International Civil Aviation Organization SAM/IG/20-WP/05
South American Regional Office 28/09/17
Twentieth Workshop/Meeting of the SAM Implementation Group (SAM/IG/20) – Regional Project RLA/06/901
(Lima, Peru, 16 to 20 October 2017)

Agenda Item 2: Optimisation of SAM airspace
- **a) PBN regional implementation progress**
- **b) Actions to standardise longitudinal separation between en-route aircraft**
- **c) Results and recommendations of PANS/OPS workshops**
- **d) Coordination of the SAM route network Version 04**

FOLLOW-UP TO PBN IMPLEMENTATION AS RELATES 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 the evolution of implementation activities related to the goals set forth in the Declaration of Bogota for the SAM Region, and other implementations related to airspace optimisation in the SAM Region, so that States may identify activities on which to focus efforts to meet the established goals.

REFERENCES:

- RAAC/13 (Bogota, Colombia, 4-6 December 2013) - Declaration of Bogota
- Fourth meeting of Air Navigation and Flight Safety Directors (Lima, Peru, 2-4 October 2017)
- Tenth meeting of the Coordination Committee of Project RLA/06/901, (Lima, Peru, 25-26 August 2016)
- SAM/IG meetings
- ATSRO meetings
- PANS-OPS workshops

ICAO strategic objectives:	*A - Safety* *E - Environmental protection*

1. Introduction

1.1 The Fourth Meeting of Air Navigation and Flight Safety Directors (Lima, Peru, 2-4 October 2017) reviewed, *inter alia,* the status of PBN implementation with respect to route optimisation, terminal areas, PBN approach procedures, as well as the reduction of CO_2 emissions, as part of the goals approved by the RAAC/13 meeting (Bogota, Colombia, 4-6 December 2013) in the Declaration of Bogota (Conclusion RAAC/13-8 - *Implementation of air navigation and safety priorities*).

1.2 The previous SAM/IG/19 meeting, held in May 2017, took note of the progress made in PBN implementation, as well as of the difficulties hindering implementation.

2. **Discussion**

Follow-up to PBN implementation with respect to the goals of the Declaration of Bogota

PBN Concept of Operations

2.1 In order to consolidate the implementation of the Declaration of Bogota and provide a conceptual frame of reference for the SAM Performance-based air navigation implementation plan (SAM-PBIP), a draft PBN Concept of Operations (CONOPS) for SAM Airspace was developed within the context of Project RLA/06/901.

2.2 The first draft of the CONOPS was reviewed by the SAM/IG/19 meeting, which agreed to its content and proposed that, taking into account that it is still being circulated, the period of application of the document should be modified. Accordingly, the triennium 2018-2020 was established.

2.3 Within the context of the review and updating of the SAM-PBIP, which would continue in 2018, it was deemed advisable to include the PBN concept of operations for SAM airspace 2018-2020 as an attachment to the aforementioned implementation plan.

2.4 The CONOPS proposes a table with metrics and performance indicators to measure the degree of continuity and the results of PBN implementation. In this regard, note is taken of the importance of developing indicators to measure performance goals in each PBN implementation, which can be expressed as improvement rates related to en-route delays, aircraft departure delays, fuel burn, ATC workload, increased capacity *vs.* demand, etc.

PBN en route

2.5 PBN implementation en route is discussed at ATSRO meetings, based on route network versions, to ensure that the best airspace structure is available under an integrated development concept. Paragraph 2.33 deals with the activities carried out by the ATSRO/08 meeting regarding Version 04 of the route network of the Region.

2.6 The Region has continued optimising the SAM route network, covering 65% of all routes in the upper airspace, exceeding by 5% the 60% goal established in the Declaration of Bogota, as shown in the following table:

% PBN routes implemented	**Declaration of Bogota indicator: % PBN routes**
65 %	60%

2.7 As noted at the SAM/IG/19 meeting, two meetings on PBN harmonisation, modernisation and implementation were held in 2016 in Fort Lauderdale (USA) and in San Jose (Costa Rica), leading to proposals for optimisation or implementation of a set of interregional RNAV routes. In this regard, a first implementation phase was agreed with AIRAC date 17 August 2017.

2.8 Accordingly, the following table shows the five optimised interregional routes, the interface with the CAR Region, and the SAM States involved in the implementation:

Optimized RNAV routes	CAR-SAM interface	SAM State
UL342	**CHAVE**	Venezuela
UL399	**REPIS**	Venezuela
UL576	**TRAPP**	Brazil, Suriname
UL462	**LUTCH**	Brazil, Suriname, Guyana
UL776	**KORTO**	Brazil, Suriname, Guyana
UL452	**MINDA**	Brazil, Suriname, Guyana

2.9 Due to the contingency following the earthquake that occurred in Mexico City last September, the Third PBN harmonisation, modernisation and implementation meeting for the NAM/CAR/SAM Regions was postponed. A new venue and date for the event will be defined in 2018.

PBN in TMAs

2.10 PBN redesign of the main South American TMAs was promoted through implementation workshops sponsored by Regional Project RLA/06/901. In 2016, two PBN training workshops were conducted, as well as the PANS-OPS/1 workshop on flight procedure design and the corresponding ICAO criteria, which reinforces the competencies of the designers of the Region and allows for the exchange of information on user requirements.

