WORKSHOP ON

PBN AIRSPACE DESIGN

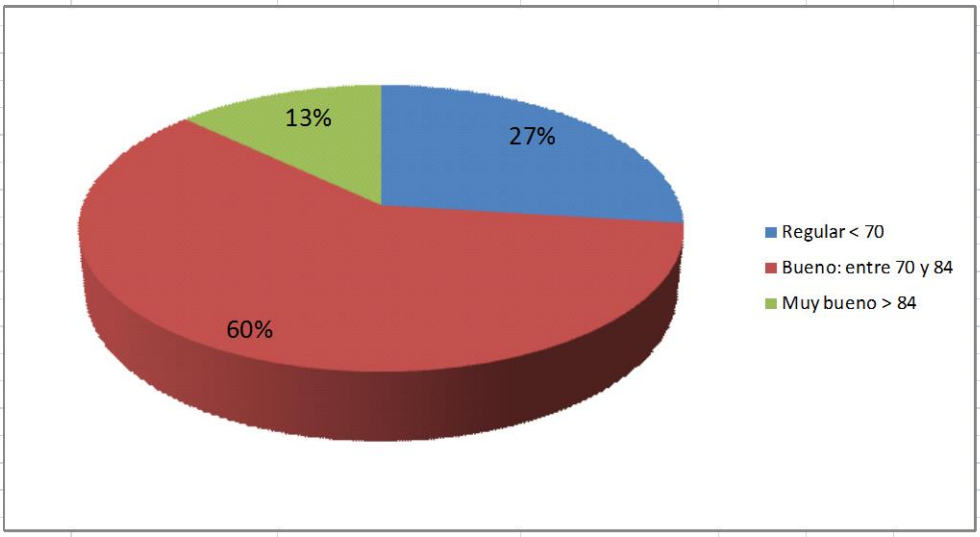
IN THE SAM REGION

COMPARATIVE RESULT OF INITIAL AND FINAL EVALUATION

INITIAL EVALUATION OF WORKSHOP

Note 1: 47 participants took the initial evaluation.

Regular < 70	Bueno: entre 70 y 84	Muy bueno > 84
27%	60%	13%

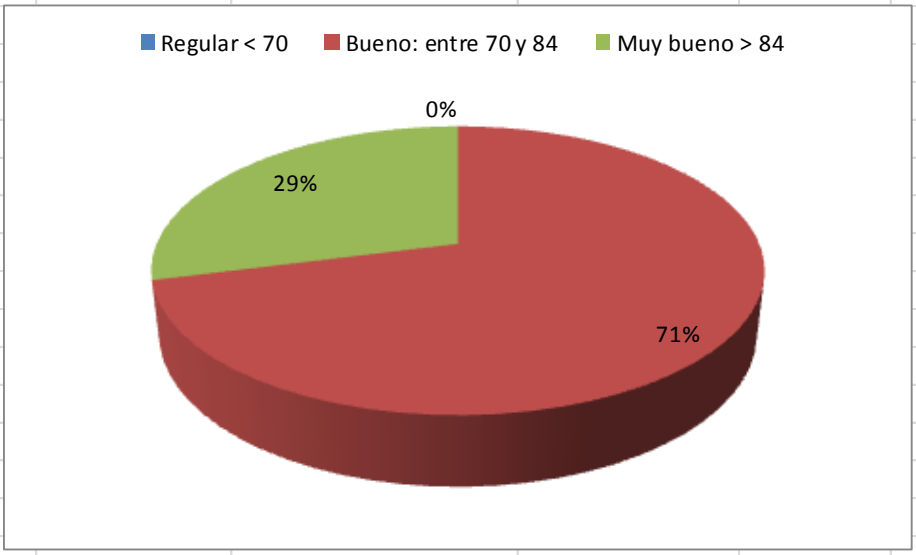


GROUP AVERAGE QUALIFICATION: 75.5

FINAL EVALUATION OF THE WORKSHOP

Note 2: 42 participants took the final evaluation.

Regular < 70	Bueno: entre 70 y 84	Muy bueno > 84
0%	71%	29%



GROUP AVERAGE QUALIFICATION: 89

- AT THE END OF THE WORKSHOP, ALL PARTICIPANTS WERE RATED AS GOOD OR VERY GOOD.
- NO PARTICIPANT OBTAINED A FINAL QUALIFICATION UNDER 72.
- THE GROUP AVERAGE INCREASED BY 13.5 POINTS (FROM 75.5 TO 89).

APPENDIX B

FIRST WORKSHOP ON
PBN AIRSPACE DESIGN
IN THE SAM REGION

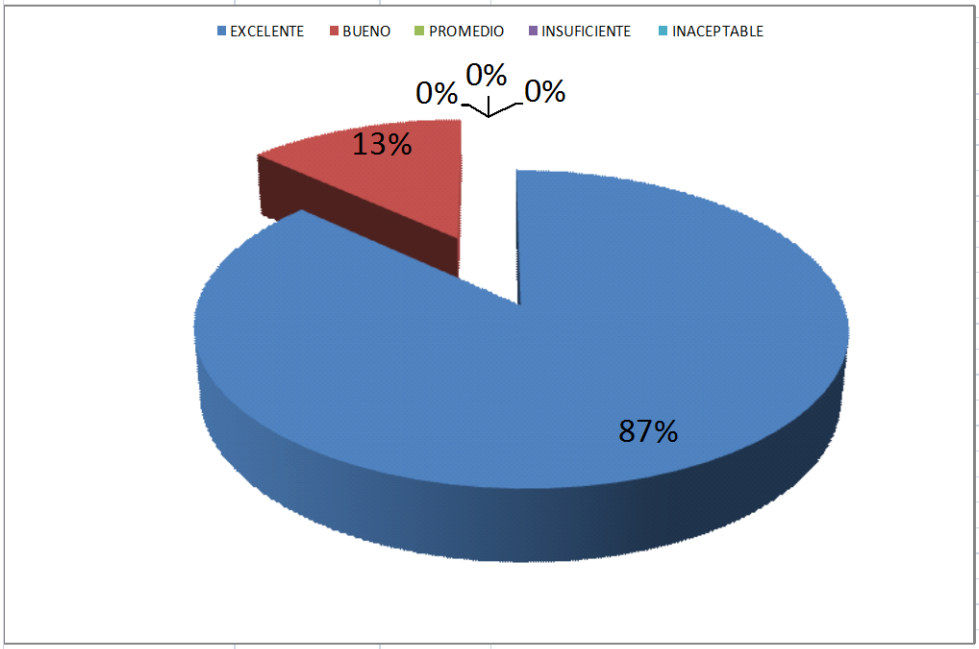
RESULT OF THE SURVEY

EVALUATION OF THE COURSE CONTENT

Clasificación: **5** = *Excelente* / **4** = *Bueno* / **3** = *Promedio* / **2** = *Insuficiente* / **1** = *Inaceptable*)

Evaluación del contenido del curso	
Los temas tratados son actuales.	5.00
¿Como califica el programa de capacitación del Taller PBN?	4.82
¿Cómo califica el material de capacitación?	4.84
Se refuerza la teoría impartida con ejercicios y prácticas.	4.84
Se vincula los temas con la realidad y/o su aplicación en casos reales.	4.87
¿Cómo califica el nivel de información?	4.87
¿El taller ha atendido sus expectativas?	4.84
¿La información suministrada es suficiente para llevar a cabo el plan de implantación PBN en su Estado o Empresa?	4.66
¿El material y la información suministrada en el taller permitirían que se dicte un curso/taller similar en su Estado o Empresa?	4.66
	4.82

