International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)
First Meeting of the Programmes and Projects Review Committee (PPRC/1)
Mexico City, Mexico, 25-27 April 2012

Agenda Item 3: Review of GREPECAS programmes and projects

FOLLOW-UP OF ACTIVITIES OF THE PROJECTS UNDER THE PBN PROGRAMME

(Presented by the Secretariat)

SUMMARY	
This working paper presents a report of implementation activities related to the projects under the PBN programme for the CAR and SAM Regions.	
References: • ICAO Doc 9859, PBN Manual • CAR/SAM ANP, Doc 8733 • GREPECAS 16 Meeting Report • SAM ANIP/PB • PBN Implementation Programme	
ICAO Strategic Objectives	*This working paper is related to the following strategic objectives:* *A – Safety* *C – Environmental protection and sustainable development of air transport.*

1. Background

1.1 The GREPECAS/16 meeting, with a view to implementing regional performance-based plans in the CAR/SAM Regions pursuant to the Global Air Navigation Plan and the Global ATM Operational Concept, agreed to modify of GREPECAS organisation, whereby the AERMET, AGA/AOP, AIM, and CNS/ATM Subgroups and their respective task forces were eliminated and their work programmes and terms of reference transformed into programmes and projects. Accordingly, it formulated Decisions 16/45 and 16/47.

1.2 In compliance with GREPECAS Decision 15/34 and to ensure better ATM and CNS coordination and the development of CAR/SAM performance-based plans for the implementation of the ATM global concept, the CNS/ATM Subgroup had already organised its work programme in nine projects distributed in four programmes. The *"Performance-Based Navigation (PBN)"* programme has the following projects:

a) PBN operational implementation; and
b) Air navigation systems in support of PBN.

2. **Discussion**

2.1 Currently, the States, Territories, and International Organisations are conducting PBN implementation activities at airports and airspaces in accordance with the regional performance-based air navigation implementation plans in the respective CAR and SAM Regions.

2.2 Project A1, which deals with PBN operational implementation, involves not only PBN implementation but also the optimisation of the upper airspace route network with a view to establishing new RNAV routes or realigning the existing RNAV routes, by replacing or eliminating conventional routes whose paths match or are similar to proposed RNAV routes or that are not being used by users. The large scope of this programme requires a high level of commitment by all stakeholders, whether commercial, military, general aviation, service providers, or aeronautical authorities.

3. **Discussion**

Achievements and obstacles to PBN implementation in the CAR Region

3.1 In Project A2, related to air navigation systems in support of PBN, there are still SBAS implementation feasibility studies pending in the medium term, as well as the development of practical guides for the implementation of the SBAS system, and guidance on the use and availability of GNSS validation tools.

Achievements and obstacles to PBN implementation in the SAM Region

3.2 PBN operational implementation in the SAM Region involves the Airspace Optimisation Programme for the reorganisation of ATS route network. Following the implementation of **Phase 2**, Version 1 of the ATS route network, in March 2011, significant results were obtained in terms of fuel efficiency. Based on a predictive calculation done together with IATA in a period corresponding to 13 AIRAC cycles, with a price of **U$S 1.06** per gallon of fuel, savings exceed **US$ 7’600,000** and the environmental benefits resulting from reduced contaminating emissions amount to more than **22’600,000 k of CO2**.

3.3 Likewise, with respect to **Phase 1** of the SAM ATS route network optimisation programme, RNAV5 was implemented satisfactorily on RNAV routes in continental airspace on **20 October 2011**, without causing any problem. This will permit continued implementation of the route network optimisation programme through the execution of **Phase 3 of Version 2** of the SAM ATS route network optimisation programme, a phase that has already started.

3.4 During the implementation of Version 1 of the ATS route network and of RNAV5, the capacity of the aircraft fleet and air traffic services was analysed to verify the impact of both implementations on the airspace. In each case, the respective risk analysis was conducted using the methodology proposed in safety management systems (SMS).

3.5 Furthermore, the second workshop/seminar on safety monitoring of the system post-implementation of Version 1 of the SAM ATS route network was conducted, where participating States analysed some of the difficulties faced during the implementation process and which could have potentially affected safety during RNAV5 implementation.

3.6 It should be noted that a DME/DME coverage study has been conducted in the SAM Region to know the percentage of coverage offered by these systems in case of failure of the satellite-based navigation system.

3.7 As we have seen, the SAM Region has already started Phase 3 of the SAM ATS route network optimisation programme and the ATSRO/3 meeting (July 2011) recognised the convenience of collecting new statistical data in order to analyse the evolution of air traffic demand in the region. In fact, the detailed study of the SAM ATS route network in this phase might not reflect the results expected, since some States have not yet submitted the statistical data collected.