2.11 In this sense, the PANS-OPS/2 workshop was conducted on the week of 18 September 2017, with the participation of 25 State designers and airline experts. Paragraph 2.27 of this working paper describes the results of that workshop.

2.12 The new PBN airspace of the Asunción FIR and TMA and the Silvio Pettirossi international airport entered into force in August 2017. Likewise, on 12 October of this year, *Aerocivil* of Colombia implemented the new TMA of Bogota with RNAV/RNP approach procedures and standard routes for the El Dorado airport, which included the reconfiguration of the main flows to/from Medellín and to/from the Colombian Caribbean.

2.13 PBN optimisation in the East-West flows between Brazil, Argentina and Uruguay is still underway. Through the PBN SUL project, which became effective on 12 October, significant improvements have been made in the Curitiba FIR, resulting in the optimisation of several main TMAs (Curitiba, Florianopolis, Santa Maria, Porto Alegre, etc.) and major airports in southern Brazil. Furthermore, a set of routes were realigned in coordination with Uruguay, although still with no changes in the FIR boundary points, that is, they are ready to connect with the paths that may result in the future from improvements in the Baires and Montevideo TMAs.

2.14 PBN procedures have already been implemented at the Argentinian airports of Aeroparque, Córdoba, Salta and Iguazú, amongst others. It is expected that the implementation of Version 04 of the route network will create the conditions for connecting the airspaces serving flows between Curitiba, Montevideo and Buenos Aires and *vice versa*. Likewise, it is expected that the design of the Baires TMA and the reorganisation that includes training of ATC personnel will be completed by the first semester of 2019. At present, Panama is defining a process for promoting activities to improve and redesign the TMA airspace of the Tocumen airport.

2.15 An important aspect is the investment made in PANS-OPS training of the personnel of the administrations of Argentina, Bolivia, Ecuador, Uruguay, Guyana and Peru. The lack of PANS-OPS designers is being gradually reversed in the Region.

2.16 SAM States are updating the implementation dates in their action plans. The following table shows the 93% of States that have submitted their Action plans for PBN redesign of selected airspaces:

May 2017	ARG	BOL	BRA	CHI	COL	FGY	ECU	GUY	PAN	PAR	PER	SUR	URU	VEN
93%	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES

2.17 The tentative dates of implementation, based on the aforementioned action pans, shall be defined and updated at this Meeting by the States that have not yet completed their activities. The status of implementation is shown in the following table:

PBN redesign of selected airspaces			
State			**Implementation**
Argentina	BAIRES		**TBD at SAM/IG/20**
Bolivia	Cochabamba		**TBD at SAM/IG/20**
	La Paz		**TBD at SAM/IG/20**
	Santa Cruz		**TBD at SAM/IG/20**
Brazil	Brasilia		12 Nov 2015 (implemented)
	Belo Horizonte		12 Nov 2015 (implemented)
	Sao Paulo (partial modifications)		12 Nov 2015 (implemented)
	Salvador		27 Apr 2017 (implemented)
	Manaus		17 Aug 2017 (implemented)
	(PBN SUR)	Curitiba	12 Oct 2017 (implemented)
		Florianopolis	
		Joinville	
		Navegantes	
		Porto Alegre	
		São Paulo (modifications)	
		CW FIR route network	
Chile	Santiago (Sur)		08 Dec 2016 (implemented)
	Santiago FIR route network		
Colombia	Bogota		12 Oct 2017 (implemented)
Ecuador	Guayaquil		21 Jul 2016 (implemented)
Panama	Panama		**TBD at SAM/IG/20**
Paraguay	Asunción		17 Aug 2017 (implemented)
Peru	Arequipa		**TBD at SAM/IG/20**
	Cuzco		**TBD at SAM/IG/2**
	Juliaca		**TBD at SAM/IG/20**
	Puerto Maldonado		**TBD at SAM/IG/20**

PBN redesign of selected airspaces		
State		**Implementation**
Uruguay	Carrasco and Laguna del Sauce	**TBD at SAM/IG/20**
Venezuela	Maiquetía	**TBD at SAM/IG/20**

Implementation of PBN SIDs, STARs and approach procedures

2.18 The *Declaration of Bogota* commits States to the implementation of PBN SIDs and STARs at international aerodromes with a view to attaining the established goals, based on CDO and CCO. Likewise, the aforementioned Declaration urges States to implement APV approach procedures in compliance with ICAO Assembly Resolution A37-11.

2.19 Taking into account recent implementations in Argentina, Brazil, Paraguay and Colombia, implementation of PBN SIDs/STARs as of 12 October reaches 72.9%. The goal of the Declaration of Bogota was 60% by 2016. See the following table:

Indicator: % of PBN SIDs/STARs at international airports	**Indicator: % of PBN SIDs/STARs at international airports**
As of 12 October 2017	2016 goal
72.9%	60%

2.20 Associated to the design of arrival and departure procedures is the application of CDO and CCO, which have reached the following implementation percentages: CDO 34% and CCO 26%.

