Agenda Item 2: **SAM airspace optimisation**
a) PBN en route
b) PBN in terminal area
c) PBN procedures
d) Longitudinal separation reduction

FOLLOW-UP TO PBN IMPLEMENTATION IN RELATION TO THE GOALS OF THE DECLARATION OF BOGOTA AND OTHER IMPLEMENTATIONS RELATED TO AIRSPACE OPTIMISATION

(Presented by the Secretariat)

SUMMARY

This working paper presents a report on implementation activities related to the goals of the Declaration of Bogota and other implementations concerning airspace optimisation in the SAM Region, so that the States may identify those activities on which to efforts should be focused to meet the established goals.

References:

- RAAC/13 (Bogota, Colombia, 4-6 December 2013) – Declaration of Bogota
- Third Meeting of Air Navigation and Safety Directors of the SAM Region (Lima, Peru, 22-24 August 2016)
- SAM/IG meetings

ICAO strategic objectives:	*A - Safety* *B – Air navigation capacity and efficiency* *E – Environmental protection*

1. Introduction

1.1 The Third Meeting of Air Navigation and Safety Directors (Lima, Peru, 22-24 August 2016) analysed, *inter alia*, the status of PBN implementation with respect to the optimisation of routes, terminal areas (SIDs, STARs, CCO, and CDO), PBN approach procedures, as well as the reduction of CO_2 emissions, as part of the goals approved by the RAAC/13 meeting (Bogotá, Colombia, 4-6 December 2013) through the Declaration of Bogota (Conclusion RAAC/13-8 – *Implementation of air navigation and safety priorities*).

1.2 The Third Meeting of Air Navigation Directors recognised the delay in the implementation of PBN in some airspaces of the Region, and identified issues such as the lack of designers in some States, failure by PBN project management to meet the agreed goals, and interruptions to address other projects being executed in parallel.

2. **Discussion**

Updating of national PBN plans and action plans

2.1 The activities related to the implementation goals include national PBN implementation plans, in accordance with Conclusion SAM/IG/14-5, whereby SAM States must submit their updated national PBN plans at SAM/IG meetings. These plans were requested by Headquarters for their inclusion in the PBN website. At the Third Meeting of Directors, Panama informed that it would do its utmost to update its national PBN plan before the end of 2016. The updated status of implementation of national PBN plans is shown in **Table 1** below:

2016	**ARG**	**BOL**	**BRA**	**CHI**	**COL**	**FGY**	**ECU**	**GUY**	**PAN**	**PAR**	**PER**	**SUR**	**URU**	**VEN**
86%	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	NO	YES	YES

Table 1 – States that have submitted their updated national PBN plans

2.2 As a supplement to PBN plans, SAM States must submit their Action Plan for the use of PBN in the redesign of selected airspaces, using the model action plan approved to that end. The updated status of action plans is shown in **Table 2**. The PBN/IMP/1 workshop noted that several States had modified the implementation dates. The States that have modified the dates must submit their updated action plans to the Secretariat during the Meeting.

2016 79%	**ARG**	**BOL**	**BRA**	**CHI**	**COL**	**FGY**	**ECU**	**GUY**	**PAN**	**PAR**	**PER**	**SUR**	**URU**	**VEN**
	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES	YES	NO	YES	YES

Table 2 – States that have an Action plan for the redesign of selected airspaces based on PBN

PBN en route

2.3 PBN implementation en route is addressed at ATS/RO meetings, based on the route network version concept. The use of route network versions reflects the need for regular, comprehensive reviews to ensure the best possible airspace structure at all times within an integrated development concept. PBN route optimisation depends on TMA design based on PBN. Full route optimisation will be achieved once the routes have been integrated into TMAs and PBN-based procedures.

2.4 Sixty-five per cent (65%) progress has been achieved in the implementation of RNAV routes in upper airspace, exceeding the 60% goal established in the Declaration of Bogota. In order to get a more clear idea, **Table 3** below shows the number of regional conventional and PBN routes in upper airspace, as well as the percentage of PBN routes achieved.

Total ATS routes in upper airspace	Conventional routes	PBN routes	% PBN routes implemented	Declaration of Bogota indicator: % PBN routes

145	52	93	**65%**	60%

Table 3 - ATS routes (conventional and PBN) in upper airspace

PBN in TMA

2.5 Full PBN redesign of the main South American TMAs was accomplished through PBN workshops sponsored by Regional Project RLA/06/901. Four training/follow-up workshops were conducted to address the planning, design, validation, and implementation phases, respectively.

2.6 Likewise, the First workshop on PBN implementation (PBN/IMP/1, April 2016) was conducted with the participation or one or more leading operators, which contributed to collaborative decision-making and improved the results of the planning, design, and validation phases. This workshop focused on the implementation of already completed designs, and updated the status of implementation of the respective action plans of the States that were still in the design phase.

2.7 At the PBN/IMP/1 workshop, several States informed of modifications to their action plans and of substantial delays for various circumstances, which gave rise to a change in the schedule of activities associated to PBN implementation in TMAs.

2.8 As may be recalled, Version 3 of the route optimisation depended on the definition of new gateways in the PBN design of TMAs and on the conduction of the ATS/RO/8 meeting to make adjustments to implementation agreements and dates. Given the delays in PBN implementation in TMAs, the SAM/IG/17 meeting proposed a change in the scheduled date of the PBN/IMP/2 workshop and the cancellation of the ATS/RO/8, which was approved by the States and the RCC/10 meeting.

2.9 The PBN/IMP/2-PANS-OPS workshop only analysed projects of those States that had specified implementation dates for late 2016 and early 2017. In order to optimise activities during this event, a PANS-OPS workshop was included for the purpose of analysing, together with the procedure designers, the amendments made to ICAO Doc 8168 and Circular 336, in relation to RNAV and RNP approaches. The report of these activities is contained in **Appendix A** to this working paper.

2.10 In order to minimise the impact on implementation, a supplementary activity was defined involving the hiring, with the support of project RLA 06/901, of two experts for 3 weeks to develop the operational concept for the PBN route structure (ATS routes, SIDs, STARs) for the period 2017/2019. The States that deem it appropriate may send an expert to cooperate in the development of the concept. The Secretariat is scheduling this activity for November 2016.

Implementation of SIDs, STARs, and PBN approach procedures

2.11 At the Third Meeting of Air Navigation Directors, some States updated the status of implementation of the SIDs, STARs, and PBN procedures, as shown in **Appendix B** to this working paper. The latest information on international aerodromes in the Region has also been collected, as shown in **Appendix C** to this working paper. This information will be included in the procedure implementation control template, and thus the new international aerodromes will be part of the template starting on 1 January 2017.

2.12 This update did not reveal any significant progress towards meeting the commitment assumed at the General Assembly, pursuant to Resolution A37-11, before the end of 2016, since only 75% regional implementation had been achieved. Consequently, the States shall double their efforts in order to meet this goal. The table below shows the status of implementation:

Total of international aerodromes	Total IFR thresholds	Total APV or RNP AR or LNAV IAPs	ICAO indicator A37-11 % APV on IFR routes	
			Actual regional	GOAL 2016
99	175	131	75%	100%

2.13 Regarding CCO, 20% implementation has been achieved, and 22% for CDO. The Third Meeting of Air Navigation Directors analysed the possibility of applying the processes described in the CDO and CCO manuals to the SIDs and STARs already implemented, for their validation as such.

2.14 The status of implementation of PBN SIDs / STARs in the Region is shown in the table below. It may be noted that the goal established in the Declaration of Bogota has been exceeded, and that the implementation of PBN SIDs and STARs continues.

Total airports	Total SIDs/STARs	Total PBN SIDs/STARs	ICAO indicator: % of PBN SIDs/STARs at international airports	ICAO indicator: % of PBN SIDs/STARs at international airports
			April 2016	GOAL 2016
99	1680	1209	72 %	60%

Reduction of CO_2 emissions as a result of PBN implementation in TMAs

2.15 Several States have done a good job at calculating savings derived from the optimisation of selected airspaces. Most of the States have used the ICAO IFSET tool. Other States have calculated these savings in collaboration with the operators. The Secretariat will prepare the total savings obtained in 2016 based on the information provided at PBN workshops.

Activities and resources approved for 2017 with the support of Project RLA/06/901

2.16 The Tenth meeting of the coordination committee of Project RLA/06/901 (RCC/10) approved the following activities to support SAM airspace optimisation in 2017:

- **Second workshop on PANS-OPS implementation,** to continue with the harmonisation and coordination of PBN instrument procedures in the SAM Region, advanced RNP, and CDO/CCO, foreseen to be held in Lima, Peru for one week in July 2017.