3.8 Accordingly, note should be taken of the importance of Regional Project RLA/06/901, *Assistance for the implementation of a regional ATM system taking into account the ATM operational concept and the corresponding CNS technology support*, in assistance activities to regular programmes and to the development of the global air navigation plan initiatives.

Plan of activities of the PBN Operational Implementation Project

3.9 Appendices A and B to this working paper show PBN (RNAV/RNP) implementation activities in the CAR and SAM Regions, respectively, taking into account the terms of reference and programme structure approved by GREPECAS.

4. Suggested action

4.1 The Meeting is invited to:

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

b) review and consider the projects listed in Appendices A and B; and

c) suggest other actions it may deem appropriate.

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APPENDIX A1

PROJECT ON THE IMPLEMENTATION OF PERFORMANCE-BASED NAVIGATION (PBN)

CAR Region	**PROJECT DESCRIPTION (DP)**	**DP N° A1**	
Programme	**Title of the Project**	**Start**	**End**
Performance-base navigation (PBN) (Programme coordinator: Victor Hernandez)	*Performance-Based Navigation (PBN)* Project coordinator: Alfredo Mondragón (COCESNA)	2008	2014
Objective	Support the implementation of the project on ATS route structure optimisation in terminal airspace (SID/STAR RNAV) and en-route (RNAV), as well as the implementation of RNP approaches based on the regional performance objectives of the NAM/CAR Performance-based implementation plan (NAM/CAR RPBANIP)		
Scope	Gradual implementation of PBN in accordance with the goals established in Assembly Resolution A 37-11 and the CAR PBN Airspace Concept.		
Metrics	• 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 that have implemented SID/STAR RNAV, RNP and continuous descent and climb operations (CDO/CCO) • Estimated fuel saved with operational improvements • Percentage of runway ends with instruments for vertical guidance approach procedure (APV), (BARO-VNAV and/or GNSS augmentation), either as primary approach or in support of precision approaches • Percentage of international airports with SID/STAR RNAV, RNP and continuous descent and climb operations (CDO/CCO) implemented • Estimated fuel savings as a result of operational improvements		

Strategy	Activities will be coordinated amongst project members, the project coordinator, and the programme coordinator. The programme and project coordinators will coordinate the requirements of other projects and NAM/CAR implementation working groups. States will draft their respective national route and approach procedure implementation programmes in accordance with the CAR PBN Airspace Concept. Experts nominated by the States, Territories, and International Organisations will be assigned to tasks as required.
Rationale	The Assembly Resolution A37-11, performance-based navigation (PBN) global goals, urged States to implement RNAV and RNP ATS routes and 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 according to the defined implementation plans and report annually to ICAO any deficiencies that may occur. 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 performance framework includes the implementation of a set of performance common metrics to facilitate comparative analysis of overall regional development, such as operational and economic cost-effectiveness of gate-to-gate flight operations, and the protection of the environment in the planning, implementation and operation processes of the global ATM system.
Related projects	• Improvement of demand-capacity balancing • Flexible use of airspace • Improvement of ATM situational awareness • Implementation of the new ICAO flight plan format

Project Deliverables	Relationship with the NAM/CAR RPB-ANIP	Responsible Party	Status of Implementation*	Date of Delivery	Comments
PBN Airspace Concept	RPOs 1, 2, 3	Alfredo Mondragón		2014	A comprehensive PBN airspace concept was developed for the design and implementation of a trunk route network to/from city pairs in the upper and lower airspace
Optimize the ATS route structure based on RNAV-5 implementation in the upper continental airspace	RPOs 1.1	States, Territories, International Organisations		2012	Some States have already implemented RNAV 5 in the upper airspace
Implement SIDs/STARS, CDO and CCO in terminal areas based on RNAV/1-2 and RNP1 navigation specifications	RPOs 1.2	States, Territories, International Organisations		2012	-165 SIDs implemented -126 STARs implemented -Some States have implemented CDO/CCO
Design and implement PBN APV (BARO-VNAV) approach procedures in accordance with Assembly Resolution A37-11	RPOs 1.3	States, Territories, International Organisations		2014	118 RNP approach procedures implemented
Study for the implementation of a comprehensive PBN airspace concept for the lower and upper airspace in the Central American FIR	RPOs 1, 2, 3	Alfredo Mondragón		2012	COCESNA coordinates with Central American States

