International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)

WORKING PAPER

GREPECAS/21 — WP/10
18/10/23

Twenty-first Meeting of the CAR/SAM Regional Planning and Implementation Group (GREPECAS/21)
Santo Domingo, Dominican Republic, 15 to 17 November 2023

Agenda Item 3: Global and Regional Developments
3.3 CAR/SAM Air Navigation Services (ANS) Implementation Level

INFORMATION ON PBN AND ATFM ADVANCES IN THE CAR/SAM REGIONS

(Presented by the Secretariat)

EXECUTIVE SUMMARY

This paper presents a report on the evolution of GREPECAS implementation activities in CAR/SAM Regions, related to the PBN Programme, as well as the evolution of activities related to the ATFM Programme projects.

Action:	Suggested Actions are presented in Section 4
Strategic Objectives:	• Safety • Air Navigation Capacity and Efficiency • Environmental Protection
References:	• Doc 9613 — Performance-based navigation manual (PBN) • Doc 9750, Global Air Navigation Plan (GANP) • Doc 9971, Manual on collaborative management of ATM. • Reports of GREPECAS, PPRC and e PPRC meetings.

1. Introduction

1.1 In follow-up to GREPECAS Decisions 16/45 and 16/47, the "Performance-Based Navigation (PBN)" Programme was structured with the following associated projects:

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

1.2 Following the analysis of the current airspace structure of the CAR Region, and taking into consideration the development of a roadmap to achieve the Aviation System Block Upgrade (ASBU) element - FRTO – B1/1 - Free Route Airspace (FRA); the ICAO NACC/WG Airspace Optimization Taskforce (AO/TF) is proposing an amendment to the name and associated work plan of the A1 CAR project from Implementation of Performance Based Navigation (PBN) to CAR/SAM Airspace Optimization – (Transition to Free Route Airspace).

1.3 The AO/TF has drafted an Optimized Airspace Concept for the CAR Region which includes a plan to transition to FRA. It is noted that PBN Implementation is incorporated as part of the transition to FRA and therefore the PBN objectives outlined in the previous work plans have been amended into the new work plan. See **Appendix A**. The Optimized Airspace Concept (draft) for the CAR Region is presented as **Appendix B** to this WP.

1.4 Additionally, in Working Paper GREPECAS/21 - WP/15, the execution of Decision GREPECAS/20/01 - *AMENDMENT TO PROJECTS A1 OF THE CAR AND SAM REGIONS ON THE IMPLEMENTATION OF PBN, WITH THE PURPOSE OF DEVELOPING CONCEPTS FOR THE OPTIMIZATION OF THE AIRSPACE* is presented, with the purpose of developing concepts for the optimization of the airspace through the new NEOSPACE-1 Project.

1.5 In turn, the ATFM Programme was structured with the following associated projects:

a) Improve the balance between demand and capacity, in the CAR and SAM Regions; and
b) Implementation of flexible use of airspace, in the CAR Region

2. Analysis

2.1 *CAR Region*

2.1.1 Following discussions held at the ANI/WG/5 meeting (May 2019) and based on input from IATA and CANSO, it was decided that the scope of the activities undertaken by the NACC/WG AO Task Force should be expanded to cover the broader concept of airspace optimization. While the implementation of PBN remains a high priority, the Task Force should also pay attention to additional airspace considerations that contribute to the development of ASBU concepts such as improved operations through enhanced en-route trajectories (FRTO). During the NACC/WG/6 meeting (August 2021 –online), it was agreed that the ICAO NACC PBN Taskforce would change its name to Airspace Optimization Taskforce (AOTF); and adjust its work plans as required.

2.1.2 During the COVID 19 Pandemic, collaborative efforts between CANSO and IATA resulted in trials of optimized routes servicing specific city pairs between North America and South America. In September of 2021, the AO/TF joined with CANSO and IATA to create the CANSO/IATA/ICAO Free Route Airspace (CIIFRA) Team. As part of the AOTF, the CIIFRA Team coordinates the trials of optimized routes through the region between ANSPs and Airline Operators. The trials have proven to be very successful in reducing fuel consumption, CO2 emissions and the overall operating costs to the operators.

