



Agenda Item 3: Review of the GREPECAS Programmes and Projects

3.1 Projects under the PBN Programme (B0-APTA, B0-FRTO, B0-CDO and B0-CCO)

Follow-up to the activities under Project A1 (PBN implementation) and Project A2 (Air navigation system in support of PBN)

(Presented by the Secretariat)

SUMMARY	
This working paper presents a report on the evolution of implementation activities related to the projects “ <i>PBN implementation</i> ” and “ <i>Air navigation system in support of PBN</i> ” under the PBN Programme, approved by the GREPECAS/16 for the CAR and SAM Regions, since the Second Meeting of the Programmes and Projects Review Committee (PPRC/2).	
REFERENCES:	
<ul style="list-style-type: none">• Doc 9750, Global Air Navigation Plan• Doc 9613, ICAO PBN Manual, 4th Edition• GREPECAS/16 meeting report• Report of the Second Meeting of the Programmes and Projects Review Committee (PPRC/2) (Lima, Peru, 16 to 18 July 2013)	
<i>ICAO Strategic Objectives:</i>	<i>B - Air Navigation Capacity and Efficiency</i> <i>E - Environmental Protection</i>

1. Introduction

1.1 Pursuant to GREPECAS Decisions 16/45 to 16/47, the Programme entitled “*Performance-Based Navigation (PBN)*” was structured with the following associated projects:

- a) Operational implementation of PBN; and
- b) Air navigation systems in support of PBN

2. Discussion

2.1 Since the Second Meeting of the Programmes and Projects Review Committee (PPRC/2) the status in the progress of implementation of the project activities that conform the Programme A: *Performance-based navigation (PBN)* are as follows:

2.2 *CAR Region*

Project A1 “PBN Implementation”

2.2.1 The Fourteenth Directors of Civil Aviation of the Central Caribbean Meeting (C/CAR/DCA/14, Kingston, Jamaica, 14 to 15 May 2015) approved the Conclusion 14/7, urging the C/CAR Region States to develop a PBN Airspace Redesign Project for CAR Region.

2.2.2 At the PPRC/2 Meeting, Projects A1 and A2 of the CAR Region were merged into one project entitled “PBN Implementation”. The States/Territories agreed to update the regional performance objectives (RPO) in the NAM/CAR RPBANIP, as approved by the Fifth Meeting of Civil Aviation Directors of North America, Central America and the Caribbean (NACC/DCA/5).

2.2.3 Based on the objective of PBN training outlined in the work programme and under the RLA 09/801 project, two PBN implementation workshops were held at the ICAO NACC Office:

- The ICAO NAM/CAR/SAM Performance-Based Navigation (PBN) Approach Procedure Design Workshop - Special Implementation Project (SIP), 17 to 28 November 2014, which provided training in Instrument Approach Procedure (IAP) design and included technical training in developing RNAV approaches, Arrival and departure procedures, Baro VNAV Approaches and coding.
- The Workshop on Regional Implementation on Performance-Based Navigation (PBN) Airspace Redesign for the CAR Region, 4 to 8 May 2015, provided a platform for discussion between adjacent States/Territories and Organizations on airspace harmonization.

2.2.4 Since GREPECAS/17 the implementation target for PBN approach procedures has been regionally completed by more than 90% of CAR States, as established in the Assembly Resolution A37-11 and the *Port-of-Spain Declaration* (Trinidad and Tobago, April 2014). Belize, Mexico and Nicaragua, who are behind the global and regional targets, reported that they have developed drafts on PBN approach procedures to be published during 2015.

2.2.5 The following tasks for the implementation of a PBN airspace concept requires that States implement RNAV 5/2 routes in continental upper airspace, publish Continuous Descent Operations (CDO) and Continuous Climb Operations (CCO) in terminal areas using Standard Instrument Departures (SIDs) and Standard Instrument Arrivals (STARs). Furthermore, in accordance with Assembly Resolution A37-11, it also requires to continue the publication of Required Navigation Performance (RNP) approach procedures.

2.2.6 **Appendix A** shows the status and results of PBN implementation reported to ICAO Headquarters in Montreal for the dashboards. More information is available at: <http://www.icao.int/safety/pbn/Pages/default.aspx>

2.2.7 Based on the analysis made by the C/CAR/DCA/14 Meeting it is necessary that States develop a PBN Airspace Redesign Project for the CAR Region to be implemented in the short term upon a comprehensive concept of PBN airspace approach as a high priority matter for the CAR Region considering gate-to-gate operations for medium and long terms. The Project should meet safety objectives, ATS capacity and environmental impact mitigation, including airspace organization details, as well as regulatory and infrastructure requirements and assess annually benefits to the environment obtained by the route and CO₂ reduction.

2.2.8 The Project for the redesign the upper and lower airspace should consider air traffic increase for 2015-2017, through four phases as described in Doc 9992 - *Manual on the Use of Performance-based Navigation (PBN) in Airspace Design*:

- Planning
- Design
- Validation
- Implementation

2.2.9 In order to achieve successful PBN Airspace Redesign Projects, States should designate and foster the participation of their regulators, controllers, airspace planners, pilots/operators, military authority, general aviation representatives, etc. PBN projects should focus on Area Navigation (RNAV) routes implementation, RNP approach procedures, Standard Instrument Departure (SIDs) and Standard Instrument Arrival (STARs) with Continuous Climb Operations (CCO) and Continuous descent operations (CDO) criteria, RNAV 10 or RNP 4 for Oceanic airspace as required. States should complete the following implementation tasks as a regional strategy to improve Airspace Organization and Management (AOM) in the CAR Region:

Phase	Operational improvement
Phase I (2015 2016)	<ul style="list-style-type: none"> • Realign, delete and/or implement RNAV routes in the upper airspace based on RNAV 5 navigation specification • Realignment and/or implementation of new RNAV routes in the interface of the upper airspace between the NAM/CAR/SAM, based on three representing the traffic flows between North and South America: <ul style="list-style-type: none"> <input checked="" type="checkbox"/> North America – Central America – South America <input checked="" type="checkbox"/> North America – Central Caribbean – South America <input checked="" type="checkbox"/> North America – Eastern Caribbean – South America • Implement random routes and/or RNP 10 navigation specification in the oceanic areas of Central American, Mazatlan oceanic and Piarco FIRs • Implementation of RNAV routes in the lower airspace based on RNAV 1, RNAV 2 and RNP 1 navigation specifications, as required • Implementation of PBN approach procedures (APV, BARO-VNAV) in 100% of the instrument runways, in accordance with Assembly Resolution A37-11.
Phase II (2015 2016)	<ul style="list-style-type: none"> • Review of the terminal areas (TMAs) configuration, as required. • Implementation of CDO and CCO in the international airports, as required. • Up to date SUPPS and LOAs for dynamic airspace configuration

Phase III (2016 2017)	<ul style="list-style-type: none"> • Review of the upper airspace configuration of CAR FIRs • Implementation of flexible use of airspace (FUA) • Implementation of regional procedures for dynamic Air Traffic Management between adjacent FIRs
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2.2.10 States should also keep close coordination with other States and stakeholders of the FIRs involved working together for inter-regional PBN harmonization, and conduct a yearly assessment based on reduced track miles and CO₂ reduction so as to define operational benefits.