PBN training programme for pilots, ATCOs, operators and regulators	RPOs 1	States, Territories, International Organisations		2012	Some States conduct their training programme in accordance with the ICAO PBN Manual, Doc 9613
Evaluate and implement ATC automated system requirements in accordance with the new ICAO Flight Plan Form requirements	RPOs 1, 3, 4, 5	States, Territories, International Organisations		15/11/2012	
Draft a proposal of amendment to the ATS route network for the implementation of RNP 10 in the oceanic area of the Gulf of Mexico, and for the implementation of RNAV 5 in continental areas	RPOs 1.1	Alfredo Mondragón, Roy Grimes		2012	Draft version of 22 RNAV routes to be implemented/realigned. Develop proposal of PBN amendment to the relevant regional documentation.
Develop a PBN Safety Assessment Programme based on the SMS methodology	RPOs 1	States, Territories, International Organisations		2010	States conduct safety assessment to implement changes in their airspace.
Implementation of random routes in defined oceanic airspace	RPOs 1.1, 3	Trinidad and Tobago		2014	Piarco implemented random routes in the oceanic airspace of the Piarco FIR
Develop a performance measurement programme	RPOs 1, 3	ICAO		2010	Implementation results were presented at NACC/DCA meetings
Monitor system performance	RPOs 1, 2, and 3	ICAO		2010	The ICAO NACC Regional Office conducts this activity
Resources needed	CAR regional project with the participation of States in support of PBN training matters.				

Grey Task not started yet
Green Activity being implemented as scheduled
Yellow Activity started with some delay, but expected to be implemented on time
Red Activity not implemented on time; mitigation measures are required

APPENDIX A2

PROJECT ON AIR NAVIGATION SYSTEMS IN SUPPORT OF PBN

CAR Region	**PROJECT DESCRIPTION (DP)**	**DP N° A2**	
Programme	**Title of the Project**	**Start**	**End**
Performance-based performance (PBN) (Programme coordinator: Victor Hernandez)	*Air Navigation Systems in Support of PBN* Project coordinator: Jose Antonio Pérez y Pérez (Dominican Republic)	2009	2016
Objective	Support the implementation of GNSS navigation infrastructure for PBN based on the regional performance objectives of the NAM/CAR performance-based implementation plan (NAM/CAR RPBANIP)		
Scope	Drafting of guides and proposals for GNSS evolution and implementation in support of PBN implementation and benefits.		
Metrics	• 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 • Percentage of instrument runway ends with vertical guidance approach procedure (APV), (BARO-VNAV and/or GNSS augmentation), whether as primary approach or as support to precision approaches • Percentage of international airports with SID/STAR RNAV, RNP and continuous descent and climb (CDO/CCO) operations implemented • Estimated fuel savings due to operational improvements		

Strategy	Project activities will be coordinated amongst project members, the project coordinator, and the programme coordinator. The programme and project coordinators will coordinate the requirements of other projects and NAM/CAR implementation working groups. Experts nominated by the States, Territories, and International Organisations will be assigned to tasks as required.
Rationale	The Assembly Resolution A37-11, performance-based navigation (PBN) global goals, urged States to implement RNAV and RNP ATS routes and 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 according to the defined implementation plans and report annually to ICAO any deficiencies that may occur. 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 performance framework includes the implementation of a set of performance common metrics to facilitate comparative analysis of overall regional development, such as operational and economic cost-effectiveness of gate-to-gate flight operations, and the protection of the environment in the planning, implementation and operation processes of the global ATM system.
Related projects	• Improvement of demand-capacity balancing • Improvement of ATM situational awareness • Implementation of the new ICAO flight plan format • Optimisation and modernisation of the communications infrastructure

Project Deliverables	Relationship with the NAM/CAR RPB-ANIP	Responsible Party	Status of Implementation*	Date of Delivery	Comments
Analyse DME/DME and GNSS infrastructure and coverage required to support PBN implementation	RPOs 1	States, Territories, International Organisations		2012	Current DME infrastructure supports PBN approach procedure requirements. Table CNS 4: revised and updated with the current regional conventional navaids infrastructure.
Regional feasibility study of SBAS (WAAS/SACCSA) implementation.	RPOs 1	Jose Antonio Pérez y Pérez assisted by SACCSA and WAAS		2012	Feasibility of regional application, technical aspects, operational benefits, associated costs of SBAS (WAAS/SACCSA) implementation. Implications for airborne equipment (factory delivered and retrofits) and other relevant aspects.
Practical guide for the implementation of GBAS systems	RPOs 1	Jose Antonio Pérez y Pérez assisted by SACCSA and WAAS		2014	
Guidance on the use and availability of GNSS prediction/validation tools	RPOs 1	Jose Antonio Pérez y Pérez assisted by SACCSA and WAAS		2014	
Enhance communication, navigation, and surveillance infrastructure in accordance with PBN /GNSS requirements	RPOs 1, 4, 5, 8, 9	States, Territories, International Organisations		2015	

Monitor system performance	RPOs 1	ICAO		2010	ICAO NACC Regional Office conducts this activity
Resources needed	CAR regional project with the participation of States to support PBN training issues				