2.1.3 During 2022, a new concept has been introduced into airspace optimization, Strategic Direct Routing (SDR). The following is a definition of SDR:

"Strategic Direct Routing (SDR) – SDR allows users to plan a route using any named waypoints within a specified volume of airspace as long as the route complies with parameters set by the State. The parameters may include restrictions such as hours in which SDR rules apply, at or above altitude requirements and maximum distance between waypoints. Users must file flights via authorized (i.e., published) routes to the entry and exit point at the boundaries of the SDR airspace volume; that is, the SDR system only applies inside the defined volume of airspace. SDR is considered to be a transition to the implementation of the Free Route Airspace (FRA) concept".

2.1.4 In November 2022, Mexico began limited Strategic Direct Route (SDR) trials and have been providing valuable information to the CIIFRA team.

2.1.5 During the AO/TF/3/ATFM/TF/5/CIIFRA/7 meeting held in September 2023, guidelines were provided to Air Navigation Service Providers (ANSPs) to start SDR trials (**Appendix C**). Additionally, several ANSPs began developing their own SDR trial/implementation plans and are expected to provide their plans to the ICAO NACC Regional Office by 31 December 2023.

2.2 *ATFM Minimum requirements for the CAR Region*

2.2.1 The Seventh North American, Central American and Caribbean Working Group Meeting (NACC/WG/07) held at the ICAO NACC Regional Office in Mexico City, Mexico, from 29 August to 1 September 2022 approved Conclusion NACC/WG/07/01 asking the Secretariat to continue developing the proposal for amendment for the inclusion in the CAR/SAM Regions Air Navigation Plan of minimum requirements for ATFM in the CAR Region, in accordance with the required levels of services and their interrelation in the Regional ATM network and asking States to support the implementation and operation of ATFM in the CAR Region, promoting decision-making from a regional perspective in order to collaborate to reduce the impact of air traffic management measures taken by any State/Territory or ANSP.

Support ATFM Performance Measurement.

2.2.3 The evolution and enhancement of the ATM system will be directly related to the ATM community's ability to clearly define performance expectations, set a relevant performance framework, set achievable targets, and implement change cost-effectively, based on capabilities at any particular time along the planning horizon. Like any other component of the ATM system, ATFM must be evaluated to ensure that the ATM community's expectations of it are being met. The ATFM programme performance may be generically evaluated, from three perspectives:

- ATFM programme effectiveness: How effective is the ATFM measure implemented in delivering the intended level of traffic?
- Compliance assessment: How well do stakeholders comply with the ATFM measure?
- Impact analysis: Who are impacted by the ATFM programme, and how?

2.2.4 The CAR and SAM Regions are working collaboratively to develop the CAR/SAM Electronic Air navigation plan (e-ANP) Vol. III. The CAR/SAM e-ANP Vol. III will have a performance-based framework for ANS planning and implementation in the CAR/SAM Regions. As part of this process, the CAR/SAM Region identified three Key Performance Areas (KPAs) to be addressed by the CAR/SAM ANP Vol. III:

Capacity, Efficiency and Predictability

2.3 Future Work Programme priorities

- Improve Pre-Event Planning and coordination/collaboration with stakeholders.
- Task force will support planning for the FIFA 2026 World Cup which will be held in three States within the NAM/CAR Regions.
- Continue Collaborative Decision Making outreach via virtual workshops.
- Improve Post-Event Analysis.
- Improve Seasonal Review Capability with stakeholders.
- Continue efforts to enable ANSPs to connect to the basic ATFM platform for real-time demand visualization and awareness.

2.4 *SAM Region*

Project A1 " PBN Operational implementation"

2.4.1 The Meetings of the Implementation Group of the South American Region (SAM/IG) concentrate their actions for the Enroute, SID/STAR Standard Route and TMA PBN airspace phases, as well as PBN approach procedures.

2.4.2 Since 2019, the SAM Airspace Study and Implementation Group (GESEA) has been established, which aims to increase the efficiency of the work promoted by the SAM/IG. GESEA has been working since its creation on the basis of teleconferencing and electronic communication.

2.4.3 It is noted that during the pandemic period, airspace design personnel and/or PANS OPS, in most administrations, were assigned to remote work. In several States, the number of specialist designers has been reduced either by retirement or by reassignment to operational functions. However, the average regional SAM deployment continues to rise.