EXCELENTE	33	87%
BUENO	5	13%
PROMEDIO	0	0%
INSUFICIENTE	0	0%
INACEPTABLE	0	0%
	38	**100%**

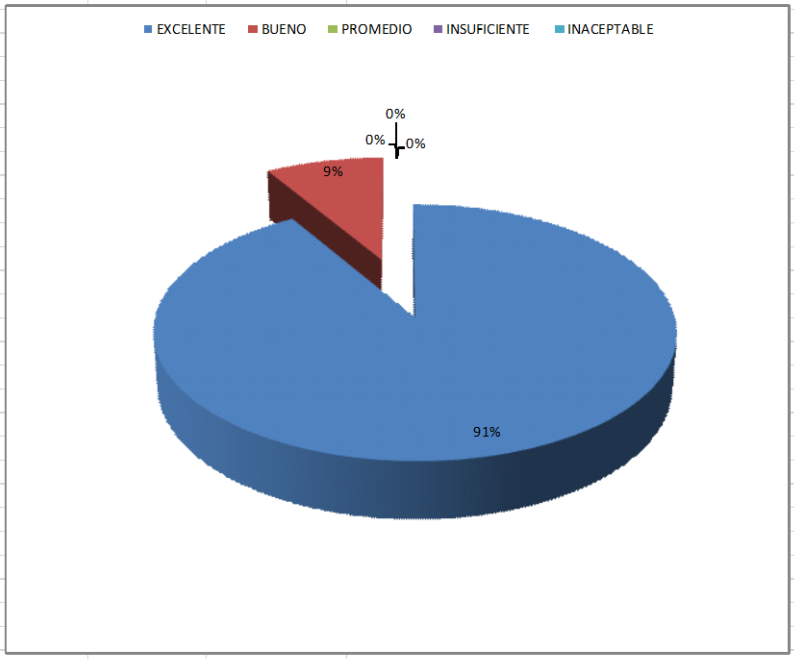


EVALUACION OF THE INSTRUCTORS

Clasificación: **5** = *Excelente* / **4** = *Bueno* / **3** = *Promedio* / **2** = *Insuficiente* / **1** = *Inaceptable*)

Evaluación de los instructores	
Facilitan la comprensión de los diferentes temas presentados	4.53
Estimulan la participación y el trabajo en equipo.	4.47
Motivan los participantes en los diferentes tópicos del curso.	4.55
Mantienen el orden y el control del horario establecido.	4.47
Hacen uso adecuado de las ayudas didácticas y de las instalaciones.	4.45
promedio	4.49

EXCELENTE	32	91%
BUENO	3	9%
PROMEDIO	0	0%
INSUFICIENTE	0	0%
INACEPTABLE	0	0%
	35	100%



What suggestions can be offered to improve the workshop?

- Always maintain performance in radar; the participation of Mariela Valdes is invaluable.
- Highlight and discuss certain very important. Sometimes people's interpretation may vary.
- The workshop was conducted flawlessly, exceeding my expectations. I have no suggestions.
- Overall, very good contents and organization on the part of the instructors. Just to improve, presentations could be optimized in some cases.
- Working groups should not be involved by many people, as participation could be distorted.
- I would like to have more working hours with Mariela Valdes, regarding design and calculation of gradients and climbs.
- I believe that all was very well.
- Fewer participants or divided into more groups. Practice focused in training of participants and not in the implementation of a State, in order to homogenize more the knowledge. Increased participation of instructors in practice.
- Divide the groups into more than two, in order to allow more people to participate.
- Try to work in smaller groups to facilitate the performance.
- In view of the quality of the event, if there has been something to improve, it would be very minimal.
- In order to improve work, I suggest that exercises are developed in Leticia TMA, with the data submitted by instructors. For larger groups do not become a subdivision.
- Two suggestions. During the practice, a fictional TMA is considered, so that everyone can get the same level of knowledge and all concepts are applied. To divide the groups into smaller parts. In our case, 4 groups would be good.
- As lived experience in C.A., would suggest ATC involvement from the beginning of the design until activity 14 – implementation.
- To consider training courses, as the level of participants is not the same. To consider other scenarios (airports), of other States, to receive support from specialists of the Region.
- To improve training in IFSET.
- Would suggest that groups were smaller. Two or three groups working on a same topic and then cross information.
- Through the experience gained on workshops and based on the observations made after each presentation, plus the contributions of each State, it could be considered to provide a more comprehensive guide on the process to follow as well as on the provision of deliverables. That is, a kind of list of activities.
- Due to noise, the auditorium was used only by one group to carry out the work. The rooms assigned to the other group did not allow proper display of projections and only a limited number of outlets were available.
- Maintain the same group of instructors. It is difficult to improve them.

Comments

- Control the logistics, so that all groups have equal physical conditions (facilities). Control internet services.
- Very good lecturers. Congratulations.
- I consider the level at which topic was discussed was excellent. Requires more disclosure and support from all involved areas in order to achieve implementation in shorter periods.
- The professional level of instructors is excellent. All expectations were met.
- Keep it up! Excellent job!
- In order to carry out the implementation plan, it would be convenient to receive training in Project management in each State.
- Excellent and very practical workshop, with high level lecturers, according to company's needs.
- To thank the dedication to us.
- The workshop exceeded my expectations.
- Excellent hosting State. Excellent instructors' academic level.
- Congratulations to all the team for their dedication and commitment.
- Excellent workshop and congratulations to the instructors for their dedication.
- High quality and experience in the instructors' team. Scenarios treated (Bogota and Asuncion), were ideal for its complexity and traffic density. Hopefully such seminars are repeated more often. Congratulations.
- Some design problems require internet. Connection should be improved.
- The workshop was a success. Updated in the global context. Enables to observe details that will be used in the PBN design in my State.
- All was excellent. Hope to continue taking into account the Central American Region.
- That SAM Office supports States which require training in procedure design.
- As far as possible, supply more information regarding RNAV and conventional flight treatment in a same scenario, specially referring to separation criteria that should be applied by air traffic controllers.

-END-

SECOND PBN WORKSHOP

Summary

The Second workshop on PBN airspace design was held in Lima, Peru, on 8-12 September 2014, under the auspices of the ICAO South American Office and with the support of Regional Project RLA/06/901 – "*Assistance for the implementation of a regional ATM system based on the ATM operational concept and the corresponding CNS technological support",* pursuant to ICAO Assembly Resolution A37-11 whereby the global implementation of performance-based navigation (PBN) was approved.

Pursuant to Conclusion SAM/IG/11-1 (*Support to SAM States for the redesign of their TMAs*), it was deemed advisable to plan Project RLA/06/901 activities for 2014 in order to define the needs and broaden the training of ATM experts in the SAM Region with a view to supporting and expediting the regional PBN implementation plan, thus increasing the knowledge of participants concerning the use of PBN.

The SAM/IG/12 meeting (Lima, Peru, 14-18 October 2013) agreed on the convenience of conducting the required training in three consecutive phases:

- The first phase consisted on distance training, in which participants had to learn about PBN basics through the ICAO website (http://www.icao.int/safety/pbn/SitePages/PBN%20ikit.aspx) and study the following PBN-related manuals: the PBN Manual (Doc 9613), Manual on the Use of Performance-Based Navigation (PBN) in Airspace Design (Doc 9992), Continuous Descent Operations Manual (Doc 9931), and Continuous Climb Operations Manual (Doc 9993).

- The second phase consisted in participation in the First workshop on PBN airspace design, for a period of two weeks, the purpose of which was to provide theoretical/practical training on PBN design of terminal areas, using 1 highly complex TMA and 1 less complex TMA for the practical exercise, for which the terminal areas of Bogota and Asuncion were selected, respectively.

- The third phase involved participation in the Second workshop on PBN airspace design, for a period of 1 week, where all the participants from the first workshop had to submit the preliminary basic design for 1 TMA selected for each State, and the proposed designs were to be harmonised and optimised during the workshop, applying the techniques learned at the first workshop, integrating the points of entry and exit of these TMAs with a view to developing version 3 of the SAM route network.

The second PBN workshop for the South American Region was attended by 34 experts from 11 States and 9 experts from the industry (IATA and Jeppesen), representing aeronautical authorities, air navigation service providers, and civil and military aircraft operators of the South American Region. In general, they were experts in areas such as air traffic control, airspace planning, instrument approach procedure design, airline pilots and operations technicians/engineers, aircraft dispatch, air navigation inspectors, and aeronautical mapping.

During the opening of the PBN workshop, Mr. Julio Pereira, ATM Officer of the ICAO South American Regional Office briefly explained the objectives of the workshop and acknowledged the effort made by aeronautical authorities of the SAM Region to send their experts to this important event, which falls within the framework of the regional strategy for attaining the goals of the Bogota Declaration.

The following aspects were noted during the presentation of the preliminary design and action plan by each SAM State.