Grey	Task not started yet
Green	Activity being implemented as scheduled
Yellow	Activity started with some delay, but expected to be implemented on time
Red	Activity not implemented on time; mitigation measures are required

END

APPENDIX B1

PROJECT ON PBN OPERATIONAL IMPLEMENTATION

PROJECT DESCRIPTION (DP)		DP N° A1	
Programme	**Title of the Project**	**Start**	**End**
Performance-based navigation (PBN) (Programme coordinator: Celso Figueiredo)	PBN Operational Implementation *Project coordinator: Alexandre Luiz Dutra Bastos (Brazil)* Experts contributing to the project*: Jorge Fernandez (ATS consultant), Tomas Yentzch (Paraguay)*	2011	2018+
Objective	Support the implementation of the project on the optimisation of the ATS route structure in terminal airspace (RNAV SIDs/STARs) and en-route (RNAV), as well as the implementation of RNP approaches, associated to **Result 1.1 of Immediate Objective N° 1 of Project RLA/06/901**		
Scope	The project contemplates planning in three different phases: Phase 1 – Implementation of RNAV5; Phase 2 – Implementation of Version 1 of the SAM ATS route network, and Phase 3 – Implementation of Version 2 of the SAM ATS route network		
Metrics	• Reduction in the number of air traffic incidents for every 100,000 operations per year • Increase of ATC sector capacity • Reduction of CO^2 emissions per 100,000 operations per year • Percentage of international airports with RNAV and/or RNP SIDs/STARs implemented where applicable • Percentage of international airports with continuous descent and climb operations implemented • Number of air traffic incidents per 100,000 operations per year • Tonnes of CO^2 emissions per 100,000 operations per year • Reduction of aviation noise		

Strategy	Project activities will be coordinated amongst project members, the project coordinator, and the programme coordinator, mainly through SAM/IG meetings. The project coordinator will coordinate with the programme coordinator for the inclusion of additional experts in accordance with the tasks and work to be carried out. States must also review their respective national RNAV route implementation programmes to ensure compatibility with the SAM RNAV implementation programme. Route revision, implementation, modification, or elimination activities are foreseen in the SAM Region in order to continue with the optimisation of the ATS route structure.
Rationale	The 36th ICAO General Assembly requested the Council to encourage Contracting States to improve air traffic efficiency, which will result in emission savings, to report developments in this field, and to expedite the development and implementation of routings and procedures that will enable an efficient consumption of fuel in order to reduce aviation emissions.
Related projects	• Flexible use of airspace • Improvement of demand-capacity balancing • Implementation of the new ICAO flight plan format • Automation

Project Deliverables	Relationship with the regional performance-based plan (PFF)	Responsible Party	Status of Implementation *	Date of Delivery	Comments
Implementation of Version 1 of the ATS route network based on RNAV, with the required PBN values to respond to the current requirements of airspace users.	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		October 2013	The hiring of 2 experts for a period of 3 weeks during the second half of February 2012 has been foreseen to conduct a detailed study of the SAM ATS route network with a view to developing Version 2 of the route network.
Implementation of RNAV5 in the SAM Region	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		October 2011	-
Action plan for the implementation of Version 2 of the ATS route network optimisation programme	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		ATS/RO/3	-
Guidance material for the implementation of the flexible use of airspace concept	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		ATS/RO/4	A new collection of statistical data was deemed advisable to enable the analysis of the evolution of air traffic demand in the Region.
Route implementation and/or realignment proposals based on the FUA	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/7	95% of the SAM fleet is eligible for RNAV5 approval. States must continue doing efforts to complete the database (Conclusion SAM/IG/4-3)

Traffic data to understand airspace traffic flows	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/6	-
Navigation capacity of the fleet	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/9	Information on RNAV5 approval is being sent to CARSAMMA and it is expected that operators and aircraft will be ready by the implementation date (Oct 2011). The navigation capacity database will be completed as foreseen in the SAM/IG/2 and SAM/IG/4 meeting reports (Conclusion SAM/IG/4-3). Pending updating.
List of gateways of the main SAM TMAs	PFF SAM ATM 02	Alexandre Luiz Dutra Bastos		SAM/IG/9	-
Letters of agreement and contingency with adjacent States	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/10	-
Detailed study of the SAM ATS route network with a view to developing Version 2 of the route network	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		April 2012	Hiring of 2 experts for a period of 3 weeks. Period defined: 12-30 March

"*Airspace Modelling*" studies and fast-time simulation to assess the scenarios developed in the detailed study of the SAM ATS route network.	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/10	-
Safety assessment of Version 2 of the SAM ATS route network using a qualitative methodology based on the SMS	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		SAM/IG/10	States shall conduct a safety analysis of changes in its terminal areas (TMA)
Proposal of amendment to the CAR/SAM Air Navigation Plan	PFF SAM ATM 01 PFF SAM ATM 02	Alexandre Luiz Dutra Bastos		August 2013	-
Drafting of Version 3 of the ATS route network, including the application of RNP 4 for oceanic routes, and RNP 2 for continental airspace	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		2015	Regional project supported by States
Implement random routes in defined continental areas	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos		2018+	-
Resources needed	Designation of experts for the execution of some of the deliverables.				