2.2.11 The ICAO NACC Regional Office has conducted PBN technical assistance missions (TEAMs), with the assistance of two (2) Subject Matter Experts (SMEs).

2.2.12 Whilst many States/Territories/Organizations are working on airspace configuration, routing and approach issues within their area of responsibility, there is generally a lack of collaboration between neighbors. This results in lack of harmonization which does not facilitate coordination and provision of Air Traffic Control (ATC) service, as well as limited use by operators. Whether this is due to poor operational benefits or lack of end - user equipage needs to be determined. Nevertheless, this points out to lack of proper stakeholder collaboration prior to the design of the procedure.

2.2.13 Other identified areas as an issue was the training in PBN related matters and the inefficient application of longitudinal separation across the NAM/CAR/SAM Regions. While some FIRs were using as low as 5NM in their own airspace, based on existing procedures and LoA's, in most cases, ten (10) minutes (80NM) were required for transfer from one FIR to the next.

2.3 *SAM Region*

Project A1 "PBN Implementation"

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

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

2.3.3 Considering the complexity in this implementation process, it has been convened the importance of project management technics application, to clearly identify deliverables in the enroute, TMA and approach phases, and the interconnection among them, in order to allow a follow-up to the different implementation activities and provide coherence in their development, establishing the appropriate dependence between them. Main activities of the PBN SAM project are attached as **Appendix B1** to this Working Paper.

National PBN plans update

2.3.4 In reference with SAMIG/14/5 Conclusion Argentina, Brazil and Chile presented their National PBN updated plans in the SAMIG/15 Meeting. As a complement to the PBN plans, SAM Region States should present their action plan for the application of selected PBN airspace redesign using the action plan model approved to this end. The action plan update status is shown in paragraph 2.3.17. Since GREPECAS/17 the Regional progress in the PBN National plans has been 21%. The goal to achieve in 2015 is 50% and in 2016 is 100%.

PBN en-route

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

2.3.6 In this regard, the Meeting recalled that the implementation Route Network Version 03 depends on a consistent and harmonized implementation in the SAM TMAs and that delay on projects of one or more States could affect the rest of the States and the Regional Project as a hole.

2.3.7 Considering that the complete redesign process of the principle SAM TMAs has not achieve yet the required maturity level for a comprehensive implementation, the ATS/RO/6 Meeting has decided to split the implementation SAM routes Version 03 in two stages; Stage 1 has included realignment and removal routes proposals, as well as new RNAV routes implementation based on the current principal South American TMAs design. Final version (Stage 2) Routes Network Version 03 depends on PBN redesigns principal TMA, which implementation process is being performed in the SAM PBN Workshops.

2.3.8 As an outcome of the teleconferences on Version 03 Stage 1 implementation, the Route network optimization was developed through SAM15/01-ATM Amendment. In this regard, 13 RNAV Routes were added, 7 RNAV routes and 3 conventional routes were realigned and 6 conventional routes and one RNAV were eliminated. During 2014 the annual goal of 40.000 tons were exceeded from the Bogota Declaration in more than 11.000 tons of CO₂ reduction. 51.132 tons of CO₂ reduction was achieved in the South American Region. During 2015 annual calculated savings with the IFSET tool of 2.133 tons of fuel was achieved, which is equal to 6.738 tons of CO₂ reduction.

2.3.9 Since GREPECAS/17 up-to-date the progress on RNAV Routes implementation has been 20% reaching 58%, missing only 2% to achieve with the goal established in the Bogota Declaration of 60%.

PBN in Terminal Area (TMA)

2.3.10 The process of complete redesign with PBN application in the principal South American TMAs are being performed through PBN Workshops, under the support of Regional Project 06/901. Since GREPECAS/17 Meeting PBN Workshops 2 and 3 were carried out.

2.3.11 These workshops were focused on Design and Validation phases of needed processes for effective implementation. It was observed that more commitment and support to these processes were required from States in order to carry out all the needed tasks to complete validation.

2.3.12 Considering the PBN optimization impact in the east-west flows among Argentina, Brazil and Uruguay with the Regional Office support, a series of teleconferences has been started and it is expected to carry out a trilateral coordination meeting to establish requirements and procedures that will be applied taking into account the new design. These activities have required longer time in coordination for PBN implementation in these airspaces.

2.3.13 In the PBN Workshops has been recognized that one or more leader operator's participation in diverse PBN implementation phases helps decision-making processes in collaboration and to improve planning, design and validation phase's results. These have been demonstrated, in a practical way, in the projects presented by Chile, Panama and Peru.

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

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

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

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

2.3.18 SAM Region States are working in the implementation of dates update for action plans update. The States that have sent their Action Plans updated for PBN-based redesign in their selected airspace are shown in the below table:

States that have presented their Action plans updated for PBN-based redesign in selected airspaces.

	ARG	BOL	BRA	CHI	COL	FGY	ECU	GUY	PAN	PAR	PER	SUR	URU	VEN
2015 49%	NO	YES	NO	YES	NO	NO	YES	YES	YES	NO	NO	NO	YES	YES

2.3.19 Since GREPECAS/17 the progress on action plans development for selected airspaces redesign applying PBN has been of 42%. 2015 goal is to achieve 50% and in 2016 100% of PBN action plans development.

SID, STAR and PBN Approach Procedures Implementation

2.3.20 *Bogota Declaration* urges States to implement PBN SID and STAR in international airports, in scope to achieve established goals, based on CDO and CCO techniques. Additionally, the mentioned Declaration encourages States to implement APV approach procedures, in scope to attend A37-11 resolution. The data that support the presented information up-to-date on SID, STAR and PBN IAC implementation status is shown in **Appendix B2** to this Working Paper. The following aspects need to be highlighted:

- a) Data highlighted in yellow shows *Bogota Declaration* goals and each State's participation to achieve each one of those goals. Red information shows SAM Region status, which is the mainly indicator to be considered, taking into account that the goal to be achieved is Regional.
- b) IAP APV or RNP AR or LNAV columns consider that the apron count with an APV procedure, with an IAC APV based in RNP APCH with VNAV or by IAC RNP APCH AR. It is also considered that the apron attend to *Bogota Declaration* requirements and has a LNAV procedure, in accordance with the ICAO Assembly A37-11 Resolution. Nevertheless, it is expected that States implement APV procedures.
- c) Information was submitted by SAM States and their AIPs. Colombia, Guyana, French Guiana and Suriname only of AIP data were collected, respectively, taking into account that no direct information from these States has been received up-to-date.
- d) SID, STAR RNAV which no navigation specification was indicated were considered as SID and STAR PBN
- e) Only CDO and CCO airports were considered and followed a complete validation process, considering, among other aspects, controllers training, LoAs needed changes and operational procedures that avoid aircrafts to unnecessary level during climbing or descent, etc.
Note: SAM States should notify on airports that have followed the implementation process with recommended CDO and CCO
- f) It was considered the airports that have, at least one apron, with IFR operation, in accordance with FASID AOP-1 Table.
- g) IFR aprons were only considered, in accordance with FASID AOP-1 Table.