Argentina

One of the main objectives of PBN implementation at the Baires TMA is to minimise interference between arrivals and departures at the main airports of the TMA: Aeroparque, Ezeiza, and San Fernando.

Taking into account the interface among the route networks of Argentina, Brazil, and Uruguay, the need was identified for closer coordination among these States during the PBN planning, design, validation, and implementation phases, including the conduction of specific trilateral meetings.

A more comprehensive data collection and analysis is required in order to develop a PBN airspace design that can move into the validation phase.

The PBN design of the Baires TMA that was presented at the workshop was constrained by the structure of the TMA and the existing routes, and had 9 points of entry and exit. Consequently, it was recommended to study the feasibility of dividing the Baires TMA project into two phases:

- Phase 1 - Current route structure, analysis of a new TMA and new entry and exit points;

- Phase 2 - Version 3 of the SAM route network.

Given the significant flow between SAEZ and SUMU, it was suggested that this segment be subject to a specific analysis, including the possibility of eliminating the ATS routes and replacing them with RNAV1/RNP 1 departure and arrival procedures that would permit a 7 NM lateral separation.

Bolivia

The main challenge of the Bolivian administration will be the implementation of a PBN airspace concept in a TMA lacking ATS surveillance.

A more comprehensive data collection and analysis is required in order to develop a PBN airspace design that can move into the validation phase.

The development of a PBN airspace design based on “four corners” has been recommended, seeking a conventional aircraft flow that is consistent with the PBN design.

It was suggested that the “user case” technique be used, which consists in developing several scenarios to verify the feasibility of adopting PBN and non-PBN air traffic routing and separation procedures, based on the existing conventional separation techniques, taking into account the usual air traffic flow of the Santa Cruz TMA.

Taking into account the goal of implementing APV procedures in all thresholds operating under IFR, it was recommended that this type of procedure be implemented as soon as possible in threshold 16 of the Santa Cruz Airport.

The Workshop suggested that the implementation of the PBN concept at the Santa Cruz TMA be done in 2 phases:

- Phase 1 - Without ATC surveillance;

- Phase 2 - With ATS surveillance, taking into account the existence of an ATS surveillance implementation project in Bolivia.

Brazil

The Brazilian delegation did not submit the preliminary design of the Southern PBN (PBN SUR) as scheduled, since efforts were focused on:

- Issues identified during monitoring following PBN implementation in Sao Paulo;

- The need for adjustments in the BH and BR TMAs.

The Southern PBN implementation dates (second semester of 2016 or first semester of 2017) will have a significant impact on PBN implementation in the Montevideo and Buenos Aires TMAs. Accordingly, the meeting recommended that PBN implementation in these TMAs be divided into 2 phases, before and after the implementation of Version 03 of the route network, taking into account that it may be affected by the deadlines set by Brazil. It is important to highlight that the dates established by the Brazilian administration might affect the attainment of the Bogota Declaration goals, due by the end of 2016.

Taking into account the interface amongst the route networks of Argentina, Brazil, and Uruguay, the need was identified for close coordination among these three States during the PBN planning, design, validation, and implementation phases, including the conduction of specific trilateral meetings.

The Brazilian delegation has submitted an airspace planning data collection and processing model (city pair flow - “temperature”), which should be used by the other States.

Chile

The PBN design of the Santiago TMA was considered to be consistent and ready for the validation process. The design was enabled by the implementation of the PAMPA Project, due on 18 September 2014. The validation process may be considered as started, since tests of the new proposed sectors have already been conducted.

The tentative implementation date of the PBN project at the Santiago TMA is September 2015.

The PBN design for RWY 17 was assigned priority in view of the absolute prevalence of operations in this threshold (98% of operations).

According to data collected on the navigation capacity of the fleet, a significant difference was found between the operators approved for using GNSS en-route and those approved for using GNSS in the TMA. Accordingly, it was recommended that an in-depth analysis be conducted on the subject, bearing in mind the importance of this sensor for PBN operations in the TMA.

An initiative of the Chilean administration has been to use FOQA data for the design and monitoring of PBN operations. It is recommended that, if proven feasible, this technique be used by the other States.

The following has been suggested for a second PBN implementation phase at the Santiago TMA:

- Assess the feasibility of conducting independent and/or segregated operations in SCEL, if necessary using RNP and ILS;

- Use of Version 03 of the SAM Route Network.

Colombia

The Workshop noted that no progress had been made in the preliminary PBN design of the Bogota TMA, based on the one developed during the first PBN workshop. The Colombian administration has decided to set the institutional foundation for the Bogota TMA PBN project, with the following documents: project guide, project letter, and AIC announcing PBN implementation. Other States could use these documents for their implementation projects.

It was felt that the project might have been oversized, since it included some activities directly related to PBN implementation, such as: Bogota Airport Master Plan, and Plan for the construction of other airports. This oversizing could have a negative impact on, and unnecessarily delay, PBN implementation in the Bogota TMA.

The representative of Colombia informed about the need for coordination between the Bogota TMA PBN implementation project and the project for the new ATC control and systems centre, taking into account that the two changes must be sufficiently spaced in time so as to avoid operational problems resulting from the proximity of the dates. In this sense, it was suggested that the Colombian administration continue with the various phases of the Bogota TMA PBN project, taking into account that only upon completion of all the foreseen stages will it be possible to define an actual implementation date and use it as a basis for coordinating dates with other projects.

The representative of Colombia also noted that a desirable requirement of the project should be the acquisition of software for the development of instrument procedures and the implementation of the new ATC simulator, both already contemplated by the Colombian administration.

During the presentation of the Bogota TMA PBN project, it was noted that a survey had been used to collect data on controller and aircraft operator requirements. Although this was considered to be a good initiative, it should be used with caution, given its natural limitations given the fact that such requirements are based on the current airspace structure and its corresponding operational flaws. The best strategy to meet the requirements of air traffic controllers and aircraft operators is to ensure their participation from the onset of the PBN implementation process, starting in the planning phase.

A more comprehensive data collection and analysis is required in order to develop a PBN airspace design that can move into the validation phase.

Ecuador

The Workshop took note that the Ecuadorian authority had made a significant investment in air navigation, including the following: ATC simulator, fight inspection aircraft, procedure design course, new navigation and surveillance equipment, etc.

A more comprehensive data collection and analysis is required in order to develop a PBN airspace design that can move into the validation phase.

The Workshop recommended that consideration be given to the feasibility of simplifying the PBN design of the new TMA, reducing the number of crossings between departure and arrival paths. It was also suggested that departures and arrivals in Sector E of the Guayaquil airport be assessed, taking into account the prohibited area of the Ecuadorian Air Force (SEP1).

The need was identified to expand the flexible use of airspace at the Guayaquil TMA and its surroundings, in view of the existence of a significant number of restricted and prohibited areas, their significant size and their interference with civil air traffic, making it extremely difficult to optimise aeronautical operations in the region.

It was also recommended that Class E be adapted to the current and the new Guayaquil TMA, taking into account that a VFR aircraft may fly in this airspace without ATC clearance and without establishing bilateral communication.

The tentative implementation date of the Guayaquil TMA PBN project is 26 May 2016.

Panama

The Workshop noted that operations in the Panama TMA were already based on RNAV. Accordingly, the implementation process -especially the validation phase- should be carried out in greater depth, taking into account the need for the proposed design to be safer and more efficient than the existing one.

A more comprehensive data collection and analysis is required in order to develop a PBN airspace design that can move into the validation phase.

The configuration of the Tocumen Airport (location of passenger terminals and movement between frequently used thresholds – RWY 03) favours segregated and independent operations. In a first phase, the recommendation is to assess segregated operations under IMC and independent approaches under VMC, applying RNP approaches.

It was also recommended that instrument procedure alternatives be sought in order to reduce the impact of obstacles and terrain on the take-off sector of RWY 03, possibly enabling segregated operations and/or independent approaches.

Taking into account the existence of a new DME in the Panama TMA, it has been recommended that a technical (coverage and geometry) and operational (fleet capacity and need for a backup RNAV system) assessment be made for DME/DME operations.

The tentative date of implementation of the Panama TMA PBN project is 17 Sep 2015.