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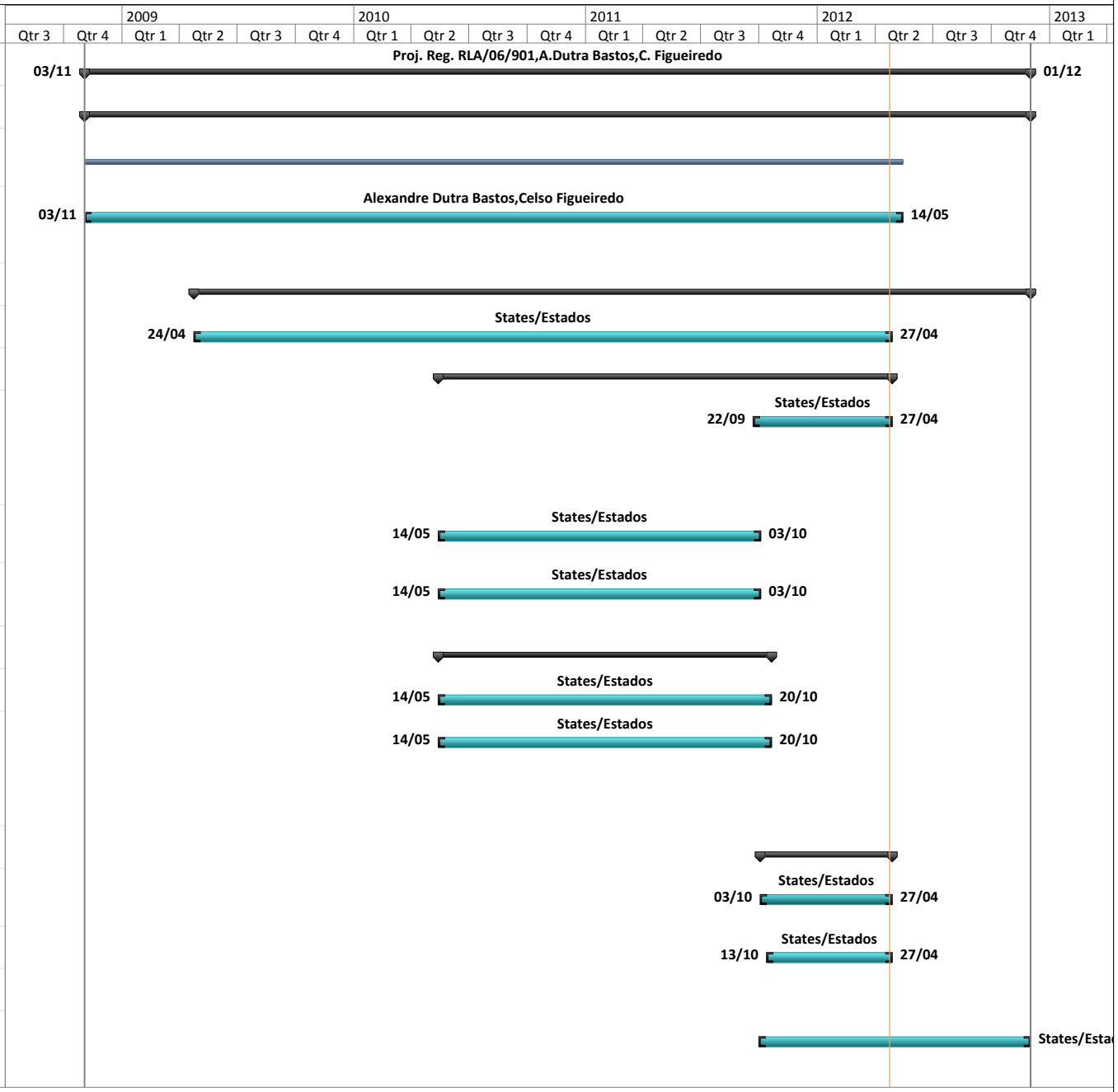
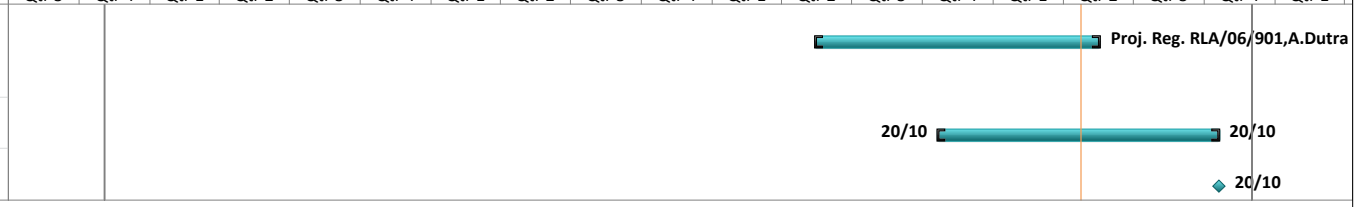
Grey	Task not started yet
Green	Activity being implemented as scheduled
Yellow	Activity started with some delay, but expected to be implemented on time
Red	Activity not implemented on time; mitigation measures are required