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

2.3.22 Regarding CDO and CCO application operation techniques application progress, since GREPECAS/17 up-to-date is 4.52% which represents 10% of the Bogota Declaration, which goal is 40%.

Project A2 Air navigation systems in support of PBN

2.3.23 Of the SAM Project A2 pending activities it had operational implementation of the forecast RAIM availability via web. The service came into force on 16 November 2014. Information is available in the webpage www.satdis.aereo and can be accessed by introducing username and password. This service up-to-date is being used by several SAM Region States for the NOTAM elaboration in case of no availability RAIM in PBN aerodrome procedures published in the AIP. In other States is in approval process. Additionally, such service is available for interested users that do not have that service.

2.3.24 Likewise, as a product of the obtained results in Brazil with GBAS SLS-4000 station, provisioned in the Santo Dumont Airport, Rio Janeiro Brazil and its behavior with the ionosphere to be used in its totality for CAT 1 operations, it was concluded that the same are not appropriate, to this end ICEA (Instituto de Control del Espacio Aéreo) will continue with the FAA investigation and the provider enterprise (Honeywell), looking to develop a risk model capable to support the behavior of the ionosphere in under latitudes. For SAM/IG/16 (October 2016) is foreseen a session where presentations will be carried out on investigation progress.

2.3.25 In this regard, it is foreseen to review the practical guideline for GBAS system implementation for it to have the investigation progress results. This task is foreseen to be completed for May 2016.

2.3.26 Project A2 activities (*Air navigation systems in support of PBN*) will be integrated to Project A1 in order to have only one PBN implementation project in the SAM Region, this regard is submitted to the PRCC/3 approval. The description of this Project is shown in **Appendix B3**.

3. Conclusion

3.1 Although significant progress has been made in PBN implementation, the need has been identified to increase the number of qualified personnel, enhance training programmes, and improve PBN operational approval programmes. Accordingly, the States need to review and improve their own PBN implementation programmes with the assistance of the ICAO CAR and SAM Regional Offices.

3.2 With the support of RLA 06/901 Project direct assistance has been followed-up to SAM Region States for PBN implementation in the selected airspaces. Used tools to this end by the SAM Region are PBN Workshops and implementation meetings (SAMIG). This strategy has allowed to instruct more than 70 State experts with the cooperation of 17 industry experts (Airbus, Boeing, IATA, Jeppesen) which ease a collaborative environment in taking decisions among different stakeholders which resulted the conceptual design of PBN selected airspace.

3.3 The activities on airspaces redesign for the SAM Region based on PBN application has a positive impact in the efficiency, safety and the inclusion of Civil aviation authorities, air navigation service providers, air operators, pilots and industry in these processes.

3.4 SAM Region PBN Projects progress since GREPECAS/17 up-to-date is the following:

- a) 21% PBN national plans update out of 50% foreseen to reach in 2015.
- b) CO2 annual reduction (51.132 tons in 2014 + 6.738 tons in the first semester of 2015). This data exceeds in more than 11.000 tons the Bogota Declaration goals.
- c) 20% RNAV Routes implementation reaching 58% and subtracting 2% to reach the goal of 60% for 2016.
- d) 42% on action plans development for selected airspace redesign applying PBN out of 50% goal for 2015.
- e) SIDs/STARs PBN implementation is 64.29% and Bogota Declaration 60% goal has been exceeded.
- f) CDO and CCO operational techniques application progress is 4.52% , which represents 10% of Bogota Declaration goal, which intends to reach in 40% of that technique application.

3.5 Appendices A and B to this Working paper show the description on Project A1 and A2 progress for the CAR and SAM Regions, respectively, based on PBN (RNAV/RNP) programme approved by GREPECAS.

4. **Suggested action**

4.1 The Meeting is invited to:

- a) take note of the information contained in this working paper;
- b) review project activities and status of implementation in Appendices A and B, and formulate other actions it may deem appropriate.
- c) approve the integration of Project A2 (*Air navigation systems in support of PBN*) to Project A1, in order to have only one implementation PBN project in the SAM Region.

APPENDIX A / APÉNDICE A

**PROJECT IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN)
PROYECTO IMPLANTACIÓN DE LA NAVEGACION BASADA EN LA PERFORMANCE (PBN)**

<i>CAR Region / Región CAR</i>	PROJECT DESCRIPTION / DESCRIPCION DEL PROYECTO (DP)	DP N° A1	
<i>Programme / Programa</i>	Project Title / Título del Proyecto	Start / Fecha inicio	End / Fecha término
<i>Performance Based Navigation /Navegación basada en la performance (PBN) Programme Coordinator / Coordinador del Programma: Victor Hernandez)</i>	<i>Performance Based Navigation / Navegación Basada en la Performance (PBN)</i> Project Coordinator / Coordinador Proyecto: Alfredo Mondragón (COCESNA) Experts / Expertos contribuyentes: Carl Gayner (Jamaica) Jose Gil (México) Julio Mejia Alcantara (Dominican Republic) Riaaz Mohamed (Trinidad and Tobago) Marco Vidal(IATA)	2008	2017
Objective /Objetivo	Support the implementation of the ATS route structure in terminal areas (SID/STAR RNAV) and en-route (RNAV) optimization Project, as well as the implementation of RNP approach procedures according to regional performance objectives of the Performance-based Air Navigation Implementation Plan for NAM/CAR (RPBANIP NAM/CAR) Regions. / Apoyar la implementación del proyecto de optimización de la estructura de rutas ATS en las áreas terminales (SID/STAR RNAV) y espacio aéreo en ruta (RNAV), así como la implantación de aproximaciones RNP en base a los Objetivos regionales de performance del Plan de Regional de Implementación de Navegación Aérea Basada en la Performance para las Regiones NAM/CAR (RPBANIP NAM/CAR)		
Scope /Alcance	Progressive implementation of PBN and use of GNSS according to the goals of Assembly Resolution A37-11 and the PBN Airspace Concept for the CAR Region. / Implantación progresiva de la PBN y uso del GNSS acorde a las metas de la Resolución de la Asamblea A37-11 y el Concepto de Espacio Aéreo PBN para la Región CAR.		