Paraguay

Regarding the PBN design of the Asuncion TMA, it was noted that the “four corners” technique had been fully applied and that the arrival and departure paths of the Asuncion Airport had been improved, giving priority to the main flows. The meeting recommended that the airspace volume of the new proposed TMA be assessed based on departure and arrival paths. The PBN design of the Asuncion TMA was considered to be consistent and ready for validation. However, the need for more comprehensive data collection and analysis was considered with a view to confirming and consolidating the PBN design of the Asuncion TMA.

Taking into account that radar vectors would be used to guide non-PBN approved aircraft on paths similar to those used by PBN-approved aircraft, radar rating of air traffic controllers of the Asuncion ACCs and APPs was considered a critical requirement of the project and a determining factor for defining the tentative date of implementation: 23 June 2016.

It was recommended that the feasibility of implementing an RNP AR approach procedure be analysed in order to shorten arrivals, based on the characteristics of the Asuncion TMA (low air traffic volume and absence of obstacles and significant terrain). However, procedure designers of the Paraguayan administration need to be trained in RNP AR.

Likewise, based on the aforementioned characteristics of the Asuncion TMA, it was recommended that the implementation of a direct omnidirectional departure be considered for times when traffic volume is low.

Peru

The Workshop took note of the broad scope of phase 2 of the PROESA project, which covers 4 TMAs: Arequipa, Cuzco, Juliaca, and Puerto Maldonado.

A more comprehensive data collection and analysis is required in order to develop a PBN airspace design that can move into the validation phase.

Initially, it was thought that the project was oversized, since it included ATFM implementation and the Chinchero Airport. However, during the debate, it was explained that the cited projects were only mentioned as a reference.

It was noted that phase 2 of the PROESA project would use parallel routes between most of the TMAs involved. Accordingly, a more in-depth assessment was recommended, taking into account that unidirectional routes could result in a loss of operational efficiency under low air traffic volume conditions. Nevertheless, unidirectional routes can be efficient in such environments in cases of significant concentration of air traffic during certain hours of the day. In order to mitigate a possible loss of efficiency due to the use of unidirectional routes, the Peruvian representative stated that the shorter segments between TMAs would be subject to a specific analysis in order to assess the possible elimination of ATS routes and their replacement with RNAV1/RNP 1 departure and arrival procedures to enable a 7NM lateral separation.

The Workshop was informed on RNP AR operations being carried out at an angle of 2.8º in Cuzco, because of the high altitude and high temperatures during certain times of the year, whereas Doc 9905 standards and criteria not necessarily apply in very high aerodromes, resulting in an approach slope steeper than desired. In this regard, it was recommended that SAM States study the Peruvian experience with the use of approach angles other than those foreseen in Doc 9905, especially at aerodromes located at very high altitudes and/or with high temperatures.

RNP AR will be used for take-off operations in the PROESA 2 project. Although the effective date for the use of this type of procedure has been set to November 2016 in Doc 8168 (PANSOPS), the workshop saw no problem in it being used, provided safety was ensured and the civil aviation authority approved the criteria for the approval of aircraft and operators and the criteria for the development of instrument procedures.

It was recommended that the holding points proposed in the project by assessed, taking into account that they might be too close to the Cuzco Airport.

The tentative date of implementation of the PROESA PBN project is February 2015.

Uruguay

The preliminary design of the Montevideo TMA submitted during the workshop sought to cover, during the first phase, 60% of the air traffic that makes use of the TMA.

As in the case of Argentina and Brazil, and taking into account the interface amongst the route networks of Argentina, Brazil, and Uruguay, the need was identified for close coordination amongst these States during the PBN planning, design, validation, and implementation phases, including the conduction of specific trilateral meetings.

A more comprehensive data collection and analysis is required in order to develop a PBN airspace design that can move into the validation phase.

It was recommended that, in a second phase, the Uruguayan administration take into account the following aspects:

- The remaining 40% of air traffic;
- Version 03 of the route network;
- Use of RNP AR in order to shorten arrivals.

As in the case of the Baires TMA, and taking into account the significant flow between SAEZ and SUMU, which, in the case of the Montevideo TMA accounts for 50% of air traffic volume, it was suggested that a specific analysis be made of this segment, including the possibility of eliminating ATS routes and replacing them with RNAV1/RNP 1 departure and arrival procedures to enable the use of a 7 NM lateral separation.

Venezuela

The Workshop recommended that an assessment be made of reducing the number of entry and exit points at the Maiquetia TMA, taking into account that the proposed design contained 9 entry and exit points.

Another important aspect is the low percentage of PBN-approved aircraft and operators, which could affect the project. In this regard, the recommendation was to conduct a more in-depth assessment of the PBN approval potential of the fleet, with a view to urging operators to move forward in the PBN approval process.

It was also recommended that an assessment be made of the allocation of class B to the TMA, taking into account that aircraft separation of VFR flights was a complex activity for air traffic controllers and was normally applied only in airspaces with high air traffic density.

The workshop recommended that, in a second implementation phase, an assessment be made of the need and feasibility of conducting segregated operations for approach in RWY 10 and for take-off in RWY 09.

Data collection and processing model (add city pairs)

The presentation by the Venezuelan delegation showed the existence of DME arc-based arrival and approach procedures that were significantly inefficient. The Workshop took note that, in practice, the procedures were not being applied, precisely because of their inefficiency. Accordingly, it recommended that an assessment be made of the modification or cancellation of the procedures not being used.

The preliminary PBN design of the Maiquetia TMA was based on a comprehensive process of data collection and processing, in which only flows between city pairs and air traffic volume graphs were missing, much the same as the one presented by the delegation of Brazil.

Next activities of the SAM TMA PBN project

The next activity of the SAM TMA PBN project will be the third PBN workshop, the main purpose of which is to validate the PBN designs for the TMAs and/or airspaces selected by SAM States.

It is important to highlight that, to date, only two TMAs have been considered sufficiently mature to start the validation process: Asunción and Santiago. The other States are in different stages of the planning and design process, at different levels of maturity, and each administration will have to make a greater or lesser effort in order to be ready to demonstrate, at the third PBN workshop, that the proposed design is suitable, especially from the safety and efficiency point of view.

It is also important to highlight that the implementation of Version 3 of the route network depends on consistent and harmonised implementation in SAM TMAs and that any delay in one or more States could affect the other States and the Regional Project as a whole.

Accordingly, SAM States shall carry out the following activities in preparation for the third PBN workshop:

a) Develop an action plan for the implementation of the PBN airspace concept in the selected airspace, as an input for the SAM PBN project.

b) Complete data collection and processing, with a view to giving consistency to the PBN design of the TMA and/or airspace selected by the State.

c) Develop, as necessary, a new PBN airspace concept, based on the collected and processed data, and on the recommendations of the second PBN workshop.

d) Complete the validation stage of the preliminary design, taking into account the following minimum requirements:

- work on the white board;
- IFSET;
- ground validation of IFR procedures and VFR corridors;
- independent review of IFR procedures, charts, and coding tables;
- SMS.

e) Review the airspace concept as needed, based on validation results, until a satisfactory PBN design is obtained for implementation, which shall be submitted at the third PBN workshop.

f) Send the PBN design of the selected TMA and/or airspace to the SAM Regional Office before 20 February 2015.

g) Participate in teleconferences in preparation for the third PBN workshop, to be carried out on the following tentative dates:

- 02 October
- 23 October
- 19 November

- 18 December
- 05 February
- 25 February

Assessment of the Workshop

A survey was conducted to measure participant satisfaction with the workshop. Survey details are contained in **Appendix A**. In summary, the results showed that 89% of participants rated the workshop as excellent, while 11% rated it as good.