ID	Task Name	Duration
1	**Implantación operacional PBN/PBN operational implementation**	**1065 days**
2	**RNAV-5 a corto plazo/ RNAV-5 Short term**	**1065 days**
3	**Establecer un proceso de toma de decisiones en colaboración/Establish a collaborative decision-making process (CDM)**	
4	Coordinar necesidades de planificación e implantación. Se requiere nuevo AIC. / Coordinate planning and implementation requirements. New AIC required.	921 days
5	**Aprobación de aeronaves y operadores / Aircraft and operator approval**	**941 days**
6	Aprobación de aeronaves y operadores / Approval of aircraft and operators	786 days
7	**Normas y procedimientos**	**511 days**
8	Publicar Suplemento AIP que contenga normas y procedimientos aplicables, incluyendo las contingencias en vuelo. / Publish the AIP Supplement containing applicable standards and procedures, including in-flight contingencies	157 days
9	Revisar el Manual de Procedimientos de las unidades ATS involucradas / Review the Procedural Handbook of the ATS units	362 days
10	Actualizar cartas de acuerdo entre unidades ATS/ Update the letters of agreement between ATS units	362 days
11	**Capacitación / Training**	**375 days**
12	Conducir programas de capacitación	375 days
13	Realizar seminarios orientados a los operadores, indicando los planes y los beneficios operacionales y económicos esperados/ Conduct seminars for operators, explaining plans and expected operational and economic benefits	375 days
14	**Decisión de implantación/ Implementation decision**	**150 days**
15	Evaluar la documentación operacional disponible (ATS, OPS/AIR) / Assess the available operational documentation (ATS,	150 days
16	Publicar trigger NOTAM / Publish trigger NOTAM	142 days
17	**Sistema de monitoreo de la performance/ Performance monitoring system**	
18	Ejecutar un programa de monitoreo post-implementación de operaciones en Ruta/ Implement a post-implementation en-route operations monitoring programme	307 days



ID	Task Name	Duration
19	Evaluar el porcentaje de operaciones RNAV5 aprobadas (espacio aéreo no excluyente) / Assess percentage of RNAV5 approved operations (non-exclusionary airspace)	266 days
20	**Fecha de implantación Pre-operacional / Pre-operational implementation date**	263 days
21	**Fecha definitiva implantación / Definitive implementation date**	0 days



APPENDIX B2

PROJECT ON AIR NAVIGATION SYSTEMS IN SUPPORT OF PBN

SAM Region	**PROJECT DESCRIPTION (DP)**	**DP N° A2**	
Programme	**Title of the Project**	**Start**	**End**
PBN (*Programme coordinator: Celso Figueireido)*	Air navigation systems in support of PBN *Project coordinator: Alexandre Luiz Dutra Bastos (Brazil)* Experts contributing to the project*: Alessander Santoro, Andre Jansen, Fabio Augusto Andrade (Brazil), Paulo Vila and Tomas Macedo (Peru) and the SAM/IG PBN Group*	January 2011	May 2013
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, which initially involves: • Practical GBAS system implementation guide • Analysis of DME/DME and GNSS infrastructure • Implementation of a RAIM availability prediction service		
Metrics	• Drafting of a practical GBAS system implementation guide • DME/DME coverage in the SAM Region • Availability of a RAM availability prediction service		
Strategy	• All tasks will be executed by experts nominated by SAM States and organisations participating in project *Air navigation systems in support of PBN* under the management of the project coordinator and under the supervision of the programme coordinator. Communications amongst project members, and between the project and programme coordinators shall be done via teleconference and the Internet. Likewise, the programme and project coordinators, as well as the contributing experts can meet during SAM/IG meetings. • Once the studies are completed, the results will be sent to the ICAO programme coordinator in the form of a final consolidated document for analysis, revision and approval of the GREPECAS PPRC.		
Rationale	• 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 installation of DMEs to support DME/DME navigation required in case of GNSS failure, the RAIM availability prediction service that will allow the user to know 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 PFFs CNS 03, ATM 01, ATM 02, and ATM 03 of the *SAM Performance-Based Navigation System Implementation Plan (SAM PBIP)*		
Related projects	• Implementation of PBN operational aspects		