<p>Metrics / Métricas</p>	<ul style="list-style-type: none"> • Percentage of instrument runway ends with an approach procedure with vertical guidance (APV), (BARO-VNAV and/or augmented GNSS) either as the primary approach or as a back-up for precision approaches; • Percentage of international aerodromes with implanted SID/STAR RNAV, RNP and continuous descent and climb operations (CDO/CCO); • Estimated fuel saved with operational improvements. / • Porcentaje de final de pistas por instrumentos con un procedimiento de aproximación con guía vertical (APV), (BARO-VNAV y/o aumentación GNSS) sea como aproximación primaria o como apoyo para aproximaciones de precisión; • Porcentaje de aeropuertos internacionales con SID/STAR RNAV, RNP y operaciones de descenso y ascenso continuo (CDO/CCO) implantados; • Ahorros estimados de combustible por mejoras operacionales.
<p>Strategy / Estrategia</p>	<p>The implementation of activities will be coordinated between Project members, the Project Coordinator and the Programme Coordinator. The Programme Coordinator will coordinate with the Project Coordinator requirements of other projects and NAM/CAR implementation working groups. States will develop their respective national programmes of implementation of routes and approach procedures according to PBN Airspace Concept in the CAR Region. Experts nominated by States, Territories and International Organizations will be incorporated to develop tasks as required. /</p> <p>La ejecución de las actividades será coordinada entre miembros del proyecto, el coordinador del proyecto y el Coordinador del Programa. El Coordinador del Programa coordinará con el Coordinador del Proyecto los requerimientos de otros proyectos y Grupos de Trabajo de implementación NAM/CAR. Los Estados elaborarán sus respectivos programas nacionales de implantación de rutas y procedimientos de aproximación acorde al Concepto de Espacio Aéreo PBN de la Región CAR. Se incorporarán expertos nominados por los Estados, Territorios y Organizaciones Internacionales para desarrollar las tareas, según se requiera.</p>
<p>Goals / Metas</p>	<ul style="list-style-type: none"> • Implement RNAV/RNP routes and RNP approach procedures according to Assembly Resolution A37-11 in 2016: • Implement a PBN Airspace Redesign Project (CDOs, CCOs, SIDs, STARs, RNAV/RNP route and RNP approach procedures) in 8 FIRs by December 2017: • Implementar rutas RNAV/RNP y procedimientos de aproximación RNP de acuerdo a la Resolución de la Asamblea A37-11, en diciembre de 2016; • Implementar un Proyecto de Rediseño de Espacio Aéreo PBN (CDOs, CCOs, SIDs, STARs, rutas RNAV/RNP y procedimientos de aproximación RNP) en 8 FIRs a fines de 2016;

<p>Justification/ Justificación</p>	<p>The Assembly Resolution A37-11, performance-based navigation (PBN) global goals, urged States to implement RNAV and RNP ATS routes and instrument approach procedures in accordance with the ICAO Performance-based Navigation (PBN) Manual, Doc 9613, and requested the PIRGs to include in their work programme the review of status of implementation of PBN by States and report annually to ICAO any deficiencies that may occur.</p> <p>In addition, NAM/CAR States adopted a regional performance framework on the basis of the regional performance objectives (RPO) of the performance based air navigation implementation plan (RPB-ANIP) for NAM/CAR Regions and the Global ATM Operational Concept. The framework includes the implementation of a set of performance metrics to facilitate comparative analysis of operational and economic regional development, such as capacity and efficiency of gate-to-gate flight operations, and the protection of the environment in the planning, implementation and operation processes of the ATM system. /</p> <p>La Resolución A37-11 de la Asamblea, metas mundiales de navegación basada en performance (PBN), instó a los Estados a implantar rutas ATS RNAV y RNP, así como procedimientos de aproximación por instrumentos de acuerdo al Manual de la OACI sobre Navegación Basada en la Performance (PBN), Doc 9613, solicitando a los PIRGs incluir en sus programas de trabajo la revisión del estado de implantación de PBN por los Estados e informar anualmente a la OACI sobre cualquier deficiencia que pudiera ocurrir.</p> <p>Adicionalmente, los Estados NAM/CAR adoptaron un marco regional de performance en base a los objetivos regionales de performance (RPO) del plan de implantación de navegación aérea basada en performance (RPB-ANIP) para las Regiones NAM/CAR y el Concepto Operacional ATM Global. El marco de referencia incluye la implantación de un conjunto de métricas de performance para facilitar el análisis comparativo operacional y económico del desarrollo regional, tales como la capacidad y eficiencia de operaciones aéreas puerta a puerta y la protección del medio ambiente en los procesos de planificación, implantación y operación del sistema ATM.</p>
<p>Related Projects / Proyectos relacionados</p>	<ul style="list-style-type: none">• Enhance demand and capacity balancing;• Flexible use of airspace;• Improve ATM Situational awareness; • Mejorar el equilibrio entre la demanda y capacidad;• Uso flexible del espacio aéreo;• Mejorar la Conciencia Situacional ATM;