APPENDIX A

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

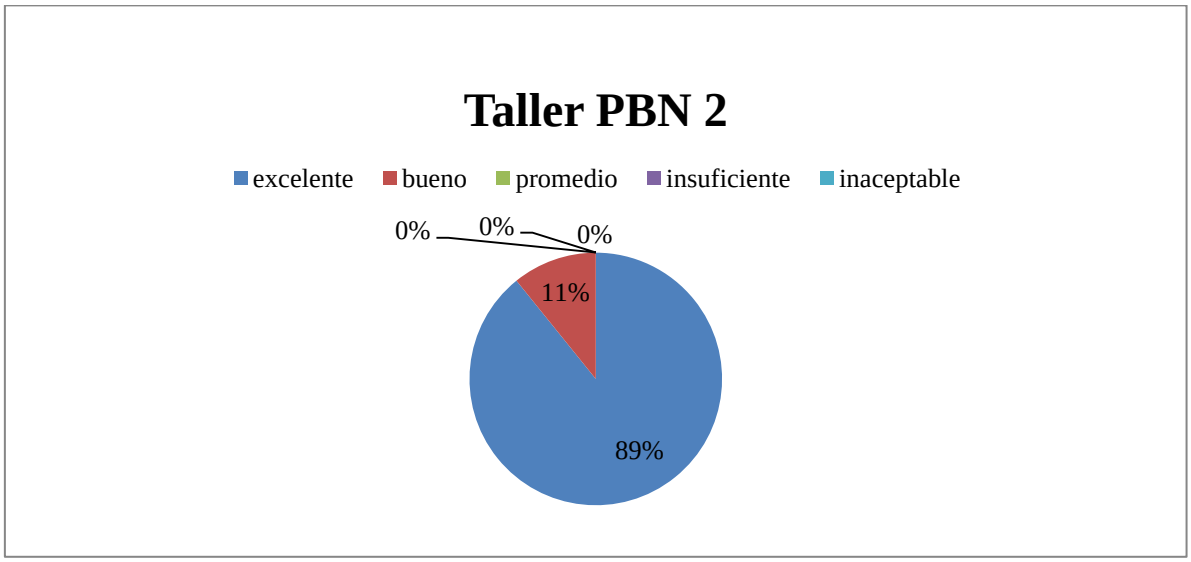
(Lima, Peru, 08 to 12 September 2014)

SURVEY RESULTS

ASSESSMENT OF COURSE CONTENTS

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

	Average
Were the topics relevant?	4.89
How do you rate the PBN workshop training programme?	4.76
How do you rate the training material?	4.43
Is theory reinforced with practical exercises?	4.70
Are topics correlated with reality and/or with their application in real cases?	4.95
How do you rate the level of information?	4.89
Did the workshop meet your expectations?	4.76
Was the information provided sufficient to develop the PBN implementation plan in your State or company?	4.65
Would the material and information provided in the workshop permit the conduction of a similar course/workshop in your State or company?	4.54
Overall average	4,73



Can you offer any suggestions to improve the workshop?

- ICAO should urge States to send the group of designers to all events related to this great PBN project, since many times they only send one or two and exclude other procedure designers who are doing the work.
- These workshops should continue, since each country has a different reality and this allows participants to gain much experience and to avoid possible incidents or accidents.
- Take maximum advantage of the website to disseminate these topics.
- Do it more often.
- Conduct frequent meetings of procedure design personnel to exchange design criteria in view of altitude differences amongst the various States.
- Better preparation; delivery of preliminary papers prior to the next workshop; and convene the next workshop sufficiently in advance to ensure participation.
- More active participation of operators. Commitment to remove obstacles. Try to guide actions towards RNP-AR procedures.
- ICAO to coordinate the tripartite Brazil-Argentina-Uruguay meeting.
- Coordinate trilateral meetings amongst Uruguay, Brazil, and Argentina. The ICAO Regional Office could convene these meetings.
- It is difficult to improve upon the workshop; it is already very good. Send ICAO Circular 324 to the participants.
- Less discussions on unrelated topics.
- Periodic refresher and update courses on Doc 8168.
- Include a post-monitoring plan in the PBN project.
- I would like more practice in design. In addition to presenting the work done, the workshop would benefit from some supplementary activity.
- I suggest that interpretation be provided for presentations made in a language other than Spanish. I thought the Brazilian presentation was very interesting but, unfortunately, I could not fully understand it.
- Sometimes, discussions extend beyond schedule and some issues are left pending, especially with the rest of the participants. The topics of the agenda are fully and properly covered during the course, but it would also be useful to discuss the experiences of other members and have more time for such discussions.
- Through the Regional Office, as an activity under Project RLA/06/901, a meeting of procedure designers working in the TMA project of each country should be scheduled before or after the workshop to harmonise concepts, especially between adjacent States.

Comments

- The PBN work team should be consolidated with the support of State authorities.
- Excellent seminar aimed at improving the route network in the States, not only to benefit passengers, who arrive faster to their destination, but also the environment, since CO_2 emissions will be reduced. Airlines will also save on fuel.
- Just my acknowledgment for the workshop.
- The States should designate the same delegates to participate in the meetings, since constant changes are detrimental to the attainment of goals.
- It helped me clarify many doubts and my colleagues helped me understand many of the concepts to be applied.
- Excellent group convened by ICAO. Great organisation and coordination of the subject matter. Congratulations: it is not easy to make progress on a topic as complex as TMA-PBN.
- Congratulations to all the States that are making the sacrifice of improving their airspace, and to ICAO and IATA.
- Excellent workshop.
- Congratulations.
- Promote meetings of procedure design experts once or twice a year.
- Very grateful for allowing me to participate as an observer; it allowed me to expand my horizons and analyse the possibility of specialising in other fields.
- A meeting of procedure designers (PANSOPS) should be organised once or twice a year to exchange experiences within the context of the SAM Region.

12 September 2014

-END-

	DATA COLLECTION DATE: 10 OCTOBER 2014								
STATE	INTERNATIONAL AIRPORTS ANP CAR/SAM	Threshold IFR	Threshold VFR	IAP APV	IAP LNAV	IAP RNPAR	SID PBN	STAR PBN	OBS
ARGENTINA	**ARGENTINA (16 AEROPUERTOS)**			0	0	0	0	0	
	SABE BUENOS AIRES/Aeroparque Jorge Newbery								
	SAEZ BUENOS AIRES/Ezeiza Ministro Pistarini								
	SADF BUENOS AIRES/San Fernando								
	SARI CATARATAS DEL IGUAZÚ/My. D. Carlos Eduardo Krause								
	SAVC COMODORO RIVADAVIA/General Mosconi								
	SACO CORDOBA/Ing. Aer. A.L. Taravella								
	SASJ JUJUY/Gobernador Guzmán								
	SAZM MAR DEL PLATA/Bgdier. Gral. B. de la Colina								
	SAME MENDOZA/El Plumerillo								
	SAZN NEUQUEN/Presidente Perón								
	SARE RESISTENCIA/Resistencia								
	SAWG RIO GALLEGOS/Piloto Civil N. Fernández								
	SAAR ROSARIO/Rosario								
	SASA SALTA/Salta								
	SAZS SAN CARLOS DE BARILOCHE/San Carlos de Bariloche								
	SAWH USHUAIA/Malvinas Argentinas								
BOLIVIA	**BOLIVIA (4 AEROPUERTOS)**			0	0	0	0	0	
	SLCB COCHABAMBA/Jorge Wilsterman								
	SLLP LA PAZ/El Alto								
	SLVR SANTA CRUZ/Viru Viru								
	SLTJ TARIJA/Oriel Lea Plaza								
	BRAZIL (27 AEROPUERTOS)			0	0	0	0	0	
	SBBE BELÉM/Val-de-Cáes Intl	6		SI	SI	NO	NO	NO	Possui SID RNAV
		24		SI	SI	NO	NO	NO	Possui SID RNAV
		2		NO	SI	NO	NO	NO	Possui SID RNAV
		20		SI	SI	NO	NO	NO	Possui SID RNAV
	SBCF BELO HORIZONTE/Tancredo Neves Intl	16		SI	SI	NO	SI	NO	Possui SID RNAV
		34		SI	SI	NO	SI	NO	Possui SID RNAV
	SBBV BOA VISTA//Boa Vista Intl	8		SI	SI	NO	NO	NO	Possui SID RNAV
		26		SI	SI	NO	NO	NO	Possui SID RNAV
	SBBR BRASÍLIA/Brasília Intl	11L		SI	SI	NO	SI	SI	
		29R		SI	SI	NO	SI	SI	
		11R		SI	SI	NO	SI	SI	
		29L		SI	SI	NO	SI	SI	
	SBKP CAMPINAS/Viracopos Intl	15		SI	SI	SI	SI	SI	
		33		SI	SI	NO	SI	SI	
	SBCG CAMPO GRANDE/Campo Grande Intl	6		SI	SI	NO	SI	SI	
		24		SI	SI	NO	SI	SI	
	SBCR CORUMBÁ/Corumbá Intl	9		NO	NO	NO	NO	NO	Não possui procedimento aproximação devido fronteira.
		27		SI	SI	NO	NO	NO	Possui SID RNAV
	SBCZ CRUZEIRO DO SUL/Cruzeiro do Sul Intl	10		SI	SI	NO	NO	NO	Possui SID RNAV
		28		SI	SI	NO	NO	NO	Possui SID RNAV
	SBCY CUIABÁ/Marechal Rondon Intl	17		SI	SI	NO	NO	NO	Possui SID RNAV
		35		SI	SI	NO	NO	NO	Possui SID RNAV
	SBCT CURITIBA/Afonso Pena Intl	11		SI	SI	NO	SI	NO	
		29		SI	SI	NO	SI	NO	
		15		SI	SI	NO	SI	SI	
		33		SI	SI	NO	SI	SI	
	SBFL FLORIANÓPOLIS/Hercílio Luz Intl		3						
			21						
		14		SI	SI	NO	SI	SI	
		32		SI	SI	NO	SI	SI	
	SBFZ FORTALEZA/Pinto Martins Intl	13		SI	SI	NO	NO	NO	Possui SID RNAV
		31		SI	SI	NO	NO	NO	Possui SID RNAV
	SBFI FOZ DO IGUACU/Cataratas Intl	14		SI	SI	NO	SI	NO	Possui STAR RNAV