2.21 Regarding the commitment assumed by all States at the 37th General Assembly of ICAO, pursuant to Resolution A37-11 concerning the implementation of PBN approaches, the States continue making efforts to achieve the 100% goal, which was expected to be reached in 2016. As of 12 October, implementation has reached 78.6%. The following table shows the current status:

Indicator: ICAO A37-11 % APV on IFR runways	
As of 12 October 2017	2016 goal
78.6 %	100 %

Environmental benefits derived from CO_2 reduction during the period 2013-2017

2.22 The process of reducing CO_2 emissions in the SAM Region is based on the implementation of PBN flight procedures and more efficient RNAV routes. As part of the airspace optimisation process, the IFSET tool calculates savings in flight distance and the efficiency of aircraft arrival/departure profiles, allowing for the identification of fuel savings for a given number of operations, expressed in the reduction in CO_2 emissions.

2.23 It has been estimated that, between January 2014 and June 2017, airspace improvements in the SAM Region resulted in CO_2 savings in the order to 93,516 tonnes, according to the following table:

Year	***CO_2 tonnes***
2014	51,132
2015	23,351
2016	11,000
2017 *	8,033
Total	**93,516**

** until June 2017*

2.24 Those States that have recent CO_2 reduction estimates shall present them at the Meeting for their inclusion in the cumulative table.

2.25 As part of the lessons learned, emphasis was placed on the need to receive feedback on calculations of fuel savings and CO_2 emissions based on data from aircraft operators, and also to include, as part of the variables to be analysed, the increase in the number of aircraft operations in the flows of the Region.

PBN focal points of the regulator and of the air navigation service provider

2.26 The list of PBN focal points of the regulator and of the air navigation service provider (ANSP) for purposes of coordination and teleconferencing is attached as **Appendix A** to this working paper. States must update this list at this Meeting, as necessary.

PANS-OPS workshops

2.27 PBN and PANS-OPS workshops are part of the PBN implementation strategy in the Region, since they are aimed at improving the competencies of flight procedure designers under ICAO criteria and other internationally applied methods. They also strengthen the collaborative relationship with experts and airline pilots, receiving valuable feedback on user requirements.

2.28 The Second PANS-OPS implementation workshop for the SAM Region (PANS-OPS/2) was held in Lima, Peru, on 18-22 September 2017, under the auspices of Project RLA/06/901, pursuant to ICAO Assembly Resolution A37-11, whereby the global implementation of performance-based navigation (PBN) was approved.

2.29 The workshop was attended by 22 experts from 10 States, 6 experts from the airlines and IATA, and a professor from the *Universidad Técnica del Callao* of Peru. The topics addressed related to the application of the criteria set forth in Doc 8168, Doc 9613, Doc 9905 and others related to these activities, as well as the topics presented by the airlines on operational requirements, coding, flight validation, and aircraft performance, are shown in the following link:

https://www.icao.int/SAM/Pages/ES/MeetingsDocumentation_ES.aspx?m=2017-PANSOPS2

2.30 The workshop reviewed the progress made in the implementation of the recommendations issued by the PANS-OPS/1 workshop, held in 2016, which are monitored using a table that is maintained since the SAM/IG/19 meeting.

2.31 The State representatives and all the participants agreed to ratify the validity of the recommendations issued by the PANS-OPS/1 workshop, noting that efforts should continue towards the implementation of these recommendations. Bolivia, Brazil, Chile, Paraguay, Peru, Uruguay and Venezuela updated the data contained in the aforementioned table, as shown in **Appendix B**.

2.32 Likewise, regarding other actions suggested at the PANS-OPS/1 meeting, the PANS-OPS/2 workshop took note that coordination on certain topics should be resumed, probably through periodic teleconferences. This included the need to develop a Regional guide on the design and use of visual RNAV procedures.

Coordination of version 4 of the SAM route network and the ATSRO/08 meeting

2.33 As agreed by the RCC/10 meeting, in order to continue with the activities concerning airspace optimisation and PBN implementation in the en-route segment, a preliminary document on Version 04 of the SAM Route Network was prepared in June 2017 based on the SAM PBN Concept of Operations - Period 2018-2020.

2.34 The ATSRO/8 meeting was held on 11-15 September 2017, in which States assessed and coordinated the implementation of Version 04 of the route network. The meeting created three working groups, which presented the results for each initiative, as shown in the final report posted on Regional Office website:

https://www.icao.int/SAM/Pages/ES/MeetingsDocumentation_ES.aspx?m=2017-ATSRO8

2.35 The meeting noted that the results of the analysis and coordination activities, in some cases, called for an internal review or validation by other technical or operational instances of the States. In this regard, proposals were received, some of which were considered as accepted and others as sufficiently viable to warrant continued coordination through the Secretariat.

2.36 In total, the meeting analysed 95 initiatives, of which 30 were accepted and 13 were rejected. The remaining 52 initiatives will be the subject of coordination.

2.37 The meeting approved Conclusion ATSRO/8-1, defining a 3-stage timetable for the publication of route modifications on AIRAC dates in June, August and October 2018, taking into account two AIRAC cycles prior to effective implementation.