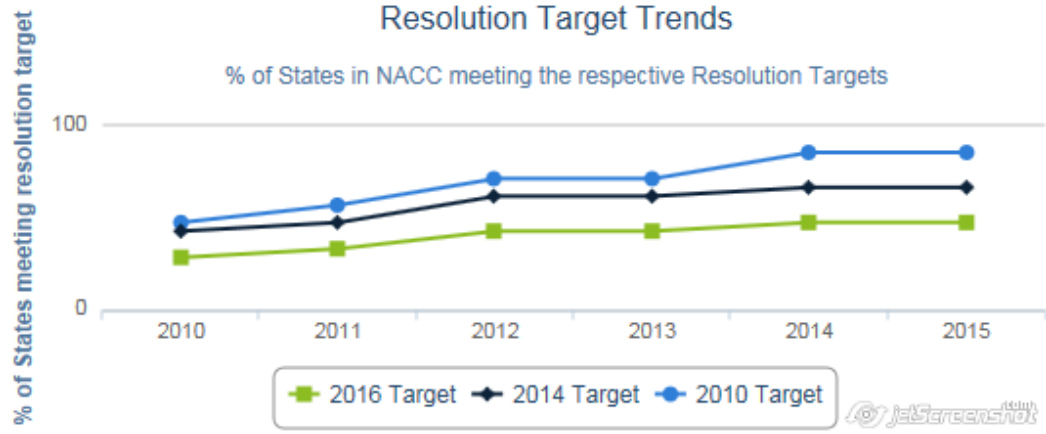
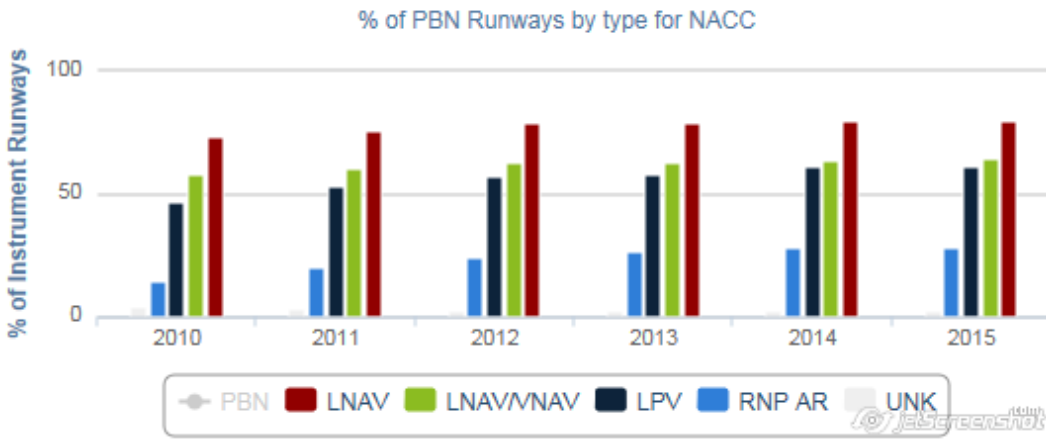
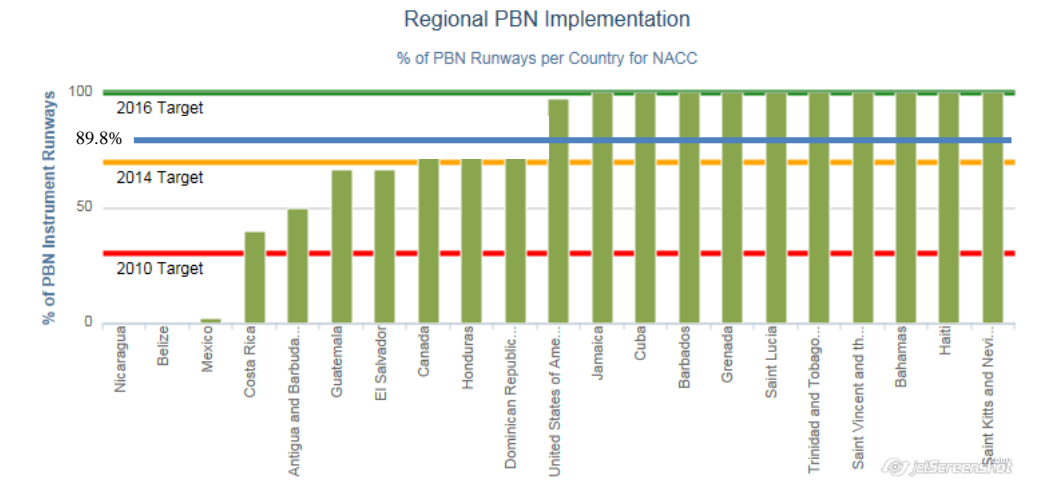
Entregables del Proyecto	Relación con el RPB-ANIP NAM/CAR	Responsable	Estado de Implantación*	Fecha entrega	Comentarios
Implement PBN Airspace Redesign Project for CAR Region	RPO 1	States, Territories, International Organizations / Estados, Territorios, Organizaciones Internacionales		2017	<p>-Up-to-date the regional PBN Airspace concept</p> <p>-States to develop and implement a PBN Airspace Redesign Project for oceanic, continental and terminal areas in accordance with the ICAO Doc 9613 and Doc 9992 /</p> <p>-Actualizar el Concepto de Espacio Aéreo PBN regional</p> <p>-Los Estados desarrollen e implementen un Proyecto de Rediseño de Espacio Aéreo acorde a los Doc 9613 y Doc 9992 de la OACI.</p>
Optimize the ATS route structure in the upper continental and oceanic airspace. / Optimizar la estructura de rutas ATS en el espacio aéreo superior continental y oceánico	RPO 1	States, Territories, International Organizations / Estados, Territorios, Organizaciones Internacionales		2017	<p>RNAV 5 Routes implemented in the upper airspace.</p> <p>On-going revision of ATS route network / States to send proposals to ICAO NACC Regional Office by 31st August 2015</p> <p>Rutas RNAV 5 implantadas en el espacio aéreo superior.</p> <p>Revisión de la red de rutas ATS en progreso</p> <p>Los Estados enviaran sus propuestas a la Oficina Regional NACC de la OACI</p>
Implement SIDs/STARS, CDO and CCO in terminal areas based on RNAV/1-2 and RNP1 navigation specifications. /	RPO 1	States, Territories, International Organizations /		2017	<p>-211 SIDs implemented /implementadas</p> <p>-145 STARS implemented /implementadas</p> <p>-Implemented STARS /SIDs meet CDO/CCO criteria. /</p> <p>On-going revision of TMAs</p>

<p>Implementar SIDs/STARS, CDO y CCO en áreas terminales en base a especificaciones de navegación RNAV/1-2 y RNP1</p>		<p>Estados, Territorios, Organizaciones Internacionales</p>			<p>-Las STARS / SIDs implementadas cumplen con criterios CDO/CCO. Revisión de las TMAs en progreso</p>
<p>Design and implement PBN APV approach procedures in accordance with Assembly Resolution A37-11 (BARO-VNAV), / Diseñar e implementar procedimientos de aproximación PBN APV (BARO-VNAV) según la Resolución de la Asamblea A37-11</p>	<p>RPO 1</p>	<p>States, Territories, International Organizations / Estados, Territorios, Organizaciones Internacionales</p>		<p>2016</p>	<p>-152 RNP approach procedures implemented represent 89.8% of the global target/ -152 procedimientos de aproximación RNP implementados representan el 89.8% de la meta global.</p>
<p>Evaluate and implement PBN requirements for ATC Automated Systems, according to the new ICAO Flight Plan Form requirements. / Evaluar e implementar los requisitos de los sistemas automatizados ATC acorde a los requisitos del nuevo formulario de plan de vuelo de la OACI</p>	<p>RPO 1</p>	<p>States, Territories, International Organizations / Estados, Territorios, Organizaciones Internacionales</p>		<p>Completed / Finalizada</p>	<p>States have implemented the New ICAO flight plan form. Follow-up updates of databases by ANI/WG/ Los Estados han implementado el nuevo formulario del plan de vuelo de la OACI Seguimiento de actualización a las bases de datos por el ANI/WG/</p>