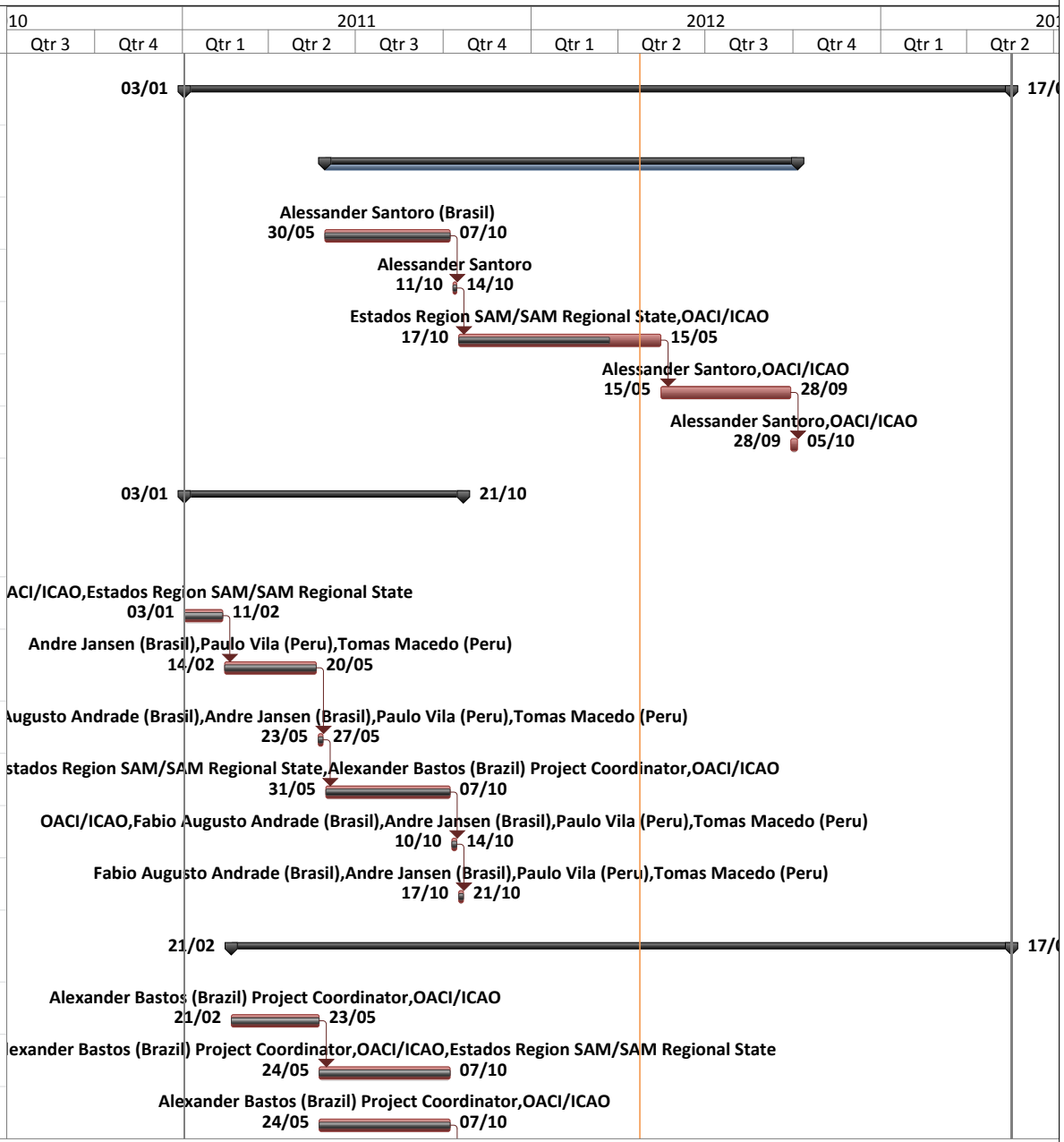
Project Deliverables	Relationship with the regional performance-based plan (PFF)	Responsible Party	Status of Implementation [1]	Date of Delivery	Comments
Develop a practical guide for the implementation of the GBAS system					
Practical guide for the implementation of GBAS systems	SAM PFF CNS 03	Alessander Santoro (Brazil)		October 2012	The initial material for the practical guide on the implementation of GNSS systems was presented at the SAM/IG/8 meeting
Analyse the DME/DME and GNSS infrastructure and coverage required to support PBN implementation					
Analysis of the DME/DME and GNSS infrastructure required to support the implementation of PBN implementation in the SAM Region	SAM PFF CNS 03 SAM PFF ATM/01 ATM/02 ATM/03	Fabio Augusto Andrade and Andre Jansen (Brazil) Paulo Vilas and Tomas Macedo (Peru)		Completed	A *DME/DME coverage study* was presented to, and reviewed by the SAM/IG/7 meeting (Lima, Peru, 23-27 May 2011). The coverage study was conducted using the EMACS tool and the result was KMZ file showing DME/DME coverage over the geographical map of the SAM Region through Google Earth
Development of guidelines on the use and availability of GNSS service forecast/validation tools					
Implementation of a RAIM availability prediction service	SAM PFF CNS 03 SAM PFF ATM/01 ATM/02 ATM/03	Project coordinator SAM/IG PBN Group		May 2013	An initial study has been conducted on the implementation of a RAIM availability prediction service, which was presented at the SAM/IG/8 meeting (Lima, Peru, 10-14 October 2011)