2.38 A meeting of SAM States for updating letters of agreement and contingency plans has been scheduled for April 2018, in which States will review data concerning aircraft transfer and ATS management in the optimised routes, as well as coordination with the Mexico NACC Office with a view to developing joint route improvement initiatives based on NAM and CAR flows.

Actions to standardise longitudinal separation of aircraft en route

2.39 The reduction of longitudinal separation applies to GNSS-equipped aircraft. In case one or the two aircraft participating in a longitudinal separation do not have GNSS capability, then the separation applied to that traffic would be 80 NM.

2.40 As noted at the SAM/IG/19 meeting, there is a set of letters of agreement or memoranda of understanding containing the commitments assumed at the SAM/IG/17 meeting regarding the reduction of longitudinal separation. **Appendix C** shows the agreements reached between the different adjacent FIRs.

2.41 Although the Paramaribo and Atlántico FIRs remain mostly with oceanic separation, the implementation process has been very positive in the States of the Region, although more coordination is required with adjacent CAR States.

2.42 The reported status of implementation with the ACCs of adjacent States is as follows:

86%	**ARG**	**BOL**	**BRA**	**CHI**	**COL**	**FGY**	**ECU**	**GUY**	**PAN**	**PAR**	**PER**	**SUR**	**URU**	**VEN**
	YES	YES	YES	NO*[2]	YES	NO*[1]	YES	YES	YES	YES	YES	YES	YES	YES

*[1] French Guiana applies oceanic separations with neighbouring States.
*[2] Chile has not yet completed the external processes for reducing the longitudinal separation with adjacent ACCs of other States.

2.43 It is expected that the updating of letters of agreement and memoranda of understanding will continue at this Meeting. Likewise, with the support of Project RLA/06/901, a 4-day workshop will be conducted on 6-10 November 2017 at the SAM Regional Office, where an Action plan to promote a reduction from 40 to 20 NM will be proposed, as well as the continuation of the signing and effective implementation of letters of agreement between States to consolidate the 40 NM separation.

SAM airspace optimisation action plan

2.44 Accordingly, a revised version of the SAM airspace optimisation action plan is required. The Secretariat wishes to highlight that the ATSRO/08 meeting requested the incorporation of the ATSRO Action Plan into the updating of the Optimisation plan that is submitted for discussion and approval. This Optimisation plan must address issues related to PBN implementation and aircraft longitudinal separation improvement, the updating of letters of operational agreement and, complementarily, the updating and consistent implementation of ATS contingency plans.

2.45 In this sense, **Appendix D** contains the SAM airspace optimisation action plan, which must be analysed by the Meeting in order to make amendments as necessary.

Activities and resources required for the implementation of the SAM airspace optimisation action plan with the support of Project RLA/06/901

Activities and resources approved for 2018 with the support of Project RLA/06/901

2.46 The Eleventh meeting of the Coordination Committee of Project RLA/06/901 (RCC/11) approved the following activities in support of SAM airspace optimisation for 2018:

- *Third PANS-OPS implementation workshop* - To continue with the harmonisation and coordination of PBN instrument procedures in the SAM Region, advanced RNP and CDO /CCO.
- *Seminar on the organisation of flight procedure design (IFPD) services* - To address the implementation of the IFPD service in accordance with ICAO Annex 11 and supplementary documents. Aimed at strengthening regional capacity to sustain PBN implementation over time.
- Preparation of the draft Version 05 of the SAM route network - Deliverable: Document containing Version 05 of the SAM route network.
- *ATSRO/9* - Follow-up to the implementation of Version 04 of the SAM route network (final version).
- *SAM/IG/21* - All air navigation implementation priorities contemplated in the Declaration of Bogota - In order to continue with implementation activities related to the action plans developed by the Project in the AGA, AIM, ATM, CNS and MET areas.
- *SAM/IG/22* - All air navigation implementation priorities contemplated in the Declaration of Bogota - In order to continue with implementation activities related to the action plans developed by the Project in the AGA, AIM, ATM, CNS and MET areas.
- *ATS meeting for contingency plans and letters of operational agreement* - Updating and harmonisation of contingency plans in accordance with ICAO Annex 11, and signing of ATS letters of agreement.
- *Support to ASBU implementation - Workshop on the identification and implementation of performance indicators of air navigation systems in the SAM Region* - Identification of performance indicators for air navigation systems in the SAM Region for their inclusion in regional plans and national plans of the States.

PBN implementation strategy in the SAM Region

2.47 SAM/IG meetings promote a PBN implementation strategy in TMA and en-route airspace, approving various activities. Some of these activities, such as PBN workshops and the PANS/OPS workshop were included in the airspace optimisation work plan.