<p>Analysis of regional feasibility for SBAS (WAAS/SACSA) implementation. / Estudio de factibilidad regional de la implantación del SBAS (WAAS / SACCSA)</p>	<p>RPO 1</p>	<p>Alfredo Mondragón assisted by / asistido por SACCSA and/y WAAS</p>		<p>Completed / Finalizada</p>	<p>-Mexico is testing 5 WAAS stations for domestic use. WAAS requirements will be regionally reviewed in the medium term. -Feasibility of regional application, technical aspects, operational benefits, associated costs, for an SBAS (WAAS/SACSA) implementation. Implications for airborne equipment (factory delivered and retrofits) and other relevant aspects. / -México tiene a prueba 5 estaciones WAAS para uso nacional. Los requisitos WAAS serán regionalmente revisados en el mediano plazo. -Factibilidad de la aplicación regional, los aspectos técnicos, los beneficios operacionales, los costos asociados, de la implantación del SBAS (WAAS / SACCSA), así como las implicaciones para los equipos de a bordo (nuevas o actualización de aviónicas) y otros aspectos pertinentes</p>
<p>Practical guidance for the implementation of GBAS Systems/ Guía práctica para la implementación de sistemas GBAS.</p>	<p>RPO 1</p>	<p>Alfredo Mondragón assisted by / asistido por SACCSA and/y WAAS</p>		<p>2018</p>	<p>- Regional agreement to organize GNSS workshop in 2016 -Acuerdo regional para organizar un Taller GNSS en 2016</p>
<p>Monitor Performance measurement programme. / Monitorear el programa de medidas de performance</p>	<p>RPO 1</p>	<p>ICAO</p>		<p>2017</p>	<p>ICAO NACC Regional Office conducts this activity. Implementation achievements are based on the regional targets of the Port of Spain Declaration and reviewed by the NACC/DCA Meetings. / La Oficina Regional NACC de la OACI lleva a cabo esta actividad Los resultados de implementación se basan</p>

					en la Declaración de Puerto España y se revisan por las Reuniones NACC/DCA
Required Resources / Recursos necesarios	CAR Regional PBN Airspace Redesign Project, which includes PBN technical assistance programme to States / Proyecto regional de Rediseño de Espacio Aéreo PBN CAR que incluye programa de asistencia técnica PBN a los Estados				

- Grey / Gris: Task not started / Tarea no iniciada;*
- Green / Verde: Activity underway as scheduled / Actividad en progreso de acuerdo con el cronograma;*
- Yellow / Amarillo: Activity started with some delay but expected to be complete don time / Actividad iniciada con cierto retardo pero estaría llegando a tiempo en su implantación;*
- Red / Rojo: It has not been posible to implement this activity as scheduled; mitigating measures are required / No se ha logrado la implantación de la actividad en el lapso de tiempo estimado se requiere adoptar medidas mitigatorias.*



APPENDIX B1

PBN OPERATIONAL IMPLEMENTATION PROJECT

<i>SAM Region</i>	PROJECT DESCRIPTION (DP)	DP N° A1	
<i>Programme</i>	Title of the Project	Start	End
<i>SAM Airspace Optimisation</i> (Programme Coordinator: Roberto Arca Jaurena)	PBN Operational Implementation <i>Project coordinator: Julio de Souza Pereira (IATA)</i>	2011	2018
Objective	Support the optimisation of the South American airspace structure through the optimisation of the ATS route structure in terminal (RNAV/RNP SID/STARs) and en-route (RNAV/RNP) airspace, as well as the implementation of PBN approaches pursuant to ICAO Assembly Resolution A37-11, aiming to achieve the goals established in the Bogota Declaration.		
Scope	The implementation project contemplates the optimisation of the South American airspace through the implementation of PBN and the application of the flexible use of airspace (FUA) concept, as well as the phased optimisation of the ATS route network of the Region.		
Metrics	<ul style="list-style-type: none"> • Reduction of CO₂ emissions in tonnes for each route optimisation version. • Percentage of RNAV and/or RNP SID/STARs implemented at international airports. • Percentage of continuous descent and climb operations implemented at international airports. • Number of RNAV/RNP routes implemented, realigned and/or eliminated. • Percentage of thresholds with APV approaches in international airports. 		

Strategy	The conduction of project activities will be coordinated among project members, the Project Coordinator, and the Programme Coordinator, at SAM/IG meetings, ATS route optimisation meetings (ATS/RO) and other events deemed necessary (PBN workshops, hiring of experts, etc.). The Project Coordinator will coordinate with the Programme Coordinator the inclusion of additional experts, if warranted by the tasks and works to be executed. Furthermore, the States must check their respective national PBN implementation programmes for consistency with the PBN Project. Activities involving the review, implementation, modification, or elimination of routes in the SAM Region are foreseen in order to continue with the optimisation of the ATS route structure.
Goals	Implementation of Version 03 of the ATS route network, based on PBN, to meet the current requirements of airspace users by the end of 2017. Achieve the goals established in the Bogota Declaration. 30% of main SAM TMAs redesigned based on PBN by 2016, 50% by 2018.

Rationale	<p>The 37th ICAO General Assembly established Resolution A37-11 (<i>Performance-based navigation global goals</i>), noting that Planning and Implementation Regional Groups (PIRGs) have completed regional PBN implementation plans and urged States to implement air traffic services (ATS) routes and approach procedures in accordance with the ICAO PBN concept laid down in the <i>Performance-based Navigation (PBN) Manual</i> (Doc 9613). It resolved that States complete a PBN implementation plan as a matter of urgency to achieve:</p> <ol style="list-style-type: none">1) implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones;2) implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV only minima, for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30% by 2010, 70% by 2014; and3) implementation of straight-in LNAV only procedures, as an exception to 2) above, for instrument runways at aerodromes where there is no local altimeter setting available and where there are no aircraft suitably equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more. <p>Furthermore, the Global Air Navigation Plan (GANP), Chapter 2 (implementation) establishes Performance-based Air Navigation as its highest priority. The GANP indicates that <i>“the introduction of PBN procedures has thus far met or exceeded the expectations of the entire aviation community. Current implementation plans should help deliver additional benefits but remain contingent upon adequate training, expert support to States, continued maintenance and development of international SARPs, and closer coordination between States and partnering organizations.”</i></p> <p>Thus, this Project provides specialized support and performs close coordination between States and other stakeholders, in order to ensure a harmonized implementation of PBN in all corresponding flight phases: En route, TMA and approach.</p>
Related projects	<ul style="list-style-type: none">• Flexible use of airspace.• Automation.• Air navigation systems in support of PBN.