[1] ***Grey*** *– Task not started yet*
Green *– Activity being implemented as scheduled*
Yellow *– Activity started with some delay, but expected to be implemented on time*
Red *– Activity not implemente on time; mitigation measures are required*

Project Deliverables	Relationship with the regional performance-based plan (PFF)	Responsible Party	Status of Implementation [1]	Date of Delivery	Comments
Monitor activities for the implementation of air navigation systems in support of PBN		ICAO		January 2011 – May 2013	
Resources needed	Implementation of the RAIM availability prediction service				

CAR/SAM REGIONAL PLANNING AND IMPLEMENTATION GROUP / GRUPO REGIONAL CAR/SAM DE PLANIFICACION E IMPLANTACION (GREPECAS)
PBN SUPPORTING AIR NAVIGATION SYSTEMS/SISTEMAS DE NAVEGACION AEREA EN APOYO A LA PBN

ID	Nombre de tarea	Duration
1	**PBN SUPPORTING AIR NAVIGATION SYSTEMS/SISTEMAS DE NAVEGACION AEREA EN APOYO A LA PBN**	**620 days**
2	**Guide on the practical guidance for the implementation of GBAS Systems / Guía práctica para implementación de sistemas GBAS**	**355 days**
3	Collection of information/Recolección de información	95 days
4	Delivery of a guide draft proposoal/Entrega de propuesta de borrador de guía	4 days
5	Review of draft proposal/Revisión del borrador de propuesta	151.88 days
6	Guide final adjustments/Ajustes finales en la guía	98 days
7	Guide final delivery/Entrega guía final	5 days
8	**Analysis of the DME/ DME and GNSS infrastructure supporting PBN implementation in the SAM Region / Análisis de la infraestructura DME / DME y GNSS requerida para apoyar la implementación de la PBN en la Región SAM**	**210 days**
9	Collection of DME installation information/ Recolección de información sobre DME	30 days
10	Analysis for DME/DME using EMAC software tool/ Análisis de DME /DME usando sofware EMAC preliminar	70 days
11	Delivery of a preliminary analysis/Entrega análisis inicial	5 days
12	Review of preliminary analysis/Revisión del borrador inicial	94 days
13	Adjustments in the Analysis/Ajuste en el análisis	5 days
14	Delivery of final analysis/Entrega análisis final	5 days
15	**Implementation of a RAIM availability prediction service/Implantación de un servicio predicción de la disponibilidad RAIM**	**585 days**
16	Collection of information/Recolección de información	66 days
17	Development of requirements/Desarrollo de requerimientos	99 days
18	Service provider consult/Consulta proveedor de servicio	99 days



CAR/SAM REGIONAL PLANNING AND IMPLEMENTATION GROUP / GRUPO REGIONAL CAR/SAM DE PLANIFICACION E IMPLANTACION (GREPECAS)
PBN SUPPORTING AIR NAVIGATION SYSTEMS/SISTEMAS DE NAVEGACION AEREA EN APOYO A LA PBN

ID	Nombre de tarea	Duration
19	State consult for implementation/Consulta a los Estados para la implantación	40 days
20	Drafted technical specification/Elaboración especificaiones técnicas	115 days
21	Bid process/Proceso de licitación	46 days
22	Implementation/Implantación	65 days
23	**Monitor PBN supporting air navigation systems activities in the SAM Region / Monitorear las actividades de implantación de los sistemas de navegación aérea de apoyo a la PBN en la Región SAM**	**620 days**
24	Monitor PBN supporting air navigation systems activities in the SAM Region/Monitorear las actividades de implantación de los sistemas de navegación aérea de apoyo a la PBN en la Región SAM	620 days