2.48 Taking into account that SAM/IG meetings would not be enough for such follow-up, it would be advisable to resume monthly PBN teleconferences. In summary, PBN implementation would be based on the following activities/events.

a) Updating of the SAM-PBIP document and drafting of Volume III of the eANP.

b) Conduction of a workshop on performance indicators on the second semester of 2018, and development of a data collection process for calculating the performance indicators contemplated in the PBIP, as well as a simple tool to facilitate such calculation and its submission.

c) ATSRO/9 meeting, with activities to follow-up the implementation of Version 04 of the ATS route network and make adjustment thereto.

d) Development of a draft Version 05 of the ATS route network.

e) PBN implementation in TMAs - SAM/IG meetings and monthly teleconferences (last Thursday of each month).

f) Harmonisation and coordination of PBN instrument procedures in the SAM Region – PANS-OPS workshops.

g) Longitudinal separation optimisation - multilateral and bilateral meetings.

h) Meetings for updating contingency plans and ATS letters of agreement, to guarantee safety and consolidate PBN implementation and improvement, in addition to ensuring that benefits are derived.

i) Workshop for drafting an action plan for promoting the reduction from 40 to 20 NM, and continuing with the signing and effective implementation of letters of agreement between States to consolidate the 40 NM separation.

j) Coordination and harmonisation of the route network and longitudinal separation between CAR/SAM Regions - NAM/CAR/SAM interregional implementation meetings and teleconferences.

3. **Suggested action:**

3.1 The Meeting is invited to:

a) take note of the information provided in this working paper;

b) update the tentative dates for PBN redesign of selected airspaces, and deliver the updated PBN action plans to the Secretariat;

c) review the information provided in Appendix A, and inform the Secretariat if any changes are required;

d) review, propose changes or improvements, and approve the SAM PBN implementation strategy;

e) review the information provided in Appendix B, and update the implementation process if so required;

f) update the information contained in Appendix C in relation to the status of implementation of longitudinal separation optimisation in the SAM Region;

g) coordinate with the Secretariat in the case of States that need to update or sign LoAs or MoUs on longitudinal separation;

h) review the information provided in Appendix D in relation to the SAM airspace optimisation action plan and inform the Meeting if any improvement is required; and

i) submit to the Secretariat all information on calculated fuel savings related to route optimisation or redesign of selected airspaces.

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APPENDIX A / APÉNDICE A

LIST OF CONTACTS FOR OPERATIONAL PBN FOCAL POINTS

LISTA DE CONTACTOS PARA PUNTOS FOCALES PBN

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** Updated SAM/IG/18 / Actualizados en la SAM/IG/18*

APPENDIX B

PANS-OPS/1 WORKSHOP RECOMMENDATIONS

Conclusion/Task	ARG	BOL	BRA	CHI	COL	ECU	FGI	GUY	PAN	PAR	PER	SUR	URU	VEN	REMARKS
1. IFPP Panel 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.	OG	OG	OG	YES		YES			YES	OG	OG		OG	YES	Argentina: Applies Resolution 457 of year 2016, which included the use of TERPS-FAA Concepts for IFP designs.
2.Changes in the denomination of approach procedures (Circular 336) 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..	YES		NO			OG					NO		YES	OG	Argentina: Yes Rest of States: Pending recommendation is assumed as indicated in ICAO bulletin suspending Circular 336
3. Procedure validation That SAM States consider the adoption of documentation on ground and flight validation of procedures, similar to that applied by Argentina.	YES	YES	NO	OG		OG			YES	NO	YES		OG	OG	Brazil counts with a consolidated ground validation process

Conclusion/Task	ARG	BOL	BRA	CHI	COL	ECU	FGI	GUY	PAN	PAR	PER	SUR	URU	VEN	REMARKS
4. RNAV1/RNP/1 in SID/STARs 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.	YES	OG	YES	OG		YES			YES	YES	OG		OG	YES	
5. RNAV-1 and RNP-1 in RNAV/ILS approaches 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.	YES	OG	YES	OG		YES			YES	YES	OG		OG	OG	
6. Advanced RNP (A-RNP) 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.	YES	OG	OG	NO		NO			OG	OG	OG		NO	OG	
7. ATC gradient 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	YES	YES	NO	OG YES		OG NO			OG	OG	NO		OG OG	YES	

Conclusion/Task	ARG	BOL	BRA	CHI	COL	ECU	FGI	GUY	PAN	PAR	PER	SUR	URU	VEN	REMARKS
enhance situational awareness of controllers and pilots.															
8. Identification of SIDs/STARs • That 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.	YES	YES	YES	OG OG		OG NO			OG	YES N/A	OG OG		YRS NO	YES	
9. Minimum altitudes of SIDs 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.	YES	OG	OG	OG YES		YES YES			OG	YES	YES YES		YES YES	YES	

Conclusion/Task	ARG	BOL	BRA	CHI	COL	ECU	FGI	GUY	PAN	PAR	PER	SUR	URU	VEN	REMARKS
10. Level segments to intercept the ILS glide slope 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.	YES	YES	YES	OG OG		YES YES			OG	YES	YES YES		OG YES	YES	
11. Elimination of publication of procedures on paper 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.	NO	OG	NO	OG		YES			OG	OG	NO		OG	YES	

Conclusion/Task	ARG	BOL	BRA	CHI	COL	ECU	FGI	GUY	PAN	PAR	PER	SUR	URU	VEN	REMARKS
12. Retirement of information on ceiling and MDA/MDH from approach charts 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..	NO	YES	YES	OG		OG			YES	YES	YES		NO	YES	
13. Application of CCO/CDO techniques at airports with low traffic volume 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.	NO YES	NO	YES	NO YES		YES YES			OG	YES	NO YES		YES YES	YES	