- **Longitudinal separation optimisation workshop,** to develop an implementation plan for reducing longitudinal separation in SAM airspace from 40 to 20 NM, and sign the letters of operational agreement, foreseen to be held in Lima, Peru, for one week in October 2017.

- **Version 4 of the SAM route network, based on the PBN operational concept,** to develop the operational concept on the PBN route structure (ATS routes, SIDs, and STARs) for the period 2017-2019, including the implementation strategy, the navigation specification to be applied en route and in TMAs, as well as metrics and indicators, to be conducted by two experts of the Region in Lima, Peru, during three weeks in August 2017.

- **ATS/RO/8 workshop/meeting,** to conduct the preliminary review of Version 4 of the route network optimisation, and to approve the final version to be implemented, foreseen to be held in Lima, Peru, for one week in September 2017.

- **SAM/IG/19** and **SAM/IG/20 meetings,** to continue with the activities for the implementation of the AGA, AIM, ATM, CNS, and MET action plans developed under the Project. These meetings will be held in May and October 2017, respectively.

- **Workshop on ASBU implementation and PBIP revision,** to review the PBIP and the national air navigation plans aligned with ASBU, foreseen to be held during one week in September 2017.

Monitoring the implementation of reduced longitudinal separation in the Region and signing of letters of operational agreement

2.17 The Secretariat has prepared **Appendix D** to this working paper for purposes of updating the status of implementation of reduced longitudinal separation in the Region during the Meeting. This reduction applies to GNSS-equipped aircraft. In case one or the two aircraft participating in a longitudinal separation lacked GNSS capacity, the separation to be applied to this traffic is 80 NM.

2.18 Likewise, the States of the Region can take advantage of the Meeting to sign the corresponding amendment to the letters of operational agreement.

2.19 The reported status of implementation is as follows:

2016 77 %	**ARG**	**BOL**	**BRA**	**CHI**	**COL**	**FGY**	**ECU**	**GUY**	**PAN**	**PAR**	**PER**	**SUR**	**URU**	**VEN**
	YES	YES	YES	YES	YES	NO	YES	NO	YES	YES	YES	NO	YES	YES

PBN focal points of the regulator and air navigation service provider

2.20 Because of the various changes that have taken place in the administrations of the States of the Region, and the transfer of human resources to other areas and responsibilities, it is felt advisable to update the list of PBN points of contact of the regulator and the air navigation service provider (ANSP). This is required for coordination and teleconferencing purposes. The list to be updated at the Meeting appears in **Appendix E** to this working paper.

3. **Suggested action**

3.1 The States participating at the Meeting are invited to:

a) submit their updated national PBN plans to the Secretariat, if they have not done it yet;

b) submit the updated action plans to the Secretariat, containing the latest date modifications concerning the redesign of selected airspaces based on PBN;

c) inform the Secretariat about the status of implementation of SIDs, STARs, and PBN procedures;

d) inform the Secretariat about any errors in the new list of international aerodromes of the Air Navigation Plan;

e) submit to the Secretariat all information on estimated fuel savings that was not delivered at the two previous PBN workshops and that is related to route optimisation or the redesign of selected airspaces;

f) update the PBN focal points of the regulator and the air navigation service provider; and

g) provide the Secretariat any information on progress or changes in the implementation in the selected TMAs.

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APPENDIX A

RESULTS OF THE

SECOND WORKSHOP ON PBN IMPLEMENTATION IN TMA

AND OF THE

FIRST PANS-OPS WORKSHOP

(PBN/IMP/2-PANS-OPS)

Lima, Peru, 12 to 16 September 2016

APPENDIX A1

REPORT

SECOND WORKSHOP ON PBN IMPLEMENTATION IN TMAs (PBN/IMP/2)

(Lima, Peru, 12 September 2016)

The Second workshop on PBN implementation in TMAs (PBN/IMP/2) analysed the following scenarios, which were scheduled for implementation during the period 2016-2017. The scenarios under consideration were the PBN SUR Project (Brazil), covering the Curitiba FIR in Brazil, scheduled for implementation on 14 September 2017, as well as the Pampa SUR Project (Chile), covering the southern part of the Santiago TMA in Chile, and taking into account the areas of Temuco, Concepción, and Punta Arenas. This implementation is scheduled for 8 December 2016. An analysis was also made of the Asunción TMA in the Project of Paraguay, scheduled for implementation in June 2017. Information was also provided on the designs being developed for the Carrasco TMA (Uruguay) and the persisting difficulties related to the lack of instrument procedure designers.

Brazil

Regarding the PBN SUR project in Brazil, the following was noted:

a) The Curitiba FIR had been sectorised, and several arrival scenarios into Sao Paulo had been analysed.

b) The scenarios had been analysed taking into account controller workload and severity, as part of the safety analysis.

c) Following validation, scenario number 5 had been selected.

d) A real-time simulation had been conducted, with 1:30-hr exercises, which demonstrated the feasibility of the scenario.

e) The PBN Sur project comprises 347 charts (506, including draft simulation charts).

f) (GEAI – Flight inspection) **-** (PEA – Quality check).

g) It is an integrated airspace process (route, approach).

h) The concept is effective 14 September 2017. Users have already tested it in the simulator.

IATA commented on the advantages of real-time simulation compared to accelerated simulation if States were not familiar with the accelerated simulation tool, which is a complex tool that requires much training.

The Secretariat requests that an action plan adjusted to September 2017, as well as savings estimates, be submitted in an information paper to the SAM/IG/18 meeting. It also requested that an information paper be submitted to the SAM/IG/19 meeting containing the results of the real-time simulation.

Chile

Regarding the Pampa SUR project, the experts of this State pointed out that the following had been taken into account:

a) Conventional routes were maintained, and a design had been developed to reduce points of conflict. The design considers CCO and CDO techniques; and

b) GNSS-based navigation was assigned priority in the design.

<u>Santiago terminal area</u>

a) For the Santiago TMA, two projects had been combined: the Santiago terminal area and the Pampa SUR project, enhanced in 2016 with the introduction of arrival-only and departure-only points.

Regarding traffic on Runway 17, arrival and departure flows were segregated, so vertical windows have also been included in the design. Priority has been assigned to meeting optimum flight profiles, and the design includes an open STAR so that the ATC may assign vectors as necessary.

Regarding traffic on Runway 35, flows were analysed in order to segregate arrivals from departures.

The Pampa SUR project gives priority to GNSS-capable aircraft. Arrival and departure flows at the Concepción and Temuco TMAs have been segregated. Regarding the Punta Arenas TMA, all arrivals are executed through a single point, and STARs are the same, although approach procedures change.

It was noted that there were non-measurable safety benefits to be derived from the implementation of segregated routes.
Savings are obtained in the order of 2,047 tonnes of CO_2, equivalent to 647 tonnes of fuel.

An analysis of weather conditions at the Merino Benitez airport had also been conducted, showing that visibility is more than 5,000 m 84.6% of the time. This analysis was considered of great value and, in this sense, it is recommended that all States conduct an analysis of weather conditions applying the methodology used by Chile and, based on such analysis, calculate VMC and IMC capability.

Chile was asked to submit an information paper on the methodology used for this analysis at the next SAM/IG/18 meeting.

Paraguay

The workshop took note of the progress made in the Asunción TMA project:

a) The design and basic validation had been completed.

b) In parallel, progress was being made to update the AIRCOM 2100 radar control automated system.

c) Seminars for the technical personnel had been conducted.

d) Implementation tasks had been established.

e) Implementation was scheduled for 22 June 2017.

f) A PBN Manual had been completed, containing operational and contingency procedures for ATCOs.

g) An SMS analysis had been conducted as part of the validation.

h) Regarding the publication, waypoints were still expressed in alphanumeric terms and would be changed to permanent.

The Secretariat requested Paraguay to submit an information paper to the SAM/IG/18 meeting containing the PBN Manual, as well as the updated implementation plan, and thanked Paraguay for the information on the training courses, which also included a PANS-OPS course.

Uruguay

Regarding the Carrasco TMA, it was noted that it was in a very preliminary phase:

a) Although it did not have a full designer team, it was working with the available resources to implement its Action Plan by March 2017, following the recommendations of Doc 9613.

b) It had conducted risk analyses, 3 iterations, radar simulator tests, consultations with ATCOs, airlines and other users, and B737 and A330 simulator tests. It had also used the IFSET tool to calculate fuel and CO_2 savings, which total 6,900 tonnes per year.

c) It is promoting the drafting of national regulations that contemplate the "ICAO balanced approach" towards the environment and aeronautical noise, especially with respect to constructions in airport surroundings, in order to achieve a sustainable development of civil aviation.

d) The creation of a team of PANS-OPS experts is required to complete the re-design (other runways, TMA volume/layout, and Baro-VNAV procedures), if possible by 2017.

e) Instrument procedures have been published in accordance with Circular 336.