	SANTOS DUMONT/Santos Dumont Intl	32		NO	SI	NO	SI	NO	Possui STAR RNAV
	SBMO MACEIO/Zumbi dos Palmares	12		NO	SI	NO	NO	NO	Possui SID RNAV
		30		NO	SI	NO	NO	NO	Possui SID RNAV
BRAZIL	SBMQ MACAPÁ/Macapá Intl	8		SI	SI	NO	NO	NO	Possui SID RNAV
		26		SI	SI	NO	NO	NO	Possui SID RNAV
	SBEG MANAUS/Eduardo Gomes Intl	10		NO	SI	NO	NO	NO	
		28		SI	SI	NO	NO	NO	
	SBNT NATAL/Augusto Severo Intl	12		SI	SI	NO	NO	NO	
		30		SI	SI	NO	NO	NO	
		16L		SI	SI	NO	NO	NO	Possui SID RNAV
		34R		SI	SI	NO	NO	NO	Possui SID RNAV
		16R		SI	SI	NO	NO	NO	
		34L		SI	SI	NO	NO	NO	
	SBPP PONTA PORÃ/Ponta Porã Intl	4		NO	NO	NO	NO	NO	
		22		NO	NO	NO	NO	NO	
	SBPA PORTO ALEGRE/Salgado Filho Intl	11		SI	SI	NO	NO	SI	Possui SID RNAV
		29		SI	SI	NO	NO	SI	Possui SID RNAV
	SBRF RECIFE/Guararapes Intl	18		SI	SI	NO	SI	SI	
		36		SI	SI	NO	SI	SI	
	SBGL RIO DE JANEIRO/Galeão, Antonio Carlos Jobim Intl	10		SI	SI	NO	SI	SI	
		28		SI	SI	NO	SI	SI	
		15		SI	SI	SI	SI	SI	
		33		SI	SI	NO	SI	SI	
	SBSV SALVADOR/Deputado Luis Eduardo Magalhães Intl	10		SI	SI	NO	NO	NO	Possui SID/STAR RNAV
		28		SI	SI	NO	NO	NO	Possui SID/STAR RNAV
			17						
			35						
	SBSN SANTARÉM/Santarém Intl	10		SI	SI	NO	NO	NO	Possui SID RNAV
		28		SI	SI	NO	NO	NO	Possui SID RNAV
	SBSL SÃO LUIS/Marechal Cunha Machado Intl		9						
			27						
		6		SI	SI	NO	NO	NO	Possui SID RNAV
		24		SI	SI	NO	NO	NO	Possui SID RNAV
	SBGR SÃO PAULO/Guarulhos Intl	09L		SI	SI	NO	SI	SI	
		27R		SI	SI	NO	SI	SI	
		09R		SI	SI	SI	SI	SI	
		27L		SI	SI	NO	SI	SI	
	SBTT TABATINGA/Tabatinga Intl	12		NO	NO	NO	NO	NO	
		30		NO	NO	NO	NO	NO	
	SBUG URUGUAIANA/Rubem Berta Intl	9		NO	NO	NO	NO	NO	Não possui procedimento aproximação devido fronteira.
		27		NO	NO	NO	NO	NO	
	CHILE (8 AEROPUERTOS)			**0**	**0**	**0**	0	0	
	SCFA ANTOFAGASTA/Cerro Moreno	01			SI	SI	SI	SI	
		19			SI	SI	SI	SI	
	SCAR ARICA/Chacalluta	02			SI	NO	NO	SI	NO por Limite Politico Internacional
		20			NO	NO	SI	NO	
	SCIE CONCEPCIÓN/Carriel Sur	02		SI	SI	SI	SI	SI	
		20		SI	SI	NO	SI	SI	
	SCIP ISLA DE PASCUA/AP Mataveri	10		NO	SI	NO	NO	NO	
		28		NO	NO	NO	NO	NO	
	SCDA IQUIQUE/Gral. Diego Aracena	01			NO	NO	NO	NO	Por Topografía
		19			SI	SI	SI	SI	
CHILE	SCTE PUERTO MONTT/El Tepual	17		SI	SI		SI	SI	
		35		SI	SI		SI	SI	
	SCCI PUNTA ARENAS/Pdte. C. Ibañez del Campo	01							
		07		SI	SI			SI	
		12		SI	SI			SI	
		19							
		25		SI	SI		NO*	SI	
		30		SI	SI		NO*	SI	
	SCEL SANTIAGO/Arturo Merino Benítez	17R		SI	SI	SI	SI	SI	
		35L		SI	SI		SI	SI	
		17L		SI	SI	SI	SI	SI	
		35R		SI	SI		SI	SI	
	COLOMBIA (11 AEROPUERTOS)			0	0	0	0	0	
	SKBQ BARRANQUILLA/Ernesto Cortissoz								
	SKBO BOGOTÁ/Eldorado/Distrito Capital								
	SKBG BUCARAMANGA/Palonegro								
	SKCL CALI/Alfonso Bonilla Aragón								
	SKCG CARTAGENA/Rafael Nuñez								
COLOMBIA	SKCC CUCUTA/Camilo Daza								
	SKLT LETICIA/Alfredo Vásquez Cobo								