APPENDIX C

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	OG				
	LA PAZ	YES	01/01/17			
	EZEIZA			YES	13/10/2016	
	MENDOZA			YES	13/10/2016	
	RESISTENCIA			YES	13/10/2016	Some problems with VHF Com.
RESISTENCIA	ASUNCION	YES	01/01/17			
	LA PAZ	YES	01/01/17			
	CORDOBA			YES	13/10/2016	
	CURITIBA	YES	01/01/17			
	EZEIZA			YES	13/10/2016	
	MONTEVIDEO	YES	01/01/17			
EZEIZA	COMODORO RIVADAVIA			YES	13/10/2016	
	MENDOZA			YES	13/10/2016	
	PUERTO MONTT	OG				
	CORDOBA			YES	13/10/2016	
	RESISTENCIA			YES	13/10/2016	
	MONTEVIDEO	YES	01/01/17	YES	2010	PAPIX, KUKEN and DORBO 20NM
MENDOZA	EZEIZA			YES	13/10/2016	
	SANTIAGO	OG				
	CORDOBA			YES	13/10/2016	
COMODORO RIVADAVIA	EZEIZA			YES	13/10/2016	
	PUNTA ARENAS	OG				
	PUERTO MONTT	OG				

BOLIVIA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
LA PAZ	AMAZÓNICO	YES	01/01/17			
	ASUNCION	YES	01/01/17			
	CURITIBA	YES	01/01/17			
	CORDOBA	YES	01/01/17			
	LIMA	OG				
	IQUIQUE	OG				
	RESISTENCIA	YES	01/01/17			

BRAZIL						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
AMAZÓNICO	BRASILIA	---	---	---	---	10NM
	BOGOTÁ	YES	13/10/16			
	CAYENNE	---	---	---	---	10 Minutes
	CURITIBA	---	---	---	---	10NM
	GEORGETOWN	YES	07/01/16			
	LA PAZ	YES	01/01/17			
	LIMA	YES	31/03/16			COM/SUR required, does not apply, overflights from/to La Paz FIR
	MAIQUETIA	YES	23/10/16			
	PARAMARIBO	YES	13/10/16			
	RECIFE	---	---	---	---	10NM
	ATLANTICO	---	---	---	---	10 Minutes
BRASILIA	AMAZÔNICO	---	---	---	---	10NM
	CURITIBA	---	---	---	---	5NM
	RECIFE	---	---	---	---	5NM
CURITIBA	ASUNCION	YES	Mar/2016			
	AMAZONICO	---	---	---	---	10NM
	BRASILIA	---	---	---	---	5NM
	LA PAZ	YES	01/01/17			
	MONTEVIDEO	YES	01/01/17			
	RECIFE	---	---	---	---	5NM
	RESISTÊNCIA	YES	01/01/17			
	ATLÂNTICO	---	---	---	---	10 Minutes
RECIFE	AMAZÔNICO	---	---	---	---	10NM
	BRASÍLIA	---	---	---	---	5NM
	CURITIBA	---	---	---	---	5NM
	ATLÂNTICO	---	---	---	---	10 Minutes
ATLÁNTICO	AMAZÔNICO	---	---	---	---	10 Minutes VHS Com. problems
	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					5NM
	LIMA	OG				
	MENDOZA	OG				
	PUERTO MONTT					5NM
IQUIQUE	CORDOBA	OG				
	LA PAZ	OG				
	LIMA	OG				
PUERTO MONTT	SANTIAGO					5NM
	PUNTA ARENAS					5NM
	EZEIZA	OG				
	COMODORO RIVADAVIA	OG				
PUNTA ARENAS	PUERTO MONTT					5NM
	COMODORO RIVADAVIA	OG				

COLOMBIA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
BOGOTA	AMAZÔNICO	YES	13/10/16			
	CENAMER					No available information
	GUAYAQUIL	YES	13/10/16			Reduced separation of 40 NM is applied. Memorandum of Understanding among ATC service providers signed.
	LIMA	YES	31/03/16			COM SUR required, does not apply overflights
	MAIQUETIA	YES				Informed on 23/3/2017
	PANAMÁ	YES	Oct/16			
	BARRANQUILLA					No available information
BARRANQUILLA	MAIQUETIA	YES				Informed on 23/3/2017
	PANAMÁ	YES	Oct/16			
	BOGOTÁ					No available information
	KINGSTON					No available information
	CURAÇAO					No available information

ECUADOR						
ACC	ACC ADJ	Longitudina separationl				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
GUAYAQUIL	BOGOTÁ	YES	13/10/16			Reduced separation of 40 NM is applied. Memorandum of Understanding among ATC service providers signed.
	LIMA	YES	31/03/16			COM/SUR required, does not apply overflights. Updated with signing of LoA during SAM/IG/18, limitations on overflights is eliminated since 10/11/16.
	CENAMER	NO	---	N/A	---	Oceanic Separation

FRENCH GUIANA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
CAYENNE	AMAZÔNICO	---	---	---	---	10 Minutes
	PARAMARIBO	---	---	---	---	10 Minutes
	PIARCO					No available information