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APPENDIX A2

REPORT

FIRST PANS-OPS WORKSHOP

(Lima, Peru, 13 to 16 September 2016)

Information provided by the IFPP Panel member

An explanation was provided on the activities, composition, and operation of the Instrument Flight Procedures Panel (IFPP), as well as of the processes followed for the development of new IFP criteria, timelines, and the distribution of tasks among its members.

An explanation was also given of the existence of several Task Forces engaged in the development of procedure monitoring requirements, the analysis of limiting surfaces, quality assurance, chart symbology, as well as operations dealing with the interpretation of procedures by pilots.

Information was provided on the issues to be covered by the upcoming amendments in 2018, such as:

- RNP AR departures;
- Updating of the RNP AR Procedure design manual (Doc 9905);
- VSS – Clarification and application.

The analysis of an issue by the IFPP may take up to 7 years until a new amendment to Doc 8168 and the corresponding documents is introduced, which may result in failure to properly meet the needs of the industry. Accordingly, the States normally seek provisional solutions, based on the experience gained by States with a recognised global air navigation capability, such as the United States (FAA) and European Community member countries (EUROCONTROL and EASA).

Recommendation
Inasmuch as possible, to seek regional harmonisation (SAM) in the use of documentation developed by States of recognised capacity in global air navigation, such as the United States (FAA) and European Community member countries (EUROCONTROL and EASA), while waiting for ICAO documentation.

Database coding

The importance of publishing the Coding Table was discussed and it was recognised that the descriptive text of a procedure does not contain information that is sufficiently clear and objective to be inserted in the database of the aircraft navigation system. All the States participating in the workshop applied the Coding Table to the procedure.

The recommendation is to publish an AIC with detailed information about the Table, on how to access the Table, on the responsibility of the provider to produce such coding, and on any parameter that is different from, or more complex than, the standard and is not contained in the Coding Table.

It would be interesting if a regional harmonised coding table were to be submitted at the next workshop. In this regard, Brazil could send the AIC and its Coding Table to the Group to be used as a basis for discussion in order to define a harmonised regional coding table.

A matter for discussion is the change that would be required in the procedure development software that already has a harmonised coding table. The Secretariat suggested that an agenda item be included for the next workshop on coding tables.

Action by Panel members		
Suggested action	**Responsible party**	**Date**
Send the AIC and the Coding Table to the Panel members (e-mail)	Brazil	Upon completion of the final version of the AIC/Coding Table
Comments on the AIC and the Coding Table sent by Brazil	All	PANS-OPS /2 workshop

Changes in the denomination of approach procedures (Circular 336)

The Secretariat presented the changes effective on 1 December 2022 and the tasks to be taken into account for the transition with regard to changes, the designation of procedures in the charts, and the notes on requirements to be included in the charts. The States also took note of the processes for the development of a transition plan and the assessment of the impact of the proposed changes on all stakeholders.

Recommendation
That States, when implementing the changes foreseen in Circular 336, take into account the processes for the development of the transition plan and the impact assessment, and publish an AIC on this issue, in coordination with all stakeholders.

Procedure validation processes

The training modules of Aerolineas Argentinas for ground- and flight-validation pilots were shown in this presentation. This was considered important because it showed a professional course with detailed standard procedures for validating instrument procedures.

These validations are done in simulator and in real flight. The meeting felt that the validation process used by the airline was very useful, and recommended it use by all the airlines in the Region. Note was taken of the importance of data assessment and encoding, and of training requirements and contents of the ground validation IFP Package.

After data documentation, the simulator flight is prepared. The importance of having highly reliable data on the runway and other infrastructure was analysed. It was noted that the flight must be validated "*on course" / "on path*" and that the coded path must be compared with the actual stable flight path, without fix and segment "*bypassing*". The issue of segments was also addressed. These must be long enough to allow for slowing down and changing altitude as needed. Lateral and vertical transition must also be stable to avoid autopilot disconnect.

The participants took note of the importance of assessing each segment, the banking angle, the descent rate, the flyability of the segment, and finally the position of the aircraft with respect to the runway, and others, such as the "*TAWS Caution*" or "*Warnings*", interception courses and angles.

It was deemed advisable to assess the procedures with vertical guidance up to the DA, verifying the *full stop landing* and the *missed approach*. The question was raised as to whether the *missed approach* with one engine inoperative was assessed since, in this case, operators need to create their escape routes, etc.

Human factors were also analysed in terms of the complexity and information contained in the chart, as well as the workload involved in each segment.

The last stage consists in documenting if the procedure is ready for the implementation stage. This documentation is harmonised with that applied by Argentina and may be used as an example for the other SAM States.

Recommendation
That SAM States consider the adoption of documentation on ground and flight validation of procedures, similar to that applied by Argentina.

Flight validation

The workshop analysed the importance of flight validation, although it recognised that in case flight validation was not possible, the flight simulator could be used to check the "*flyability*" of the procedure. One of the core issues in this type of validation is the quality and level of detail of the scenario used in the simulator.

In accordance with Doc 9906, flight validation is required in the following circumstances:

a) the "*flyability*" of a procedure cannot be determined by other means;
b) the procedure requires mitigation for deviations from design criteria;
c) the precision and integrity of terrain and/or obstacle data cannot be determined through other means;
d) the new procedures differ significantly from the existing procedures; and
e) for PinS procedures for helicopters.

If the procedure requires mitigation for deviations from the design criteria, or the integrity and precision of terrain and obstacle data cannot be determined through other means, or the new procedures differ significantly from the existing ones, it is advisable to conduct a flight validation check.

Mention was made of the advisability for the aircraft and the crew to be certified for checking the "*flyability*" of the procedure, which is not always the case.

In any case, the workshop felt that these issues should continue to be analysed in order to define a harmonised process for the Region.

Ground validation

It was felt that ground validation process should always be carried out, as indicated in Doc 9906. The implementation of quality assurance processes is considered essential for the procedure design process.

Regarding simulator validation of an RNP AR procedure, there are differing opinions. This is a matter that should continue to be studied by the Group.

Action by the Panel members		
Suggested action	**Responsible party**	**Date**
Determine in which cases should validation and simulator flights be carried out, based on Doc 9906 and the best international practices.	All	PANS-OPS 2 workshop

Visual RNAV procedure

The workshop took note of existing regulations, their application, as well as the publication and coding of these procedures, through examples. The examples showed the difference between conventional visual approaches and RNAV visual approaches, which permit the use of waypoints instead of geographical locations, altitude and speed indications, which are useful for the ATC and the crew, and vertical guidance in some cases.

This helps to reduce unstable visual approaches. Taking into account that most accidents occur in the approach phase, this type of procedure can help reduce the rate. For this type of implementation, CDM between the authority and the operators must be applied starting in the design phase.

Pilots emphasised the ideal point at which visual conditions should be known in order to perform the RNAV visual procedure. The workshop considered this matter to be very important and that warranted further discussion. One possibility would be to establish an MSA or a point at a given altitude in a STAR at which the VMC condition should be assured.

The operators understand that the use of RVFP is basically to ensure a stabilised approach. In this sense, it is advisable to make this decision at a position close to the airport. However, it was felt that the RNAV visual approach was the most appropriate on runways that lacked instrument approach at an airport, in order to ensure the safety of the operation at that airport.

It was also noted that the ATC must be trained in the use of RVFP and can also permit interception of the RVFP at a point other than the starting point, but must not provide vectoring to the aircraft at the beginning of an RF segment.

The pilots and IFALPA delegates attending the meeting noted that the work mix (instrument references in the cockpit and visual references from outside the cockpit) increases pilot workload if compared with a manual visual flight. However, it is recognised that there are more destabilised approaches in fully manual approaches. Consideration should be given to the possibility of having this application available provided specific training is given for this type of approach.

Regarding lateral and vertical guidance, it enhances safety, but consideration should be given to whether the increased workload in the cockpit is manageable and acceptable for the crew and the operator in some cases.

In this regard, a small working group should be established to consider mitigating measures that could be part of a guide for the implementation of visual RNAV, taking into account IFALPA's *Briefing 15ATSB Lima03*.

The Secretariat proposed to work on this matter through TELECONs and prepare a draft discussion paper for the SAM/IG/19 meeting, which could be discussed by a TF within the PBN Group, with a view to developing an acceptable guide on the use of visual RNAV approaches.

The workshop also analysed the benefits of this type of approach in terms of safety and improved TMA capacity and flow management, tactical airspace management, and separation of airport flows with converging paths. Logically, the avionics capacity of the aircraft is critical for taking advantage of these procedures. In VFR thresholds, these procedures help to avoid CFIT, and to reduce runway excursions.