2.4.4 **Appendix D** to this note outlines the progress of the project for the period 2019 – 2023. ICAO's iSTARS application considers this year a total of 223 instrument runway thresholds in the SAM Region (international airports). The average implementation of PBN approaches reached 92.4%.

2.4.5. The details of the main activities of the PBN SAM Implementation Project are attached as **Appendix E** to this paper.

2.5 Project A2 - Air Navigation systems in support of PBN

2.5.1 The improved version of the SAM Region Autonomous Receiver Integrity Monitoring (RAIM) Availability Prediction Service (SATDIS) software is implemented in the Member States of the RLA/06/901 Project. States are being encouraged to extend access to the web tool for air users and operators.

2.5.2 Regarding the implementation of GBAS technology (preparation of a Practical Guide), no progress has been recorded since the GREPECAS/20 meeting, however, at this meeting Working Papers presented by Brazil and the industry on GBAS and SBAS will be analysed. See **Appendix F**.

2.6 Project B1 "Improving the balance between demand and capacity"

2.6.1. Since June 2021, Sub Group 3 – ATFM (SG3), of the SAM Airspace Study and Implementation Group (GESEA), was constituted, which defined the necessary deliverables to boost the activity of ATFM services.

2.6.2. SG3 worked on the preparation of an ATFM Operations Plan (OPSAM) with the aim of structuring actions that allow, during the recovery phase of operations in the SAM region, to adjust ATC and Airport capacity to the gradual demand increase. As well, contribute to the recovery and sustainability of the air transport system at regional and global level in the new projected scenario.

2.6.3 This mechanism includes the creation of a dashboard with a single database format to allow the exchange of information on demand and support the establishment of two Operational Teleconferences ATFM SAM (BRISA), one pre-tactic and one Strategic/Post-operations.

2.6.4 Currently, the dashboard (IATA Summer 23 season data) has the schedule of flights from 10 SAM states, to be used in the organization of the BRISA. As the post-operations information provided by the States is analyzed, the management of KPIs referring to punctuality, flight efficiency, etc. is being initiated. See the dashboard in the following link:
https://app.powerbi.com/view?r=eyJrIjoiMDZiNjU0MzktOGQ1Yy00ZWJkLTgwMGUtZTQ0NTU2MzVjOGQ0IiwidCI6IjI2MjI4ZGNhLTcwZDMtNDkxNy04MjMzLTA4M2FjMzY1NWE5MSJ9

2.6.5 Based on demand and effective operations data provided by ATFM services, from October 2023 the first tests of KPI 09 and KPI10 performance indicator calculations will be included in the dashboard. These calculations could evolve into data for the Tables of Vol. III, after validation and adjustments.

2.6.6 Paraguay has completed runway capacity calculations for Asuncion Airport, with support from Brazil. Studies on cross-border ATFM are underway based on current collaborative practices between the services Argentina, Brazil, Chile and Uruguay.

2.6.7 The details of the main activities of the ATFM SAM Implementation Project are attached as **Appendix G** of this paper.

2.7 Initiative on Flexible use of Airspace (FUA)

2.7.1 The Workshop/Meeting for the SAM Region on Flexible Use of Airspace (FUA) and Civil-Military Cooperation in the ATM (Lima, Peru from June 19 to 23, 2023) was held to consolidate the progress of the implementation of the FUA in the SAM Region and strengthen in the States the management of security aspects, economic and environmental operations of civil and military operations in airspace.

2.7.2 It was recognized that the SAM Region should prioritize the adoption activities of the provisions of ICAO Document 10088. It was agreed that the implementation of a Committee for the Organization and Management of Airspace (CAOM) in each administration is feasible in the short term, approving for this purpose a draft that allows the elaboration of a National Manual FUA that incorporates the legal system and practices in matters of FUA and airspace management.