GUYANA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
GEORGETOWN	AMAZONICO	YES				
	PIARCO					No available information
	MAIQUETIA	OG				
	PARAMARIBO	YES				

PANAMÁ						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
PANAMÁ	BOGOTÁ	YES	Oct/16			
	BARRANQUILLA	YES	Oct/16			
	CENAMER	OG	Oct/16			

PARAGUAY						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
ASUNCION	CURITIBA	YES	Mar/16			
	LA PAZ	YES	01/01/17			
	RESISTÊNCIA	YES	01/01/17			

PERU						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
LIMA	AMAZONICO	YES	31/03/16			COM/SUR required, does not apply overflights to/ from La Paz FIR
	BOGOTÁ	YES	31/03/16			COM/SUR required, does not apply overflights
	SANTIAGO	OG				
	IQUIQUE	OG				
	GUAYAQUIL	YES	31/03/16			COM/SUR required, does not apply overflights. With updated LoA signed during SAM/ IG/18, overflights limitation is eliminated since 10/11/16.
	LA PAZ	OG				

SURINAME						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
PARAMARIBO	AMAZÓNICO	YES	13/10/16			OG
	GEORGETOWN	YES	29/03/16			Signed
	PIARCO	N/A				Oceanic Separation
	CAYENNE	N/A	---	---	---	Oceanic Separation

URUGUAY						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
MONTEVIDEO	CURITIBA	YES	01/01/17			
	EZEIZA	YES	01/01/17	YES	2010	PAPIX KUKEN DORBO 20NM
	RESISTENCIA	YES	01/01/17			

VENEZUELA						
ACC	ACC ADJ	Longitudinal separation				Comments
		40 NM GNSS/ DME	Date of Implementation	20 NM GNSS/ DME	Date of implementation	
MAIQUETIA	AMAZONICO	YES	23/10/15			
	BOGOTA	YES				Informed on 23/3/2017
	BARRANQUILLA	YES				Informed on 23/3/2017
	PIARCO					Negotiating
	CURAZAO	NO				Curazao does not accept.
	SAN JUAN	NO				San Juan has no conditions to implement
	GEORGETOWN	OG				

APPENDIX D

ACTION PLAN FOR THE OPTIMISATION OF SAM REGION AIRSPACE

Activity	Start	End	Responsible	Remarks
1. **PBN EN ROUTE: SAM Route Network**				
1.1. **Version 04 of Route Network – RNAV-5**				
1.1.1. Perform detailed study of the SAM ATS Route Network, with a view to developing Version 04 of the Route Network (TMA - Arrival/Departure/RNAV-5 route segment interface), including: • Prepare work plan for the participation of hired/loaned experts and experts from States/International Organizations who would support the preparation of the preliminary draft. • Determine tools required to conduct the study (aeronautical charts, specific software). • Analyse traffic data to understand traffic flows. • Analyse fleet navigation capacity. • Prepare the preliminary draft of Version 04 of the SAM Route Network, including control sectors, TMA interface, etc. • Assess the feasibility/need to assess the preliminary design using "*airspace modelling*" tools and fast-time ATC simulation. • Propose the initial draft of the Proposal of Amendment to the CAR/SAM ANP. • Prepare the Plan for the Optimisation of Restricted, Prohibited, Danger and Reserved Use Zones of the SAM Region.	SAM/IG/18 (October 2016)	June 2017	SAM/PBN/IG (Project RLA/06/901) States IATA IFALPA ATM RO	• Hiring/"loaning" of 2 experts for 3 weeks in order to prepare a preliminary draft. NOTE: PBN implementation in SAM TMAs progressed during 2016 and 2017. Examples: Argentina (Baires in process), Brazil, Colombia and Paraguay. **FINALISED**

Activity	Start	End	Responsible	Remarks
• Calculate fuel/CO_2 savings using IFSET to validate the preliminary design of the SAM airspace structure, covering routes/SIDs/STARs. • Prepare "SAM Route Network, Version 04" document. • Prepare working paper for the ATSRO/8 meeting.				
1.1.2. Hold the Eighth Workshop/Meeting on SAM ATS Routes Optimisation, with the purpose of reviewing Version 04 of the Route Network. Includes: • Review draft Version 04 of the ATS Route Network. Define implementation process.	SAM/IG/18 (October 2016)	ATSRO/8 (September 2017)	Project RLA/06/901 States ATM RO	
1.1.3. Joint work with States for them to perform the risk analysis on the SAM Region Route Network, Version 04.	ATSRO/8 (September 2017)	ATSRO/9 (July 2018)	Project RLA/06/901 States ATM RO	• Will be done through teleconferences and distribution of documents as guideline, if required.
1.1.4. Analysis and incorporation in SAM implementation activities, of route optimisation initiatives originated in the CAR Region and coordinated with NACC Office.	NACC III PBN Meeting (September 2017)	ATSRO/9 (July 2018)	Project RLA/06/901 States ATM RO	• Will be done through teleconferences. Coordination during SAM/IG/21 meeting (May 2018) will be considered.