The workshop deemed it important to harmonise publications, since not all charts clearly establish the requirements for their use. Likewise, it should be possible to encode the data in the NavDB and States must ensure the flyability of these procedures.

Action by the Panel members		
Suggested action	**Responsible party**	**Date**
Develop a guide for the implementation of the RNAV visual procedure, taking into account the mitigation measures required to avoid the issues mentioned in IFALPA's *Briefing 15ATSB Lima03*	All	SAM/IG/19

Interpretation of some navigation requirements

RNAV1/RNP/1 in SIDs/STARs

The workshop discussed the surveillance and alerting requirements to be met for the use of these navigation specifications. It also reviewed the tables contained in Doc 8168 Vol. II for RNAV procedures with GNSS.

It was clear that the separation between any combination of tracks with RNAV-1 or RNP- 1, or RNP APCH, or RNP AR APCH, could be reduced down to 7 NM, and down to 5 NM with RNP-1 or RNP APCH or RNP AR APCH. All RNAV-1 and RNP-1 specifications can be used up to the FAF/FAP, as established in Docs 8168 and 9613.

The majority of South American TMAs do not have the coverage or the geometry for using DME/DME to support RNAV-1 and, therefore, the use of this navigation specification is based on GNSS alone. Consequently, the workshop concluded that there was no need to consider RNP-1 alone in a setting without ATS monitoring. This conclusion is based on the fact that Doc 9613 establishes that monitoring and alerting requirements could be met through an on board navigation system capable of NSE monitoring and alerting (for example, RAIM or FDE algorithm), plus a lateral navigation display (for example, CDI indicator) enabling the flight crew to monitor the FTE. When PDE is assumed to be insignificant, the requirement is met because NSE and FTE are monitored, which leads to TSE monitoring.

The adoption of RNAV-1 or RNP-1 at the PBN STARs and SIDs allows procedures to be used by more users, taking into account that there are still airlines that do not have RNP-1 in their operational specifications.

Recommendation
That SAM States use RNAV-1 and RNP-1 in PBN SIDs/STARs, even in non-radar environments, since RNAV-1 is used exclusively with GNSS.

RNAV-1 and RNP-1 in RNAV/ILS approaches

The workshop took note that some States used the RNP APCH specification in RNAV/ILS procedures. Taking into account the need for a larger number of users to be in a position to use RNAV/ILS procedures, and considering that RNAV-1 and RNP-1 navigation specifications can be applied up to the intermediate segment, the workshop concluded that RNAV-1 and RNP-1 should be used as navigation specifications in RNAV/ILS procedures.

Recommendation
That SAM States use RNAV-1 and RNP-1 in RNAV/ILS procedures, including non-radar environments, since RNAV-1 is used exclusively with GNSS.

Advanced RNP (A-RNP)

This specification permits the application of RF and precision values between 1 and 0.3 NM. The use of this application could be considered at airports that have problems with DEP minima due to issues related to obstacles, noise, or others, which can be resolved with an RF Leg/or the application of values lower than 1 NM and down to 0.3 NM.

There is no ICAO SARP yet dealing with the application of the RNP AR specification for DEP, although some States have already applied these criteria for take-offs. SARPs for take-off could be ready by 2018. Peru has experience in the application of this specification for take-offs.

Recommendation
That SAM States study the application of A-RNP at airports that have problems with DEP minima for reasons related to obstacles or aeronautical noise, which can be resolved with an RF Leg and/or values of less than 1 NM and down to 0.3 NM.

ATC gradient

The ATC gradient concept was developed in order to:

a) Allow for steeper climb gradients, facilitating the use of CCO;
b) Reduce the number of published charts through the use, in the same chart, of a minimum climb gradient allowing for obstacle clearance, as well as an ATC gradient that provides a continuous climb, flying "above the STAR"; and
c) Give more flexibility to operations, where the ATC would be responsible for maintain the separation between aircraft that applied the minimum climb gradient and aircraft conducting arrival procedures.

Regarding this application, the workshop concluded that the operations section of airlines could have difficulties to analyse the use of both gradients, taking into account that the trend is to assess the steeper gradient. This may result in the need for a lower take-off weight and thus a reduction in aircraft payload. This factor gets worse when the published gradient does not correspond to the FL restriction shown in the chart, taking into account that the aircraft will always comply with the FL restriction, regardless of the published gradient.

The workshop felt that, in order to include an ATC gradient in the chart, it would be advisable to previously conduct CDM between users and the ATC, and should be limited to domestic airports, taking into account that a smaller number of users might facilitate the dissemination of specific procedures for the use of such gradient. Although this publication of the gradient was aimed at reducing the number of charts, consideration should be given to whether it would be convenient to use two charts with different restrictions for the same departure, with a view to enhancing situational awareness of controllers and pilots.

In case the climb requirement is too stringent, consideration should be given to the possibility of aircraft flying below the recommended altitude in certain cases. In this case, it would be advisable to have two SID charts. It is clear that it will be the airspace concept that will define this possibility, together with the feasibility study for this type of concept.

Recommendation
That SAM States, when applying the ATC gradient, take into account the following: a) To be applied only at domestic airports; b) Prior CDM process among stakeholders; c) Assess the convenience of publishing different charts to enhance situational awareness of controllers and pilots;

Identification of SIDs/STARs

The workshop discussed the issue concerning the designation of SIDs and STARs, taking into account that, in some cases, the methodology set forth in Annex 11 could increase controller and pilot workload and become a threat to safety. The application of the first "*waypoint*" of the STAR and the last waypoint of the SID to designate them in accordance with Annex 11 is a practice that enhances situational awareness of pilots, in the case of airports with a reduced number of SIDs and/or STARs. However, at airports with a more complex operational environment, with a large number of SIDs and STARs, the application of the transition concept makes it easier for the pilot to apply the procedure authorised by the controller, and the ATCO does not need to memorise a significant number of SIDs/STARs. Accordingly, the workshop concluded that the airspace planner must assess the best way of designating SIDs/STARs through a CDM process with all stakeholders.

Another matter under consideration was the designation of SIDs that used the same designation for different thresholds in parallel runways. The suggestion was to use a different name for each threshold of parallel runways in order to avoid any confusion to the pilot.

Another issue discussed at the workshop was the chart for RNP AR approach with transitions, with many intermediate fixes (IF). Pilots feel comfortable with that display. The situational awareness of pilots and controllers is enhanced. Besides, it is possible to reduce the number of published charts. However, the graphic representation of the charts must be assessed, taking into account that the use of many transitions could render the information unclear. FAA examples were used.

An important point is the fact that the ATC database in automated systems could result in a very complex display if the ATC decides to display approaches on a screen.

Recommendation
• The airspace planner should assess the best way of designating SIDs/STARs (with or without transition) through CDM with all stakeholders; • SAM States should apply the concept of transition in RNP AR procedures that have many intermediate fixes (IF), assessing their impact on the graphic representation in the chart and any possible problem in automated ATC systems.

Public/tailored RNP procedures

When addressing this issue, an explanation was given of two RNP AR drafting criteria:

a) Public criteria of Doc 9905;

b) Criteria tailored to the characteristics of the operational environment and user needs/capabilities.

Regarding aircraft/operator approval criteria, these may be:

a) *Generic*: applied to procedures in which the public drafting criteria of Doc 9905 are applied. In such cases, approval is sufficient to use any RNP AR procedure published under the public criteria of Doc 9905;

b) *Specific*: applied to procedures in which drafting criteria have been adapted to the operational environment and/or user needs/capabilities. Specific approval for an airport or threshold (*tailored*). In this case, coordination between PANS-OPS experts and aircraft and operator approval inspectors is needed, as well as the publication of drafting and approval criteria.

Regarding the publication of public and tailored RNP AR procedures in the AIP, the workshop recalled that the SAM/IG/17 meeting established, as a general rule, that procedures, whether public or tailored, should be published so that all users that have equipped aircraft and approved operations may use these procedures, which have proven more efficient and safe, and to enhance situational awareness of air traffic controllers and pilots. Nevertheless, the workshop expressed its concern in those cases in which a pilot/aircraft that is not approved for a tailored procedure uses such procedure, becoming a clear threat to safety. Peru, for example, has published tailored procedures for the Cuzco airport, without the Coding Table, to prevent non-approved users from using such procedures without the corresponding approval. In this regard, the workshop concluded that a more in-depth analysis of this matter would be required.

The workshop also received information about special procedures that differ from standard procedures, in accordance with *FAA Order 8260.60*. These are procedures that contain criteria or parameters that are different from the standard, and the user must meet the established requirements, which are developed by the State or an authorised third party. This is not published.