3. Conclusions

CAR Region

3.1 The table below presents the updated Metrics which represent information the CIIFRA team has received and is minimum yearly savings from the most recent data.

	ete	fuel	CO2	cost
	min	kg	kg	$
UPR	26,199	2,604,033	8,228,744	4,514,401
SDR	8,380	506,500	1,592,429	1,222,724
SKBO-KJFK	1,071	106,469	336,442	193,949
FDX SDR	3,136	323,796	1,023,194	579,142
KIAH-MMSD	10,038	439,326	1,388,272	833,113
Total	48,823	3,980,124	12,569,080	7,343,329

3.2 Following the Second Meeting of the North American, Central American and Caribbean Working Group (NACC/WG) Airspace Optimization Task Force (AO/TF/2) held from 13 to 17 February 2023, it was recognized that greater collaboration was required between the various taskforces of the NACC WG to effect Regional Airspace Optimization. There are CNS, AIM, ATFM AGA and MET related ASBU initiatives that support the implementation of FRTO. During the Second Meeting of Rapporteurs of the North American, Central American and Caribbean Working Group (NACC/WG/RAP/2) held from 28 to 31 March 2023, these items were discussed, and it was agreed that there will be a joint effort amongst all taskforces to support the regional implementation of FRA.

3.3 ATFM implementation must adjust to the reality of the different airspaces and evolve in those Flight Information Regions (FIRs) where better strategic decision-making regarding air traffic is necessary. The ATFM task force will continue to support the region in its ongoing evolution.

3.4 ATFM provides data that is used to measure performance in the CAR Region. The ATFM Task Force must maintain its advisory role to provide support for the establishment of the performance framework in the CAR Region.

3.5 The CANSO Air Traffic Flow Management Data Exchange Network for the Americas (CADENA) platform is widely used by the ANSPs of the NAM/CAR Regions. Last year the NACC/WG ATFM/TF approved the use of the CADENA as a mechanism to facilitate data sharing and promote a common situational awareness that is vital to the safe, efficient, and harmonized flow of air traffic. The task force encourages the continued use of CADENA as an effective tool supporting the region in ATFM matters.

SAM Region

3.6 In the SAM Region, under the auspices of Project RLA/06/901, direct assistance has been provided to the States for the implementation of PBN in selected airspaces. The conditions and/or requirements to be able to address PBN implementation in the following period are listed below:

- The SAM Region maintains the progress of the deployment. Average 92.4% was reached in PBN (APV- BARO VNAV) in September 2023.
- Refresher training needs for design personnel should be addressed, as well as renewing specialized equipment/software and updating work plans.
- Horizontal cooperation between States and, at the same time, with Industry should be emphasized to promote PBN implementation.
- The SATDIS tool has been delivered to the States of the RLA 06 901 Project, available so that users and operators in the Region can have a prediction of RAIM availability.

3.7 The implementation of ATFM in the Region has been strengthened through data management activities and demand-capacity analysis. The calculation of GANP performance indicators was started, referring to Airport Peak Capacity (KPI09) and Airport Peak throughput (KPI10). Studies on cross-border ATFM are being promoted.

3.8 Based on the results of the SAM Workshop/Meeting on FUA, States have initiated the adoption of the provisions of ICAO Document 10088.

4. Suggested Actions:

4.1 The Meeting is invited to:

a) note the information in this Working Paper;
b) review the activities detailed in Appendix A;
c) review the draft CAR Optimized Airspace Concept document presented in Appendix B and the draft SDR Trial Implementation Guidance and Working Template presented in Appendix C;
d) review the activities and status of the projects detailed in Appendices D, E, F and G
e) support the Conclusions included in Section 3; and
f) propose any other actions as deemed necessary.

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APPENDIX A

APPENDIX A – AOTF Amended Work Programme 2023-2025

Task Name/ Tarea	Start/ Inicio	Finish / Final	Deliverables/ Resultados	Follow-up/ Seguimiento	Responsible/ Responsables	Observations/ Comments- Observaciones/ Comentarios
a) Assist States/Territories with the Implementation of Airspace Optimisation concept for oceanic, continental and terminal areas in of NAM/CAR Regions in accordance with the ICAO PBN Manual Doc 9613 and Doc 9992	APR 2019	DEC 2025	i) 100% removal of **redundant** conventional ATS routes by December 2025 ii) 75% replacement of conventional routes by RNAV 5 routes by December 2025	ICAO Regional Office and NACC WG AO Task Force	AO Taskforce, ICAO, States, Territories, International Organizations	**Status: Valid - Ongoing** KPA: Capacity KPI06: En-route airspace Capacity Reference Sub-Project to Develop and Implement a Performance-Based Navigation (PBN) Airspace Concept Document for the CAR Region. **Requirements:** Commitment from executive decision makers, Funding for the project, Human Resources (Airspace Designers, ATCOs, Airline Operators, ANSP Decision makers).
	SEP 2022	June 2023	iii) Develop the CAR Airspace Optimization Concept which includes a roadmap for transition to FRA by June 2023	ICAO Regional Office and NACC WG AO Task Force	AO Taskforce, ICAO, States, Territories, International Organizations	**Status: Draft Vol.1 COMPLETED in August 2023. Approval required by NACC WG.** FRTO B0/1 and B1/1, Direct Routing and Free Route Airspace, respectively. KPA: Efficiency