Project deliverables	Relationship with the performance-based regional plan	Responsible party	Status of Implementation*	Delivery date	Comments
Implementation of Version 01 of the ATS route network, based on RNAV, with the necessary PBN values to meet current requirements of airspace users.	B0-FRTO	Alexandre Luiz Dutra Bastos		October 2010	FINALISED
Implementation of RNAV-5 in the SAM Region.	B0-FRTO	Alexandre Luiz Dutra Bastos		October 2011	FINALISED
Action plan for the implementation of Version 02 of ATS route network optimisation.	B0-FRTO	Alexandre Luiz Dutra Bastos		ATS/RO/3	FINALISED

Traffic data to understand airspace traffic flows.	B0-FRTO	ICAO coordinator		SAM/IG/6	FINALISED
Fleet navigation capacity.	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/9	FINALISED
Listing of gateways of the main TMAs in the SAM Region.	PFF SAM ATM 02	Alexandre Luiz Dutra Bastos		SAM/IG/9	Few States have provided the data requested. The SAM/IG/11 meeting agreed to support States in the re-design of their TMAs so as to expedite PBN implementation.
Letters of Agreement and Contingency with adjacent States	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/10	FINALISED
Detailed study of the SAM ATS route network, route network Version 02	B0-FRTO	Alexandre Luiz Dutra Bastos		April 2012	FINALISED
Risk analysis for the implementation of Version 02 of the ATSRO Programme	B0-FRTO	External consultants		SAM/IG/10	FINALISED
<u>SAM Route Network optimisation</u>					
Planning Version 03 – Stage 1	B0-FRTO	External consultants		SAM/IG/14	FINALISED

Implementation Version 03 – Stage 1 – Flow 1 (Argentina – Chile - Paraguay)	B0-FRTO	States SAM Regional Office		April 2015	FINALISED
Implementation Version 03 – Stage 1 – Flow 2 (Argentina – Brazil - Uruguay)	B0-FRTO	States SAM Regional Office		TBD	
Implementation Version 03 – Stage 1 – Flow 3 (Panama – CENAMER – Caribbean)	B0-FRTO	States SAM Regional Office		TBD	This tasks depends on coordination with CAR Region
Implementation Version 03 – Stage 1 – Flow 3 (Brazil – Guyana – French Guiana – Suriname – Venezuela - Caribbean)	B0-FRTO	States SAM Regional Office		TBD	This tasks depends on coordination with CAR Region
Airspace concept Version 03 – Stage 2	B0-FRTO	States SAM Regional Office		ATSRO/7	This tasks depends on main SAM TMA validated PBN airspace concept
Implementation Version 03 – Stage 2	B0-FRTO	States SAM Regional Office		November 2017	This task depends on main SAM TMA validated PBN airspace concept
Regional strategy and work programme for the implementation of the flexible use of airspace, applying a phased approach, starting with a more dynamic sharing of reserved airspace	B0-FRTO	States SAM Regional Office		2013-2018	This task is currently under Project B2 of the SAM Region, and the proposal is that it be transferred to this Project.

PBN TMA					
Update PBN implementation action plans for main TMA	PFF SAM ATM 02	States		31 December 2014	Conclusion SAM/IG/14-6. Up to date Bolivia, Chile, Ecuador, Guyana, Panamá, Uruguay y Venezuela forwarded their action plan
Update SID/STAR PBN status of implementation	PFF SAM ATM 02	States		30 June 2015	Update by 30 June and by 31 December annually, according to Conclusion SAM/IG/14-4
Update Table AOP-1	PFF SAM ATM 02	States		TBD	Conclusion SAM/IG/15-3
Approach					
Update IAC APV status of implementation	PFF SAM ATM 03 B0 APTA	States		30 June 2015	Update by 30 June and by 31 December annually, according to Conclusion SAM/IG/14-4. Implementation of RNP APCH procedures with vertical guidance Baro-VNAV or RNP AR APCH, must be informed.

Meetings/Workshops					
SAM/IG/07	PFF SAM ATM	States SAM Regional Office		May 2011	SAM PBN Implementation Group
SAM/IG/08	PFF SAM ATM	States SAM Regional Office		October 2011	SAM PBN Implementation Group
SAM/IG/09	PFF SAM ATM	States SAM Regional Office		May 2012	SAM PBN Implementation Group
SAM/IG/10	PFF SAM ATM	States SAM Regional Office		October 2012	SAM PBN Implementation Group
SAM/IG/11	PFF SAM ATM	States SAM Regional Office		May 2013	SAM PBN Implementation Group
SAM/IG/12	PFF SAM ATM	States SAM Regional Office		October 2013	SAM PBN Implementation Group
SAM/IG/13	PFF SAM ATM	States SAM Regional Office		May 2014	SAM PBN Implementation Group

SAM/IG/14	PFF SAM ATM	States SAM Regional Office		October 2014	SAM PBN Implementation Group
SAM/IG/15	PFF SAM ATM	States SAM Regional Office		May 2015	SAM PBN Implementation Group
SAM/IG/16	PFF SAM ATM	States SAM Regional Office		October 2015	SAM PBN Implementation Group
SAM/IG/17	PFF SAM ATM	States SAM Regional Office		May 2016	SAM PBN Implementation Group
SAM/IG/18	PFF SAM ATM	States SAM Regional Office		October 2016	SAM PBN Implementation Group
ATSRO/03	PFF SAM ATM 03	States SAM Regional Office		July 2011	SAM route network optimisation
ATSRO/04	PFF SAM ATM 03	States SAM Regional Office		July 2012	SAM route network optimisation
ATSRO/05	PFF SAM ATM 03	States SAM Regional Office		July 2013	SAM route network optimisation
ATSRO/06	PFF SAM ATM 03	States SAM Regional Office		October 2014	SAM route network optimisation
ATSRO/07	PFF SAM ATM 03	States SAM Regional Office		October 2015	SAM route network optimisation

ATSRO/08	PFF SAM ATM 03	States SAM Regional Office		July 2016	SAM route network optimisation
Hiring of experts for the consolidation of Version 03 Stage 2 of the SAM ATS route network	PFF SAM ATM 03	States SAM Regional Office		September 2016	SAM route network optimisation
Workshop on PBN Airspace Design in the SAM	B0 APTA B0 CCO B0 CDO	States SAM Regional Office		March 2013	Initial training on PBN airspace planning
PBN 1 Workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office		May 2014	FINALISED Objective: Training and preliminary PBN design of Asuncion and Bogota TMAs
PBN 2 Workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office		September 2014	FINALISED Objective: Preliminary PBN design of main South American TMAs
PBN 3 Workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office		March 2015	FINALISED Objective: Validation of preliminary PBN design of main South American TMAs
PBN 4 Workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office		September 2015	Objective: Guide implementation of main South American TMAs

Others					
Update and forward national PBN implementation plans	B0 APTA B0 CCO B0 CDO	States		SAM/IG/15	Up to date, only Argentina, Brasil and Chile presented the national PBN implementation plan according to the model proposed and approved by SAM/IG/14, Conclusion SAM/IG/14-5.
Resources required	Designation of experts in the execution of some of the deliverables.				