	SKPE PEREIRA/Matecaña								
	SKRG RIONEGRO/José María Córdoba								
	SKSP SAN ANDRES I./Sesquicentenario								
	SKSM SANTA MARTA/Simon Bolivar								
ECUADOR	**ECUADOR (4 AEROPUERTOS)**			0	0	0	0	0	
	SEGU GUAYAQUIL/Jose Joaquin de Olmedo	21	21	NO	NO	NO	NO		
		3	3	NO	NO	NO	NO		
	SELT LATACUNGA/Cotopaxi	19	19	NO	NO	NO	NO		
		1	1	NO	NO	NO	NO		
	SEMT MANTA/Eloy Alfaro	24	24	NO	NO	NO	NO		
		6	6	NO	NO	NO	NO		
	SEQU QUITO/Mariscal Sucre	36	36	NO	SI	SI	SI	SI	
		18	18	NO	SI	SI	SI	SI	
FRENCH GUIANA	**FRENCH GUIANA (1 AEROPUERTOS)** (France)			0	0	0	0	0	
	SOCA CAYENNE/Rochambeau								
GUYANA	**GUYANA (2 AEROPUERTOS)**								
	SYGO GEORGETOWN/Ogle International Airport								
	SYCJ GEORGETOWN/Cheddi Jagan Int´l Airport								
PANAMA	**PANAMA (6 AEROPUERTOS)**			0	0	0	0	0	
	MPBO BOCAS DEL TORO/Bocas Del Toro	08		NO	NO	NO	NO	NO	
		26		NO	NO	NO	NO	NO	
	MPCH CHANGUINOLA/Cap. Manuel Niño	04		NO	SI	NO	NO	NO	
		22		NO	NO	NO	NO	NO	
	MPDA DAVID/Enrique Malek		18	NO	NO	NO	NO	NO	
			36	NO	SI	NO	NO	NO	
	MPMG PANAMÁ/Marcos A. Gelabert	03R		NO	SI	SI	SI	SI	
		03L		SI	SI	SI	SI	SI	
	MPPA PANAMÁ/Pacífico	18		NO	NO	SI	NO	NO	
		36		SI	SI	SI	NO	NO	
	MPTO PANAMÁ/Tocumén Intl	21R		NO	SI	SI	NO	SI	
		21L		NO	NO	SI*	NO	NO	*TAILORED PROCEDURE
PARAGUAY	**PARAGUAY (2 AEROPUERTOS)**			0	0	0	0	0	
	SGAS LUQUE/Silvio Pettirossi	2		SI	SI	NO	SI	NO	
		20		SI	SI	NO	SI	NO	
	SGES MINGA GUAZÚ/Guaraní	5		SI	SI	NO	NO	NO	
		23		SI	SI	NO	NO	NO	
PERU	**PERU (8 AEROPUERTOS)**			0	0	0	0	0	
	SPQU AREQUIPA/Rodríguez Ballón Intl	10		NO	NO	NO	NO	SI	RWY 10 SOLO PARA ATERRIZAJES.
			28	NO	NO	NO	NO	NO	ATERRIZAJES SOLO VFR
		28		NO	NO	NO	SI*	NO	* TAILORED LAN PERÚ
	SPHI CHICLAYO/Cap. José Quinoñes Gonzalez	01		NO	SI	NO	NO	SI	
		19		NO	SI	SI	NO	SI	
	SPZO CUZCO/Velazco Astete		10	NO	NO	NO	NO	NO	RWY 10 SOLO PARA DESPEGUES. AERONAVES DESPEGAN EN VFR HASTA KIMOR. POSTERIOR IFR.
		10		NO	NO	NO	SI*	NO	* TAILORED LAN PERÚ
			28	NO	NO	NO	NO	SI	RWY 28 SOLO PARA ATERRIZAJES . AERONAVES LLEGAN EN IFR VIA STAR. FAP LOS CONDUCE A TRAMO FAVOR VIENTO Y ATERRIZAN VFR.
		28			NO	SI*	NO	SI*	* TAILORED LAN PERÚ
	SPQT IQUITOS/Crnel. FAP Francisco Secada Vignetta	06		NO	NO	SI*	NO	SI*	* TAILORED LAN PERÚ
		24		NO	NO	NO	NO	NO	
	SPIM LIMA-CALLAO/Jorge Chávez Intl	15		NO	NO	NO	SI	SI	
		33		NO	NO	NO	SI	NO	
	SPSO PISCO/Pisco		04	NO	NO	NO	NO	NO	
		22		NO	NO	NO	NO	NO	
	SPTN TACNA/Crnel. FAP Carlos Ciriani Santa Rosa	02		NO	NO	SI*	NO	SI*	RWY 02 SOLO PARA ATERIZAJES* TAILORED LAN PERÚ
			20	NO	NO	NO	NO	NO	
	SPRU TRUJILLO/Capitan Carlos Martínez de Pinillos	02		NO	NO	NO	NO	SI	RWY 02 SOLO PARA ATERRIZAJES
		20		NO	NO	SI	NO	NO	
SURINAME	**SURINAME (2 AEROPUERTOS)**			0	0	0	0	0	
	SMZO PARAMARIBO/Zorg en Hoop								
	SMJP ZANDERY/Johan Adolf Pengel Intl								
URUGUAY	**URUGUAY (2 AEROPUERTOS)**			0	0	0	0	0	
	SULS MALDONADO/Int. C/C, Carlos A. Curbelo Laguna del Sauce								
	SUMU MONTEVIDEO/Carrasco Intl Gral. Cesáreo L. Berisso								
	VENEZUELA (7 AEROPUERTOS)			0	0	0	0	0	
	SVBC BARCELONA/Gral. José Antonio Anzóategui Intl	15		SI	SI	NO	SI	NO	
		33		NO	NO	NO	SI	NO	
	SVMI CARACAS/Simón Bolívar Intl, Maiquetía	10		SI	SI	NO	SI	NO	
		28		SI	SI	NO	SI	NO	
	SVMC MARACAIBO/La Chinita Intl	3L		SI	SI	NO	SI	NO	
		21R		SI	SI	NO	SI	NO	

VENEZUELA	SVMG MARGARITA/Intl Del Caribe Gral. Santiago Marino	9		SI	SI	NO	SI	NO	
		27		SI	SI	NO	SI	NO	
	SVJC PARAGUANA/Josefa Camejo Intl	9		SI	SI	NO	SI	NO	
		27		SI	SI	NO	SI	NO	
	SVSA SAN ANTONIO DEL TÁCHIRA/San Antonio del Táchira Intl	17		SI	SI	NO	NO	NO	
		35		NO	NO	NO	SI	NO	
	SVVA VALENCIA/Zim Valencia Intl	10		SI	SI	NO	SI	NO	
		28		SI	SI	NO	SI	NO	
Totales	Totales			0	0	0	0	0	

APPENDIX F

ICAO NAM/CAR SAM PERFORMANCE-BASED NAVIGATION (PBN) APPROACH PROCEDURE DESIGN WORKSHOP

(Mexico City, Mexico, 17 to 28 November 2014)

TITLE

ICAO NAM/CAR SAM PERFORMANCE-BASED NAVIGATION (PBN) APPROACH PROCEDURE DESIGN WORKSHOP FOR RNAV 1/ RNP 1, RNP APCH AND BARO-VNAV SPECIFICATIONS

WORKSHOP DURATION

10 class days (two weeks)

NUMBER OF PARTICIPANTS:

A maximum of 20 trainees

WHEN AND WHERE

ICAO NACC Regional Office, Mexico City, Mexico, 17-28 November 2014. English - Spanish interpretation will be provided. Access to required ICAO Documents (9613, 8168, 4444, 9906, 9905) in electronic format on the ICAO website through controlled access by State/Territory designated Focal Points.

INSTRUCTORS

Armando Hernandez Napoles and Ruddy Abdel Romo Seguí are PANS OPS instructors from Instituto de Aeronáutica Civil de Cuba (IACC) and are both involved in the PBN Instrument Approach Procedure implementation project in Cuba.

OBJECTIVES

The purpose of the workshop is to apply procedure design criteria to development of approach procedures for a select set of the navigation specifications as established in ICAO Doc 9613, *Performance-based Navigation (PBN) Manual*, and related Standards and Recommended Practices (SARPs). The general concept will include procedure design criteria associated with specific navigation subjects such as Area Navigation (RNAV 1), Required Navigation Performance (RNP 1), Required Navigation Performance Approach (RNP APCH) and Barometric Vertical Navigation (Baro-VNAV) applications.

Main Objective 1:

Performance conditions	Maps and other documents containing validated data will be provided
Expected result	The trainee will design a RNP 1 or RNAV 1 SID procedure based on Global Navigation Satellite System (GNSS) sensor use
Criteria	In accordance with Doc 8168, *PANS OPS/611*

Main Objective 2:

Performance conditions	Maps and other documents containing validated data will be provided
Expected result	The trainee will design a STAR RNP 1 or RNAV 1 procedure based on GNSS sensor use
Criteria	In accordance with Doc 8168, *PANS OPS/611*

Main Objective 3:

Performance conditions	Maps and other documents containing validated data will be provided
Expected result	The trainee will design a Non-precision Approach (NPA) procedure (Lateral Navigation (LNAV)), based on RNP APCH operations
Criteria	In accordance with Doc 8168, *PANS OPS/611*

Main Objective 4:

Performance conditions	Maps, data and all related documentation with a complete design procedure will be provided
Expected result	The trainee will design and document a RNAV-1 SID and STAR RNP 1, an NPA RNP(LNAV), and an RNP APV Baro VNAV (LNAV/VNAV) approach procedure for validation, publication and traceability
Criteria	Accurately, in a reasonable time, and in accordance with Doc 8168, PANS OPS/611, Annex 4, Annex 15, *Quality Assurance Manual for Flight Procedure Design* (Doc 9906) and *Performance-based Navigation (PBN) Manual* (Doc 9613)

PARTICIPANTS

Prerequisites:
Students should have fundamental knowledge of PBN airspace design or approach procedure design such as:

- Non-RNAV SID, STAR and NPA procedures as well as Instrument Landing System (ILS) procedures (Reference Doc 8168 *PANS-OPS* /611, Volume II, Part I and Part II):
  - Performance Based Navigation (PBN) as in:
    - completion of the ICAO Web-based PBN training (http://icao.int/pbn); or
    - attendance at an ICAO PBN Airspace Design Seminar.
  - Air Traffic Management (ATM) as in ICAO Doc 4444 (PANS-ATM).
  - Navigation systems, aircraft performance and geography
    e.g., knowledge at a level obtained with any Instrument Rated (IR) pilot's license or 5 years of experience in air traffic control services.
  - Annex 15 (Aeronautical Information Services/AIS).
  - Aerodrome - Students must be familiar with Annex 14, obstacle limitation surfaces and aerodrome reference codes requirements.
  - Geodesy (WGS-84).
  - Charting.
  - Annex 4 with regard to SID, STAR and approach charts.