Task Name/ Tarea	Start/ Inicio	Finish / Final	Deliverables/ Resultados	Follow-up/ Seguimiento	Responsible/ Responsables	Observations/ Comments- Observaciones/ Comentarios
						KPI04: Filed flight plan en-route extension
b) Conduct an assessment of the ATM BBBs	Oct 2023	Oct 2023	A completed methodology by October 30, 2023 to assist States, Territories and Organizations to complete their individual ATM BBB evaluations	ICAO Regional Office and NACC WG AO Task Force	AO Taskforce, ICAO, States, Territories, International Organizations	**Status – Valid – To be started** A special project to be organized by the ICAO NACC Office involving the AOTF Rapporteur, The ATM RO and two (2) SMEs
c) Identify the discrepancies between the ATS routes structure implemented in the CAR region and the CARSAM eANP VOLUME II (Table ATM II - ATS Routes) and propose actions to attend the differences found	Oct 2023	Dec 2024	Identify and correct 100% deficiencies by December 31, 2024	ICAO Regional Office and NACC WG AO Task Force	AO Taskforce, ICAO, States, Territories, International Organizations	**Status – Valid – Delayed Target date extended** NACC WG AO Task Force secretariat and rapporteur will coordinate with counterparts from SAM to resolve discrepancies.

Task Name/ Tarea	Start/ Inicio	Finish / Final	Deliverables/ Resultados	Follow-up/ Seguimiento	Responsible/ Responsables	Observations/ Comments- Observaciones/ Comentarios
d) Confirm the lateral limits of the FIRs within the CAR Region and update the CARSAM eANP VOLUME I)	JUN 2023	JUN 2024	Ensure 100% completion of updates by June 30, 2024	ICAO Regional Office and NACC WG AO Task Force	NACC WG AO Task Force, ICAO	**Status – Valid – Delayed Target date extended** NACC WG AO Task Force secretariat and rapporteur will coordinate with counterparts from SAM to resolve discrepancies.
e) Develop and implement a regional process to approve and implement routes optimization initiatives for the region	AUG 2023	JUN 2025	A clear process for regional approval and implementation of routes optimization initiatives for the region to be fully functional by JUN 2025	ICAO Regional Office and NACC WG AO Task Force	States, Territories, Int. Org and ANSPs in conjunction with the NACC WG AO Task Force	**Status – Valid – Delayed Target date extended** Part of the CIIFRA process. Develop ICAO NACC Web site to support the process. Coordinate with the SAM Region Route Optimization Process.
f) Update ICARD to reflect current and accurate 5LNC	AUG 2022	DEC 2023	Ensure ICARD reflects current and accurate 5LNC of the States AIPs. 75% completion by DEC 2023	ICAO Regional Office and NACC WG AO Task Force	AOTF, ICAO, States, Territories, Int. Org.	**Status – Valid – Ongoing** NACC WG AO TF to support ANSPs to update ICARD to reflect current and accurate 5LNC
g) Conduct a review the five-year goals proposed by IATA as part of the CAR/SAM Regions' efforts toward the achievement of net zero CO2 emissions by 2050	Oct 2023	MAY 2024	A report on IATA's 5-year goals with appropriate actions. 100% completion by May 31, 2023	ICAO Regional Office and NACC WG AO Task Force	AOTF, IATA	**Status – Valid – To be started** NACC WG AO TF to collaborate with IATA