- *
 - Grey Task not started
 - Green Activity underway as scheduled
 - Yellow Activity started with some delay but expected to be completed on time
 - Red It has not been possible to implement this activity as scheduled; mitigating measures are required

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

APPENDIX B3

PROJECT A2 – AIR NAVIGATION SYSTEMS IN SUPPORT OF PBN

SAM Region	PROJECT DESCRIPTION (DP)	DP N° A2	
<i>Programme</i>	Title of the Project	Start	End
PBN (Programme Coordinator: TBD)	Air navigation systems in support of PBN <i>Project Coordinator: Julio Pereira (IATA)</i> <i>Experts contributing to the project: Alessandro Santoro, Andre Jansen, Fabio Augusto Andrade (Brazil), Paulo Vila and Tomas Macedo (Peru), and the SAM/IG SAM PBN Group</i>	January 2011	May 2016
Objective	Develop guides, conduct analyses and implement services in support of PBN implementation in the SAM Region.		
Scope	Support to PBN implementation in the SAM Region, initially consisting of: <ul style="list-style-type: none"> • Practical guide for the implementation of GBAS systems. • Analysis of DME/DME coverage to support PBN procedures. • Implementation of a RAIM availability prediction service. 		
Metrics	<ul style="list-style-type: none"> • Drafting of a practical guide for the implementation of a GBAS system. • Analysis of DME/DME coverage in the SAM Region completed. • Availability of a RAM availability prediction service. • % of States providing the RAIM availability service. 		
Strategy	<ul style="list-style-type: none"> • All activities will be conducted by experts designated by SAM States and organisations participating in the project entitled “<i>Air navigation systems in support of PBN</i>”, under the management of the project coordinator and the supervision of the programme coordinator. Communications among project members, and between the project coordinator and the programme coordinator shall be done through teleconferences and the Internet. Likewise, the programme coordinator may meet with the project coordinator and the contributing experts at the SAM/IG implementation meetings. • Once the studies have been completed, the results will be sent to the ICAO programme coordinator as a final consolidated document, and to the GREPECAS PPRC for analysis, review and approval. 		

Goals	<ul style="list-style-type: none"> • Guide for the implementation of a GBAS system, by October 2012. • Assessment of DME/DME coverage to support PBN procedures, by May 2011. • RAIM availability prediction service in the SAM Region implemented by September 2014. • 11 SAM States with RAIM availability prediction service available by February 2014. • 3 SAM States and one territory with the service available by the end of 2014.
Rationale	<ul style="list-style-type: none"> • The implementation of PBN procedures for approach, terminal and en-route operations requires the implementation of air navigation systems, services and infrastructure studies, such as the proper installation of DME to support the DME/DME navigation required in the event of failure of the GNSS system, the RAIM availability prediction service to enable the user to know what is RAIM availability for en-route, terminal and approach operations, and the implementation of GBAS systems to support precision landing procedures. • This project contributes to the implementation of SAM PFF CNS 03, ATM 01, ATM 02, and ATM 03 of the <i>SAM Performance-based navigation system implementation plan (SAM PBIP)</i>.
Related projects	<ul style="list-style-type: none"> • Implementation of PBN operational aspects.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
<i>Develop a practical guide for the implementation of the GBAS system</i>					
Review of practical guide for the implementation of GBAS systems	SAM PFF CNS 03 ANRF B0-APTA(65)	Alessander Santoro (Brazil)		May 2016	The practical guide for the implementation of GBAS systems was presented at SAM/IG/8 meeting. Same was circulated to all States of the Region for review and final version was presented at SAM/IG/11 meeting. In order to measure the real impact, a joint work was developed using station SLS-4000 and other 110 GPS L1 and L2 stations installed in Brazil. Data was collected over a period of maximum solar activity, although it has been the lowest in the last 100 years.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
					<p>From the data obtained, Brazil concluded that to date, SLS-4000 station may not be used in full for CAT 1 operations in low latitude regions, for which ICEA (Instituto de Control del Espacio Aéreo) will continue with the research in cooperation with FAA and the supplier (Honeywell), aiming to develop a threat model capable to support ionosphere behaviour in low latitudes.</p> <p>For SAM/IG/16 meeting (October 2015) a session with presentations on the progress of the research referred above is foreseen to be included.</p> <p>Brazil will continue with the research in collaboration with universities and Honeywell, aiming to develop a threat model applicable to the SAM Region.</p> <p>Following the results, a review of the practical guide for the implementation of GBAS systems will be conducted.</p>

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
<i>Analyse DME/DME and GNSS infrastructure and coverage needed to support PBN implementation</i>					
Analysis of the DME/DME and GNSS infrastructure required to support PBN implementation in the SAM Region	SAM PFF CNS/03 SAM PFF ATM/01 ATM/02 ATM/03 ANRF B0-APTA(65), B0-FRTO(10), B0-CDO(05), and B0-CCO(20)	Fabio Augusto Andrade and Andre Jansen (Brazil) Paulo Vilas and Tomas Macedo (Peru)		The coverage study to support RNAV-5 was completed (SAM/IG/8 October 2011)	A <i>DME/DME coverage study</i> was presented and reviewed at the SAM/IG/7 meeting (Lima, Peru, 23-27 May 2011). The coverage study was conducted using the EMACS tool and the results were delivered in a KMZ file clearly showing DME/DME coverage over the geographical map of the SAM Region, using Google Earth. The study only supports the RNAV-5 procedure.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
<i>Development of guidance on the use and availability of GNSS performance forecast/validation tools.</i>					
Implementation of a RAIM availability prediction service	SAM PFF CNS/03 SAM PFF ATM/01 ATM/02 ATM/03 B0-APTA(65), B0-FRTO(10), B0-CDO(05), and B0-CCO(20)	Project coordinator PBN Group SAM/IG		November 2014	<p>Two web-based distance courses were conducted on 15 and 16 September 2014, one in English and the other in Spanish, mainly including explanation of the tools contained in the SAM Region RAIM availability prediction service website (SATDIS), the procedure for assigning codes, the import and export of data, and the query and fault resolution procedure. The course was attended by all focal points nominated by the States, as well as by other participants designated by the States. All focal points received from the service provider the respective user name and password to access SATDIS as administrators.</p> <p>The SATDIS website in three languages (Spanish, Portuguese and English) started operating on 17 September 2014.</p> <p>The SATDIS FSAT final acceptance test was conducted on 18 November 2014.</p> <p>The RAIM availability prediction service is operating since 16 November 2014.</p>
Monitor activities for the implementation of air navigation systems in support of PBN		ICAO		January 2011 – May 2016	

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
Resources required	Implementation of the RAIM availability prediction service.				

Grey - Task not started

Green - Activity underway as scheduled

Yellow - Activity started with some delay but expected to be completed on time

Red - It has not been possible to implement this activity as scheduled; mitigating measures are required