Action by the Panel members		
Suggested action	**Responsible party**	**Date**
Develop a harmonised regional system for publication of tailored RNP AR procedures.	All	PANS-OPS/ 2 workshop

Minimum altitudes of SIDs

The workshop took note that the minimum climb gradient is the one that ensures obstacle clearance, and that the minimum climb gradient of the aircraft is calculated before take-off of the aircraft based on many factors, such as: aircraft type, engine type, runway length, temperature, etc., taking into account that aircraft do not have a “gradient meter”. In this sense, the crew has no way of ensuring that the aircraft will meet the minimum gradient in case of interruption of the climb by the ATCO, severe turbulence, etc. Accordingly, the workshop considered that, as an additional safety mechanism, minimum altitudes should be inserted in the SIDs, in critical segments on account of obstacles, so that the pilot may monitor such altitude with the FMS.

The recommendation is to keep the climb in the SID until exceeding the obstacle clearance level before ending the SID en route or in the airway.

Recommendation
That SAM States: a) Publish, as an additional safety mechanism, the minimum altitudes in the SIDs, in critical segments on account of obstacles, to allow the pilot to monitor such altitude through the FMS; b) Establish the proper connection between the SIDs and the ATS route network to ensure obstacle clearance.

Level segments to intercept the ILS glide slope

Whenever possible, it is advisable to use level segments in the intermediate approach so that the aircraft may lose power and get ready for an ILS approach procedure, ensuring interception of the glide slope "below the path". If a level segment is not possible, then a reduced slope in the intermediate segment is needed, at least, to allow the aircraft to lose power. Likewise, interception of the glide slope "below the path" shall be ensured.

Recommendation
That SAM States: a) Whenever possible, use level segments in the intermediate approach so that the aircraft may lose power and get ready for an ILS approach procedure, ensuring interception of the glide slope "below the path"; b) If a level segment cannot be established, then a reduced slope in the intermediate segment should be used to allow the aircraft to lose power. Likewise, interception of the glide slope "below the path" shall be ensured.

Publication of RNAV SIDs/STARs and conventional SIDs with similar paths on the same chart

There may be some confusion with the symbology or designation, and there is also the issue of the design, which is different for each. Therefore, it seems best to publish the conventional data separately from PBN.

Elimination of publication of procedures on paper

The workshop cited the following advantages to be derived from the release by the State of aeronautical publications only by electronic means:

a) Monthly updates of aeronautical publications.
b) Savings in the publication of procedures and in aeronautical publication updates, since a significant expenditure in printing and paper is avoided.
c) Expeditious publication of procedures and updating of aeronautical publications, taking into account that the AIRAC publication date could be complied with by inserting the procedure in the web, considering that the information is already known to users and is available to database providers.

However, in accordance with Annex 15, it was felt that there should be a copy of the AIP available at least at ARO/AIS offices. Likewise, in case of contingency, it is advisable for the ATS to have a hard copy of the AIP. Users wishing to keep charts in hard copy should print them or hire a specific company, like Jeppesen, Lido, etc.

Recommendation
That SAM States assess the possibility of eliminating or substantially reducing publications on paper, especially the AIP, including air navigation procedures (routes, STARs, SIDs, IAC, etc.), with a view to allowing monthly updates, savings in printing/paper, and more expeditious publication and updating of such publications.

Creation of a working group to assess the publication in OCA or OCH charts

According to Annex 6, paragraph 4.2.8.1, the State of the Operator shall require that the operator establish aerodrome operating minima for each aerodrome. Paragraph 4.2.8.2 of Annex 6 contains the parameters to be taken into account in establishing such minima, including OCH/OCA. Accordingly, it is the operator and not the State that must establish the MDA/MDH.

Likewise, Doc 9365, in item 2.1.1, states the following: "*A ceiling or vertical visibility limitation for the decision to continue the approach to land is normally not applied since a safe flight path to DA/H or MDA/H is assured by procedure design*".

Furthermore, the definition of Aerodrome operating minima in Doc 9365 does not establish "ceiling" as one of the parameters to be considered.

Aerodrome operating minima: *The limits of usability of an aerodrome for:*

a) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions;
b) landing in precision approach and landing operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the category of the operation;
c) landing in approach and landing operations with vertical guidance, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H); and
d) landing in non-precision approach and landing operations, expressed in terms of visibility and/or runway visual range, minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions.

Some States have expressed that they continued to publish ceilings for instrument approach in their approach charts. In this sense, the workshop concluded that the OCA/OCH should be published and that the MDA/MDH and ceiling should not be published, with a view to harmonising this publication throughout the Region.

Recommendation
That SAM States publish the OCA/OCH in instrument approach procedures and **not** publish MDA/MDH and ceiling, in accordance with ICAO documentation (Annex 6, Doc 8168, and Doc 9365), to ensure harmonisation in the SAM Region.

Application of CCO/CDO techniques at airports with low traffic volume

It was noted that, although a "natural" climb with no restrictions may exist at airports with a low traffic volume, it is convenient to develop optimised procedures to account for possible crossings between arrivals and departures (more direct procedures with altitude restrictions or longer procedures with no restrictions).

As to arrivals, depending on the operational scenario, it is more convenient to authorise the approach direct to the IAF, from a distance of approximately 200 NM from the airport, especially if there are no terrain and obstacle issues. This direct approach to the IAF would allow the pilot to calculate the ideal point of descent, taking the IAF as a reference, and request it from the ATCO. However, the ideal solution is to develop the corresponding STARs and SIDs, trying to apply CCO/CDO techniques within the possibilities of the scenario under consideration.

Recommendation
That SAM States: a) Publish an AIC and/or instruct air traffic controllers to authorise the approach direct to the IAF from a distance of approximately 200 NM from the airport, especially if there are no terrain and obstacle issues, in order to allow the pilot to calculate the ideal point of descent, using the IAF as a reference, and request it from the ATCO. b) Develop the corresponding STARs and SIDs, trying to apply CCO/CDO techniques within the possibilities of each scenario under consideration.

Temperature equation with respect to ISA

The workshop analysed a presentation on the incidence of temperature on the altitude indicated in the procedure design. It analysed a difference in the way this equation was expressed in Vol. I compared to Vol. II, as identified by a group of designers of Aerolíneas Argentinas.

The presentation showed the difference, which could affect the result of the equation. The error lied in the formulation of the equation in Vol. I of Doc 8168, PANS-OPS. In this regard, it suggested using the same formula as in Vol. II, which had a well-formulated mathematical expression.

Likewise, some examples were given of the incidence of temperature on the RNP AR design, giving designers the possibility of clarifying any doubts.

Support material for understanding changes in phraseology – Amendment 7 to Doc 4444

The Secretariat informed of a link to Headquarters containing support material for better understanding the changes in phraseology introduced by Amendment 7 to Doc 4444 concerning SIDs and STARs . The website address is:

http://www.icao.int/airnavigation/sidstar/Pages/CHANGES-TO-SID_STAR-PHRA-SEOLOGIES.aspx

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APPENDIX A

ESTADO/ STATE	IAC							SID		STAR		SID O STAR PBN AIRPORT	CCO	CDO
	LNAV/ VNAV	RNPAR	LNAV/ VNAV o RNP AR	LNAV/ VNAV o RNP AR AIPORT	RNPAR "ONLY" AIRPORT	LNAV	LNAV/ VNAV o RNP AR o LNAV	SID PBN AIRPORT	SID PBN	STAR PBN AIRPORT	STAR PBN			
Argentina	36.00%	0.00%	16.00%	37.50%	0.00%	36.00%	36.00%	31.25%	28.00%	56.25%	48.00%	56.25%	16.67%	20.83%
Bolivia	33.33%	0.00%	33.33%	33.33%	0.00%	33.33%	33.33%	66.67%	50.00%	0.00%	0.00%	66.67%	0.00%	0.00%
Brasil/Brazil	82.26%	4.84%	82.26%	85.71%	10.71%	88.71%	88.71%	92.86%	91.94%	42.86%	46.77%	92.86%	35.42%	35.42%
Chile	60.00%	30.00%	75.00%	62.50%	50.00%	85.00%	85.00%	75.00%	66.67%	87.50%	80.00%	87.50%	35.29%	41.18%
Colombia	0.00%	8.33%	8.33%	9.09%	9.09%	75.00%	75.00%	81.82%	83.33%	63.64%	66.67%	81.82%	0.00%	0.00%
Ecuador	25.00%	50.00%	50.00%	50.00%	37.50%	25.00%	50.00%	37.50%	50.00%	25.00%	50.00%	0.00%	0.00%	25.00%
Guyana Francesa / Fr. Guiana.	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Guyana	0,00%	0,00%	0,00%	0,00%	0,00%	75,00%	75,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Panamá	28.57%	57.14%	57.14%	50.00%	40.00%	57.14%	71.43%	25.00%	28.57%	25.00%	28.57%	25.00%	0.00%	0.00%
Paraguay	100.00%	0.00%	100.00%	100.00%	0.00%	100.00%	100.00%	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Peru	7.14%	71.43%	78.57%	87.50%	87.50%	7.69%	78.57%	50.00%	33.33%	87.50%	46.67%	87.50%	62.50%	75.00%
Surinam/ Suriname	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Uruguay	25.00%	0.00%	25.00%	50.00%	0.00%	100.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Venezuela	100.00%	0.00%	100.00%	100.00%	0.00%	100.00%	100.00%	100.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%
Región SAM / SAM Region	51.93%	14.36%	53.14%	60.82%	19.39%	68.89%	75.14%	64.95%	60.00%	46.39%	41.76%	72.16%	20.65%	22.58%