This training workshop does not use a specific procedure design software and therefore trainees will design procedures manually. For that reason, students should bring a ruler, protractor, compass, and calculator with scientific functions, as well as their own updated regulatory documents, e.g., Doc 8168, PANS-OPS/611.

ASSESSMENT

Sample of prerequisite exercises will be performed in advance

An initial assessment will be conducted before the workshop through a sample of elementary exercises that will be checked by the instructors prior to the workshop. Those exercises will be sent to the attendees a month and a half before the workshop, to be returned 10 days prior to the workshop for evaluation.
Progress tests will be conducted during the workshop.
Eventually, the presentation of the project will enable assessment of the capacity of the trainee to meet the main objectives through application of the criteria to procedure designs and, as a secondary objective, demonstration of trainee capacity to summarize, write a technical report and present a procedure design study.

TOPICS COVERED

Performance-Based Navigation (PBN) Manual (Doc 9613) Airspace Concept:

- General overview.
- Description of navigation specifications.
- Avionics, aircraft equipment and airworthiness regulations.
- Which application for which airspace?
- Performance – notions of accuracy, precision, continuity, availability.

GNSS:

- Aircraft-Based Augmentation System (ABAS).
- Satellite-Based Augmentation System (SBAS) in a PBN context.
- Ground-Based Augmentation System (GBAS) in a PBN context.

Quality Assurance Manual for Flight Procedure Design (Doc 9906):

- Document and store procedure for traceability.
- Data origin.
- Procedure design process.

Procedure design criteria (PANS-OPS, Volume II, Part III, Sections 1, 2):

- Underlying criteria.
- General criteria such as:
    - Minimum length of segments.
    - Turn protection.
    - T or Y concept.
    - Terminal Arrival Altitude (TAA).

Procedure construction (PANS-OPS, Volume II, Part III, Section 3 and Doc 9905):

- Departure criteria applicable for Basic-RNP 1 and RNAV 1/2.
- Standard arrival for RNP 1 and RNAV 1/2.
- Approach procedures for RNP AR and RNP APCH operations.
- APV baro VNAV procedures.

Document management for validation and publication (PANS-OPS, Volume II, Part III, Section 5)

- Charting and coding.

MEANS

- Theoretical lectures: Presentation and explanation of the rules and principles described in ICAO SARPs
- Laboratory exercises.

Lectures are followed by practical exercises, scheduled on a daily basis, that illustrate the elementary application of criteria in a simplified environment in order to reinforce theoretical input.

- Comprehensive On-the-Job Training (OJT) Project:

Part of the second week will be focused on OJT final project in teams up to four to design an RNAV 1 SID and STAR, an NPA RNP APCH and an RNP APV Baro-VNAV approach procedure based on simulated conditions of an actual airport environment. The design is conducted step by step under assistance and tutorials from instructors. The project also includes the design of draft SID and STAR charts and instrument approach charts, a technical report and coding instructions.

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APPENDIX G

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

1. TERMS OF REFERENCE

~~Develop guidance material for~~ Coordinate ~~RNAV/RNP~~ SAM PBN I~~i~~mplementation Project ~~processes~~ 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. ~~and Global Plan Initiatives (GPI) on this matter and the CAR/SAM PBN Roadmap (GPI 5, 7, 10, 11, 12, 20 and 21).~~

2. WORK PROGRAMME

a) Evaluate and perform the changes deemed necessary in the~~a~~ PBN Implementation Project, in the portion related to~~Action Plan for~~ En-Route Operations, ~~taking into account the CAR/SAM Roadmap,~~ with a view to optimising the ATS route structure.

b) Develop the tasks of the ~~action plan for~~ PBN implementation Project in the portion related to~~for~~ en-route operations assigned to the SAM/PBN/IG.

c) Evaluate, insert and harmonize the activities of SAM PBN Project related to ~~a Model Action Plan for~~ PBN Implementation in the TMA selected by SAM States.
Note: Implementation by SAM States. ~~, and if such were the case, insert the necessary tasks.~~

d) Evaluate, insert and harmonize the activities of the Implementation Project related to ~~a Model Action Plan for~~ 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.

~~e) Develop guidelines for PBN implementation for TMA and approach operations including: cost-benefit analysis, safety assessment, air navigation procedures construction, ATC simulations (real time and accelerated time), ATC automated systems, air traffic controllers training, approval of aircraft and operators, design and management for Terminal Control Area, Regulation model on the GNSS application (Primary Means, Supplementary, operational restrictions, etc).~~

~~f) Establish training requirements, including airspace planning, air navigation procedures construction, operators and airworthiness approval, safety assessment and airspace monitoring.~~

~~g) Verify the status of implementation of WGS-84.~~

~~h) Follow-up of PBN implementation for en-route, TMA, and approach operations to ensure its intra- and inter-regional harmonisation.~~

~~i)~~h) In coordination with ~~the GREPECAS ATM/CNS Subgroup, ATM Committee, PBN Task Force,~~ 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, Perú, Suriname, Uruguay, Venezuela and IATA.

4. RAPPORTEUR

~~Julio Pereira, Brazil.~~ Alexandre Luiz Dutra Bastos, Brazil

APPENDIX H / APÉNDICE H

LIST OF CONTACTS FOR OPERATIONAL PBN FOCAL POINTS

LISTA DE CONTACTOS PARA PUNTOS FOCALES PBN

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
ARGENTINA*	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
BOLIVIA (Plurinational State of) / **BOLIVIA (Estado Plurinacional de)***	ATCO Miguel Castillo Ochoa Dirección General de Aeronáutica Civil (DGAC) Jefe de la Unidad ATM/SAR Tel.: +591 2211-4465 Cel.: +591 7204-6745 E-mail: mcastillo@dgac.gob.bo
BRAZIL / BRASIL*	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
CHILE*	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
COLOMBIA*	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

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
ECUADOR*	Enrique Bolívar Dávalos Cárdenas Especialista en Tránsito Aéreo Dirección de Aviación Civil Av. Buenos Aires Oe1-53 y Av. 10 de Agosto Quito, Ecuador Tel: +5932 294-7400 ext. 4086 E-mail: bolivar.davalos@aviacióncivil.gob.ec bolodavalos@hotmail.com
FR.GUIANA / GUYANA FRANCESA	Philippe Rondel E-mail: philippe.rondel@aviation-civile.gouv.fr
GUYANA	Chaitrani Heeralal E-mail: dans@gcaa-gy.org
PANAMÁ*	Ana Teresa Montenegro de De León Jefe Planificación de Espacio Aéreo Autoridad Aeronática 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 Pettirossi Tel: +59521 6882346 E-mail: atm_gnna@dinac.gov.py
PERÚ*	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

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
SURINAME	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
URUGUAY*	Rosanna Barú Jefa Dpto. Servicios Aeronáuticos División Navegación Aérea - DINACIA Tel: +5982604 0408 int. 4461 Cel: +598 99204 199 E-mail: rocbb17@gmail.com; rbaru@dinacia.gub.uy 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 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 +598 96323872 E-mail: doblemaik@gmail.com
VENEZUELA (Bolivarian Republic of) / **VENEZUELA (República Bolivariana de)***	Omar Enrique Linares Planificador de Espacios Aéreos 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 Pablo Rattia Rodríguez Planificador de Espacios Aéreos 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

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