Activity	Start	End	Responsible	Remarks
1.1.5. Conduct the Ninth Workshop/Meeting on SAM ATS Routes Network Optimisation, with the purpose of monitoring the implementation of Version 04 of the Route Network and adjusting the programme of publication and entry into force. Initiatives coordinated with NACC Office will be included.	ATSRO/8 (September 2017)	ATSRO/9 (July 2018)	Project RLA/06/901 States ATM RO	
1.1.6. NAM-CAR-SAM inter-regional coordination to define implementation of exclusive RNAV-5 airspace above FL245.	TBD	TBD	SAM Regional Office NACC Regional Office	
1.2. **Version 05 of Route Network** o **RNAV-5 Regional and Inter-regional upper airspace** o **RNAV-5 for airspace below FL245** o **RNP2 for Continental and Oceanic airspaces**				
1.2.1. Perform study to develop Version 05 of Route Network, considering implementation of RNAV-5 and RNP2 navigation specification in selected airspaces. It includes: • Prepare work plan on the participation of hired/loaned experts and experts from the States/International Organizations who would support the preparation of the preliminary draft. • Define the tools required to conduct the study (aeronautical charts, specific software). • Analyse traffic data. Study of regional and inter-regional upper airspace routes network, optimization and replacement of conventional routes.	ATSRO/8 (September 2017)	SAM/IG/22 (2018)	Project RLA/06/901	2 experts will be hired for 3 weeks. Tentative date: September 2018

Activity	Start	End	Responsible	Remarks
• Analyse TMA or involved aerodromes interfaces. Select airspaces for RNAV-5 application in regional route. • Analyse traffic data for airspace involving regional routes below FL245. Analyse fleet navigation capacity, in detail on the general aviation fleet. • Analyse traffic data for RNP2 oceanic airspace. Analyse fleet navigation capacity. • Prepare the Plan for Optimisation of Restricted, Prohibited, Danger and Reserved Use Zones of the SAM Region. • Calculate fuel/CO_2 savings using IFSET to validate the preliminary design of the SAM airspace structure, covering routes/SIDs/STARs. • Develop deliverable "Version 05 of SAM Route Network", including harmonized implementation plan. • Prepare working paper for SAM/IG/23.				
1.2.2. Review preliminary deliverable of Version 05 of Route Network. Analyse and propose changes to harmonized implementation plan, as required.	SAM/IG/23 (2019)	SAM/IG/23 (2019)	Project RLA/06/901 States ATM RO	
1.2.3. Hold the Tenth Workshop/Meeting on SAM ATS Routes Network Optimisation, to review Version 05 of the Route Network. It includes: • Review draft Version 05 of the ATS Routes Network. Define process according to harmonized implementation plan for RNP2 and selected airspaces below FL245, respectively.	SAM/IG/23 (2019)	ATSRO/10 (2019)	Project RLA/06/901 States ATM RO	

Activity	Start	End	Responsible	Remarks
1.2.4. Perform risk analysis of Version 05 of the SAM ATS Routes Network, coordinating such activities with involved States.	ATSRO/10 (2019)	TBD	Project RLA/06/901 States ATM RO	1 expert will be hired for 2 weeks.
1.2.5. Hold the Eleventh Workshop/Meeting on SAM ATS Routes Network Optimisation, with the purpose of monitoring implementation of Version 05 of Routes Network and adjusting the programme of publication and entry into force.	TBD	TBD	Project RLA/06/901 States ATM RO	
1.3. **Aircraft longitudinal separation**				
1.3.1. Workshop for the optimization of aircraft longitudinal separation.	SAM/IG/20	9 November 2017	Project RLA/06/901	OBJECTIVE: Workshop to develop an action plan to promote the reduction from 40 to 20 NM, and continue the signature and effective application of Letters of Agreement between States to consolidate 40 NM separation.

Activity	Start	End	Responsible	Remarks
1.4. **Updating of ATS Letters of Agreement and Contingency Plans**				
1.4.1. ATS meetings for contingency Plans and Operational Letters of Agreement.	SAM/IG/20	March 2018	Project RLA/06/901	OBJECTIVE: Update and harmonization of contingency plans according to ICAO Annex 11 and signature of ATS Letters of Agreement. Ensure safety and consolidate implementations and PBN improvements, in addition to guarantee its benefits.
2. **PBN IN TMA AND PBN IN APPROACH**				
2.1.1. Seminar on Flight Procedure Design Services organization (IFPD).	SAM/IG/20	April 2018	Project RLA/06/901	OBJECTIVE: Approach the implementation of IFPD service, according to ICAO Annex 11 and complementary documents. Aimed to strengthen the capacity of the Region concerning PANS-OPS design, in order to support PBN implementation over time.

Activity	Start	End	Responsible	Remarks
2.1.2. Third PANS-OPS implementation workshop.	SAM/IG/20	August 2018	Project RLA/06/901	OBJECTIVE: To continue the harmonization and coordination of PBN instrumental procedures, Advanced RNP and CDO/CCO in the SAM Region.
2.1.3. Study for the development of a Regional Guideline for the design and use of RNAV Visual procedures.	TBD	TBD	TBD	OBJECTIVE: To count with a Regional Guideline for the design and use of RNAV Visual procedures, avoiding proliferating diverse criteria in the Region. Required: hiring of one expert of the Region.