Explanatory notes:

- LNAV/VNAV - Percentage of IFR thresholds at international airports with at least one LNAV/VNAV procedure, excepting RNP/AR procedures.
- RNP AR - Percentage of IFR thresholds at international airports with at least one RNP AR procedure, excepting other type of LNAV/VNAV procedures.
- LNAV/VNAV or RNP AR - Percentage of IFR thresholds at international airports with at least one LNAV/VNAV procedure, including RNP AR procedures.
- LNAV/VNAV or RNP AR AIPORT – Percentage of airports with at least one LNAV/VNAV procedure, including RNP AR procedures in at least one threshold.
- RNPAR “ONLY” AIRPORT - Percentage of airports with at least one RNP AR procedure, excepting other type of LNAV/VNAV procedures, in at least one threshold.
- LNAV - Percentage of IFR thresholds at international airports with at least one LNAV procedure.
- LNAV/VNAV or RNP AR or LNAV - Percentage of IFR thresholds at international airports with at least one LNAV/VNAV procedure, including RNP AR procedures or one LNAV procedure.
- SID PBN - Percentage of IFR thresholds at international airports with at least one SID PBN.
- SID PBN AIRPORT - Percentage of airports with at least one SID PBN in at least one threshold.
- STAR PBN - Percentage of IFR thresholds at international airports with at least one STAR PBN.
- STAR PBN AIRPORT - Percentage of airports with at least one STAR PBN in at least one threshold.
- SID or STAR PBN AIRPORT - Percentage of airports with at least one SID PBN or one STAR PBN in at least one threshold.
- CCO - Percentage of airports where Continued Climb Operations techniques apply in both, design of procedures as well as its application by air traffic controllers and pilots.
- CDO - Percentage of airports where Continued Descent Operations techniques apply in both, design of procedures as well as its application by air traffic controllers and pilots.

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM						
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
ARGENTINA						
SABE	BUENOS AIRES/Aeroparque J. Newbery RS	7	4D	13 31	PA1 NINST	
SAEZ	Ezeiza/Ministro Pistarini RS	9	4E 4E	11 29 17 35	PA3 NPA NINST PA1	
SADF	SAN FERNANDO RG	4	3C	05 23	NINST NPA	
SARI Krause	CATARATAS DEL IGUAZÚ / My. D. C. E. RNS & AS	6	4E	13 31	NPA PA1	
SAVC Mosconi RS	COMODORO RIVADAVIA/ Gral. E.	6	4D	07 25	NINST PA1	
SACO	CORDOBA/Ing. Aer. A.L.V. Taravella RS	9	4E 4C	18 36 05 23	PA1 NINST NINST NINST	
SASJ	JUJUY/Gobernador Guzmán RS	6	4D	16 34	NINST PA1	
SAZM	MAR DEL PLATA/Astor Piazolla RG & AS	6	4D	13 31	PA1 NINST	
SAME	MENDOZA/El Plumerillo RS	6	4E	18 36	NPA PA1	
SAZN	NEUQUÉN/Presidente Perón RNS & AS	6	4C	09 27	PA1 NINST	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM						
City/Aerodrome/Designation Ciudad/Aeródromo/Designación	RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
		RC	Rwy No	Rwy Type	
1	2	3	4	5	6
SARE RESISTENCIA RNS & AS	7	4C	03 21	NINST PA1	
SAWG RÍO GALLEGOS/Piloto Civil N. Fernández RS	7	4E	07 25	NPA PA1	
SAAR ROSARIO/Islas Malvinas RS	8	4E	02 20	NINST PA1	
SASA SALTA/ General D. Martín Miguel de Güemes RS	6	4D 4C	02 20 06 24	PA1 NINST NINST ……….	
SAZS SAN CARLOS DE BARILOCHE RNS & AS	7	4E	11 29	NPA PA1	
SAWH USHUAIA/Malvinas Argentinas RNS & AS	9	4E	07 25	NPA PA1	
BOLIVIA					
SLCB COCHABAMBA/ Aeropuerto Internacional Jorge Wilstermann AS	8	4D	14 32	NPA PA1	
SLLP LA PAZ/ Aeropuerto Internacional de El Alto RS	7	4D	10 28	PA1 NINST	
SLVR SANTA CRUZ/ Aeropuerto Internacional Viru Viru RS	9	4E	16 34	NPA PA1	
BRAZIL / BRASIL					
SBBE BELÉM/Val de Cans/Júlio Cezar Ribeiro, RS	9	4D	06 24	PA1 NPA	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM							
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
SBCF	BELO HORIZONTE/ Tancredo Neves, MG RS	9	4E	16 34	PA1 NPA	
SBBV	BOA VISTA/ Atlas Brasil Cantanhede, RR RS	6	4D	08 26	PA1 NPA	
SBBR	BRASÍLIA/ Pres. Juscelino Kubitschek, DF RS	9	4E 4E	11L 29R 11R 29L	PA1 PA1 PA2 PA1	
SBCB	CABO FRIO/Cabo Frío, RJ RS	9	4E	10 28	NPA NPA	
SBKP	CAMPINAS/Viracopos, SP RS	10	4E	15 33	PA1 NPA	
SBCG	CAMPO GRANDE/Campo Grande, MS RS	7	4E	06 24	PA1 NPA	
SBCR	CORUMBÁ/Corumbá, MS RS	5	4C	09 27	NPA NPA	
SBCZ	CRUZEIRO DO SUL/Cruzeiro do Sul, AC RS	5	4C	10 28	NPA NPA	
SBCY	CUIABÁ/Marechal Rondon, MT l RS	7	4C	17 35	NPA PA1	
SBCT	CURITIBA/Afonso Pena , PR RS	8	4D	15 33 11 29	PA3 PA2 NPA NPA	
SBFL	FLORIANÓPOLIS/ Hercílio Luz , SC RS	7	4C	14 32	PA1 NPA	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM						
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
				03 21	NINST NINST	
SBFZ	FORTALEZA/Pinto Martins, CE RS	8	4E	13 31	PA1 NPA	
SBFI	FOZ DO IGUAÇU/ Cataratas, PR RS	7	4D	14 32	PA1 NPAT	
SBMQ	MACAPÁ/ Alberto Alcolumbre, AP RS	6	4C	08 26	NPA NPA	
SBMO	MACEIO/Zumbi dos Palmares, AL RS	7	4C	12 30	PA1 NPA	
SBEG	MANAUS/Eduardo Gomes, AM RS	9	4D	10 28	PA1 NPA	
SBPP	PONTA PORÃ/Ponta Porã, MS RNS	3	4C	04 22	NPA NPA	
SBPL	PETROLINA/Senador Nilo Coelho, PE RS	6	4E	13 31	NPA NPA	
SBPA	PORTO ALEGRE/Salgado Filho, RS RS	8	4D 4E	11 29	PA1 NPA	
SBRF	RECIFE/Guararapes–Gilberto Freyre, PE RS	9	4E	18 36	PA1 NPA	
SBGL	RIO DE JANEIRO/Galeão-Antônio Carlos Jobim, RJ RS	10	4E 4E	10 28 15 33	PA2 PA1 PA1 NPA	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM							
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
SBSV	SALVADOR/Deputado Luis Eduardo Magalhães, BA RS	8	4E	10 28 17 35	PA1 PA1 NINST NINST	
SBSN	SANTARÉM/Maestro Wilson Fonseca, PA AS	6	4D	10 28	PA1 NPA	
SBSL	SÃO LUÍS/Marechal Cunha Machado, MA AS	7	4D	06 24 09 27	PA1 NPA NINST NINST	
SBSG	SÃO GONÇALO DO AMARANTE/ São Gonçalo do Amarante RN RS	9	4E	12 30	PA1 NPA	
SBGR	SÃO PAULO/Guarulhos-Governador André Franco Montoro, SP RS	10	4E 4E	09R 27L 09L 27R	PA3 PA1 PA2 PA1	
SBTT	TABATINGA/Tabatinga, AM RS	5	4C	12 30	NPA NPA	
SBUG	URUGUAIANA/Rubem Berta, RS RS	3	3C	09 27 04 22	NINST NPA NINST NINST	
CHILE						
SCFA	ANTOFAGASTA/ AP. Cerro Moreno AS	6	4D	19 01	NPA NPA	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM							
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
SCAR	ARICA/ AP. Chacalluta RS	6	4D	02 20	NPA NINST	
SCIE	CONCEPCIÓN/ AP. Altn. Carriel Sur AS	7	4D	02 20	PA1 NPA	
SCDA	IQUIQUE/ AP. Diego Aracena RS	6	4D	19 01	PA1 NPA	
SCTE	PUERTO MONTT/ AP. El Tepual RS	6	4D	17 35	NPA PA1	
SCCI	PUNTA ARENAS/ AP. Pdte. Carlos Ibañez del Campo AS	6	4D 4D 3B	07 25 12 30 01 19	NPA PA1 NPA NPA NINST NPA	
SCEL	SANTIAGO/ AP. Arturo Merino Benítez RS	9	4E 4E	17R 35L 17L 35R	PA1 NPA PA1 NPA	
SCIP	ISLA DE PASCUA / AP Mataveri RS	8	4D	10 28	PA1 NPA	
COLOMBIA						
SKBQ	BARRANQUILLA/Ernesto Cortissoz/Atlantico RS	7	4E	05 23	PA1 NINST	
SKBO	Bogotá /Eldorado/Distrito Capital RS	10	4E	13L 31R	PA1 NINST	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM						
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
			4E	13R 31L	PA2 NINST	
SKBG	BUCARAMANGA/Palonegro RS	6	4C	17 35	PA1 NINST	
SKCL	CALI/Alfonso Bonilla Aragón/Valle RS	7	4D	01 19	PA1 NINST	
SKCG	CARTAGENA/Rafael Nuñez/Bolívar RS	7	4D	01 19	NINST NPA	
SKCC	CUCUTA/Camilo Daza/Norte de Santander RNS & AS	7	4C 4C	16 34 02 20	PA1 NINST NINST NINST	
SKLT	LETICIA/Alfredo Vásquez Cobo/Amazonas RNS & AS	6	4C	03 21	PA1 NINST	
SKPE	PEREIRA/Matecaña RS	7	4C	08 26	NPA NINST	
SKRG	RIONEGRO/José María Córdoba/Antioquia RS	8	4D	18 36	PA1 NINST	
SKSP	SAN ANDRÉS/Gustavo Rojas Pinilla/San Andrés RS	7	4C	06 24	NPA NINST	
SKSM	SANTA MARTA/Simón Bolívar RS	6	3C	01 19	NPA NINST	
ECUADOR						
SEGU	GUAYAQUIL/José Joaquín Olmedo RS	9	4E	03 21	NPA PA1	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM						
City/Aerodrome/Designation Ciudad/Aeródromo/Designación	RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
		RC	Rwy No	Rwy Type	
1	2	3	4	5	6
SELT LATACUNGA/Cotopaxi RNS & AS	8	4E	19 01	PA1 NPA	
SEMT MANTA/Eloy Alfaro RS	8	4E	06 24	NPA PA1	
SEQM QUITO/Mariscal Sucre RS	9	4E	18 36	NPA PA1	
FRENCH GUIANA / GUYANA FRANCESA (France/Francia)					
SOCA CAYENNE/Rochambeau RS	9	4E	08 26	PA1 NPA	
GUYANA					
SYCJ Georgetown /Cheddi Jagan Int'l Airport RS	10	4E	06 24	PA1 NPA	
SYEC Georgetown/ Eugene F. Correia International Airport RS	5	3C	07 25	NPA NPA	
PANAMÁ					
MPBO BOCAS DEL TORO/Bocas del Toro RG & AS	4	3B	08 26	NPA NPA	
MPDA DAVID/Enrique Malek RS	7	4D	04 22	NPA NINST	
MPMG PANAMÁ/Marcos A. Gelabert RG & AS	6	3C	19 01	NINST NINST	
MPPA PANAMA/Panamá Pacifico AS	7	4D	18 36	NINST NPA	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM						
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
MPSM	PANAMA/Cap. Scarlett Martínez AS	7	4D	17 35	NPA PA1	
MPTO	PANAMÁ/Tocumen Intl RS	9	4E 4E	03R 21L 03L 21R	PA1 NPA NPA NPA	
PARAGUAY						
SGAS	LUQUE/Silvio Pettirossi Intl. RS	9	4D	02 20	NPA PA1	
SGES	MINGA GUAZÚ/Guaraní Intl. RS	9	4E	05 23	NPA PA1	
PERÚ						
SPQU	AREQUIPA/INTL Alfredo Rodríquez Ballón AS	7	4D	09 27	PA1 NINST	
SPHI	CHICLAYO/ INTL Capitán FAP José Abelardo Quinoñes Gonzalez; Gran General del Aire del Peru AS	8	4D	01 19	PA1 NINST	
SPZO	Cusco/INTL Teniente FAP Alejandro Velazco Astete RS	7	4D	10 28	NINST NPA	
SPQT	IQUITOS/ INTL Coronel FAP Francisco Secada Vignetta RS	8	4D	06 24	PA1 NINST	
SPJC	LIMA-CALLAO/ INTL Jorge Chávez RS	9	4E	15 33	PA2 NPA	
SPSO	PISCO/INTL Pisco AS	9	4E	04 22	NINST PA1	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM						
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
SPTN	TACNA/ INTL Coronel FAP Carlos Ciriani Santa Rosa RG	7	4C	02 20	PA1 NINST	
SPRU	TRUJILLO/ INTL Capitán FAP Carlos Martínez de Pinillos AS	7	4C	01 19	PA1 NINST	
SURINAME						
SMZO	PARAMARIBO/Zorg en Hoop RG	3	1B	11 29	NINST NINST	
SMJP	ZANDERY/Johan Adolf Pengel Intl RS	9	4E	11 29	PA1 NPA	
URUGUAY						
SULS	MALDONADO/Intl. C/C, Carlos A. Curbelo “Laguna del Sauce” RS	7	4C 3C	08 26 01 19	NPA NPA NPA NPA	
SUMU Cesáreo	MONTEVIDEO/ Intl. de Carrasco “Gral. L. Berisso” RS	9	4E 4E	06 24 01 19	NPA PA1 NPA PA1	
VENEZUELA						
SVBC	BARCELONA/Gral. José Antonio Anzóategui Intl RS	9	4C	15 33 02 20	PA1 NINST NINST NPA	
SVMI	MAIQUETIA/Simón Bolívar Intl, RS	9	4E	10 28	PA1 NPA	

SAM Region- International Aerodromes/ Aeródromos Internacionales-Región SAM						
City/Aerodrome/Designation Ciudad/Aeródromo/Designación		RFF Category Categoría RFF	Physical Characteristics/ Características Físicas			Remarks Comentarios
			RC	Rwy No	Rwy Type	
1		2	3	4	5	6
				09 27	NINST	
SVMC	MARACAIBO/La Chinita Intl RS	9	4E	03 21	PA1 NPA	
SVMG	MARGARITA/Intl Del Caribe Gral. Santiago Marino RS	9	4E	09 27	PA1 NPA	
SVMT	MATURIN/General José Tadeo Monagas Intl. RS	7	4C	08 26	NPA NPA	
SVJC	PARAGUANA/Josefa Camejo Intl RS	7	4C	09 27	NPA NPA	
SVSA	SAN ANTONIO DEL TÁCHIRA/Gral. Juan Vicente Gómez Intl RG	7	3D	17 35	NPA NINST	
SVVA	VALENCIA/Arturo Michelena Intl RS	8	4D	10 28	NPA NPA	
SVBM	BARQUISIMETO/Gral. Jacinto Lara Intl. RS	7	4C	09 27	PA1 NPA	
SVPR	PUERTO ORDAZ/Gral. Manual Carlos Piar Intl RS	7	4C	08 26	NPA NPA	
SVSO	SANTO DOMINGO DEL TACHIRA/May. Buenaventura Vivas Intl. RG	7	4C	12 30	NPA	
SVCS	CARACAS/Oscar Machado Zuloaga Intl. RG	4	3B	10 28	PA1 NPA	

References / Referencias:

RS - International scheduled air transport, regular use /
Transporte aéreo internacional regular, uso regular

RNS - International non-scheduled air transport, regular use /
Transporte aéreo internacional no regular, uso regular

AS - International scheduled air transport, alternate use /
Transporte aéreo internacional regular, de alternativa de destino

ANS - International non-scheduled air transport, alternate use /
Transporte aéreo internacional no regular, de alternativa de destino

NINST - Non-instrument runway /
Pista de vuelo visual

NPA - Non-precision approach runway /
Pista para aproximaciones que no sean de precisión

PA1 - Precision approach runway, Category I /
Pista de aproximaciones de precisión, Categoría I

PA2 - Precision approach runway, Category II /
Pista de aproximaciones de precisión, Categoría II

PA3 - Precision approach runway, Category III /
Pista de aproximaciones de precisión, Categoría III

APPENDIX D

LONGITUDINAL SEPARATION LEVEL OF IMPLEMENTATION IN THE SAM REGION

ARGENTINA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of implementation	20 NM GNSS/ DME	Date of implementation	
CORDOBA	IQUIQUE					
	LA PAZ					
	EZEIZA					
	MENDOZA					
	RESISTENCIA					
RESISTENCIA	ASUNCION					
	CORDOBA					
	CURITIBA					
	EZEIZA					
	MONTEVIDEO					
EZEIZA	COMODORO RIVADAVIA					
	MENDOZA					
	PUERTO MONTT					
	CORDOBA					
	RESISTENCIA					
	MONTEVIDEO					
MENDOZA	EZEIZA					
	SANTIAGO					
	CORDOBA					
COMODORO RIVADAVIA	EZEIZA					
	PUNTA ARENAS					
	PUERTO MONTT					

BOLIVIA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
IA PAZ	AMAZÓNICO					
	ASUNCION					
	CURITIBA					
	CORDOBA					
	LIMA					
	IQUIQUE					

BRAZIL						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
AMAZÓNICO	BRASILIA					
	BOGOTÁ					
	CAYENNE					
	GEORGETOWN					
	LA PAZ					
	LIMA					
	MAIQUETIA					
	PARAMARIBO					
	RECIFE					
	ATLANTICO					
BRASILIA	AMAZÔNICO					
	CURITIBA					
	RECIFE					
CURITIBA	ASUNCION					
	BRASILIA					
	LA PAZ					
	MONTEVIDEO					
	RESISTÊNCIA					
	ATLÂNTICO					
RECIFE	AMAZÔNICO					
	BRASÍLIA					
	ATLÂNTICO					
ATLÁNTICO	AMAZÔNICO					
	CURITIBA					
	RECIFE					
	CAYENNE					

CHILE						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
SANTIAGO	IQUIQUE					
	LIMA					
	MENDOZA					
	PUERTO MONTT					
IQUIQUE	CORDOBA					
	LA PAZ					
	LIMA					
PUERTO MONTT	SANTIAGO					
	PUNTA ARENAS					
	EZEIZA					
	COMODORO RIVADAVIA					
PUNTA ARENAS	PUERTO MONTT					
	COMODORO RIVADAVIA					

COLOMBIA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
BOGOTÁ	AMAZÔNICO					
	CENAMER					
	GUAYAQUIL					
	LIMA					
	MAIQUETIA					
	PANAMÁ					
	BARRANQUILLA					
BARRANQUILLA	MAIQUETIA					
	PANAMÁ					
	BOGOTÁ					
	KINGSTON					
	CURAÇAO					

ECUADOR						
ACC	ACC ADJ	Longitudina separationl				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
GUAYAQUIL	BOGOTÁ					
	LIMA					
	CENAMER					

GUYANA FRANCESA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
CAYENNE	AMAZÔNICO					
	PARAMARIBO					
	PIARCO					

GUYANA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
GEORGETOWN	AMAZONICO					
	PIARCO					
	MAIQUETIA					
	PARAMARIBO					

PANAMÁ						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
PANAMÁ	BOGOTÁ					
	BARRANQUILLA					
	CENAMER					

PARAGUAY						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
ASUNCION	CURITIBA					
	LA PAZ					
	RESISTÊNCIA					

PERU						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
LIMA	AMAZONICO					
	BOGOTÁ					
	SANTIAGO					
	IQUIQUE					
	GUAYAQUIL					
	LA PAZ					

SURINAME						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
PARAMARIBO	AMAZÓNICO					
	GEORGETOWN					
	PIARCO					
	CAYENNE					

URUGUAY						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
MONTEVIDEO	CURITIBA					
	EZEIZA					
	RESISTENCIA					

VENEZUELA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
MAIQUETIA	AMAZONICO					
	BOGOTA					
	BARRANQUILLA					
	PIARCO					
	CAYENNE					
	CURAZAO					
	SAN JUAN					

APPENDIX E / APÉNDICE E

LIST OF CONTACTS FOR OPERATIONAL PBN FOCAL POINTS

LISTA DE CONTACTOS PARA PUNTOS FOCALES PBN

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
ARGENTINA*	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 Víctor Marcelo de Virgilio Jefe del Departamento Gestión del Espacio Aéreo Tel.: +5411 5789 8400, Ext 68454 E-mail: dsna@faa.mil.ar
BOLIVIA (Plurinational State of) / **BOLIVIA (Estado Plurinacional de)***	Luis Benjamín Rojas Santa Cruz Dirección General de Aeronáutica Civil (DGAC-BOLIVIA) Especialista Planificación de Espacios Aéreos y Procedimientos de Vuelo Tel.: +591 4 4221696 Cel.: +591 72035429 E-mail: lrojas@dgac.gob.bo
BRAZIL / BRASIL*	Luiz Antonio dos Santos Jefe ATM Departamento de Control del Espacio Aéreo (DECEA) Av. General Justo, 160 – Centro Rio de Janeiro 20.021-130, Brasil Tel: +55 21 2101-6088 E-mail: luizantoniolas@decea.gov.br Marcelo Marques Lobo Jefe de Sección del Espacio Aéreo Departamento de Control del Espacio Aéreo (DECEA) Av. General Justo, 160 – Centro Rio de Janeiro 20.021-130, Brasil Tel: +55 21 2101-6752 E-mail: lobomml@decea.gov.br

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
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 Hector Ibarra Martínez ATC Planificador ATM Dirección General Aeronáutica Civil (DGAC) Miguel Claro 1314 Providencia, Santiago, Chile Tel: +56 2 228364020 E-mail: hibarra@dgac.gob.cl Marco Abarca Daza ATC Diseñador de Procedimientos Dirección General Aeronáutica Civil (DGAC) Miguel Claro 1314 Providencia, Santiago, Chile Tel: +56 2 22904718 E-mail: mabarca@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
ECUADOR*	Marcelo Valencia Taco Tel: +593-2-2947400, Ext. 4084 E-mail: marcelo_valencia@aviacioncivil.gob.ec Vicente Navarrete Sarasti Tel: +593-2-2947400, Ext. 4086 E-mail: vicente.navarrete@aviacioncivil.gob.ec

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
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

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
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 Tomás Ben-Hur Macedo Cisneros Experto PANS-OPS en el Área de Normas y Procedimientos Controlador de Tránsito Aéreo CORPAC S.A. Callao, Perú Tel: +511 414-1442 E-mail: tmacedo@corpac.gob.pe
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

State/ Estado	PBN FOCAL POINTS PUNTOS FOCALES PBN
URUGUAY*	Rosanna Barú Jefa Dpto. Servicios Aeronáuticos División Navegación Aérea - DINACIA Tel: +5982604 0408 int. 4461 Cel: +598 99204 199 E-mail: rbaru@dinacia.gub.uy rocbb17@gmail.com Miguel Ángel Miraballes Alonzo Instructor/Asesor Técnico - DINACIA Diag 9 E "C" y "D" Sol y Luna, Parque del Plata Canelones, Uruguay Tel: +5984 375-2405 Cel: +598 96323872 E-mail: doblemaik@gmail.com
VENEZUELA (Bolivarian Republic of) / **VENEZUELA (República Bolivariana de)***	Omar Enrique Linares Planificador de Espacios Aéreos Instituto Nacional de Aviación Civil - INAC Aeropuerto Internacional Simón Bolívar Edificio ATC, piso 1, Oficina AIS Maiquetía, Vargas República Bolivariana de Venezuela Tel: +58 212 355-2898 E-mail: o.linares@inac.gob.ve ollinaresomar2@gmail.com Pablo Rattia Rodríguez Planificador de Espacios Aéreos Instituto Nacional de Aviación Civil - INAC Aeropuerto Internacional Simón Bolívar Edificio ATC, piso 1, Oficina AIS Maiquetía, Vargas República Bolivariana de Venezuela Tel: +58 426 531-0616 E-mail: p.rattia@inac.gob.ve

** Updated SAM/IG/15 / Actualizados en la SAM/IG/15*