Task Name/ Tarea	Start/ Inicio	Finish / Final	Deliverables/ Resultados	Follow-up/ Seguimiento	Responsible/ Responsables	Observations/ Comments- Observaciones/ Comentarios
h) Develop a template to assess the implementation readiness of ASBUs relevant to FRTO and APTA	JAN 2024	AUG 2024	A report to the NACC WG/9 meeting which provides an assessment of the implementation readiness of ASBUs relevant to FRTO and APTA. 100% completion by AUG 2024	ICAO Regional Office and NACC WG AO Task Force	AOTF	**Status – Valid – To be started**
i) Conduct a survey and request States/Territories and Organizations to update any information regarding APVs, SIDs/STARS implementation and provide an update to the NACC WG/9	DEC 2023	AUG 2024	An updated status of implementation of APVs, SIDs/STARs in the CAR Region. 100% completion by July 31, 2024.	ICAO Regional Office and NACC WG AO Task Force	AOTF, ICAO, States, Territories, Int. Org.	**Status – Valid – To be started**

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APPENDIX B

INTERNATIONAL CIVIL AVIATION ORGANIZATION

SUB-PROJECT TO DEVELOP AND IMPLEMENT AN OPTIMIZED AIRSPACE CONCEPT DOCUMENT FOR THE CAR REGION

ICAO REGIONAL TECHNICAL COOPERATION PROJECT — "MULTI-REGIONAL CIVIL AVIATION ASSISTANCE PROGRAMME (MCAAP)" (RLA/09/801)

11 August 2023

Vol 1

11-8-2023

by

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ICAO Representative:	Ernest Snyder ATM/SAR NACC Regional officer
Place of Mission:	ICAO NACC Regional Office Mexico City, Mexico
Dates of Mission:	26-29 July 2022
Objectives of the Mission:	● Develop an Optimized Airspace concept for the CAR region, which includes harmonized separation standards, airspace restructuring, Performance Based Navigation and Free Route Airspace. Goals where established for the optimization of airspace to allow continuous flow in the upper and lower airspace of contiguous Flight Information Regions (FIRs) and TMAs.
Summary of Activities:	● Concept began as project under PBN Taskforce in 2018 ● Concept was continued under the Airspace Optimization Taskforce in July 2022 ● Initial meeting with the SMEs to discuss the sub-project mission objectives. ● Identify requirements for the development of an optimized airspace concept for the CAR region. ● Consider a methodology to assess the readiness of each State to transition to FRA. ● Draft a report summarizing the sub-project mission outcomes.

CONTENT

1. Introduction

1.1

Background- This document was started under the PBN Taskforce in 2018 and continued as the taskforce evolved into the Airspace Optimization Taskforce in 2022. This document aligns with and has been/will be coordinated with other regions.

1.1 The Sub-Project to develop and implement an optimized airspace concept document for the CAR Region involved Subject Matter Experts (SMEs) selected among Project Member States and led by the ICAO NACC Regional Office. This document includes recommendations for harmonized separation standards, airspace restructuring, continued implementation of Performance Based Navigation (PBN) and establishes a goal to transition to Free Route Airspace (FRA).

1.2 The GANP will be used as guidance to determine the generic requirements to optimize the airspace of the CAR Region including the transition to Free Route Airspace (FRA).

1.3 The Airspace Optimization (ASO) Taskforce will develop a methodology for future assessment of the readiness of each State to transition to FRA.

1.4 The SMEs collaborated with the CIIFRA team on the development of the optimized airspace concept and the transition roadmap for the CAR Region.

2. Objectives

2.1 The main objective of this document is to serve as a regional document on the process to move towards FRA as well as follow up with the ICAO program No Country Left Behind (NCLB). The Airspace Optimization (ASO) Taskforce will collaborate with the States to assist them with the individual airspace optimization plans.

2.2 Specific objectives:

The CAR Region Airspace Optimization has the next specific objectives aligning with the upcoming Air Navigation Plan (ANP) CAR/SAM Vol III

Safety: Reduce ATS incidents, Controlled Flights Into Terrain (CFIT), trough harmonization of airspace and improvement of STARs, SIDs and APPs designs.

Capacity: Allow a more flexible use of airspace to avoid saturation of traffic over determined areas.

Efficiency: Reduce work overload for crewmembers and Air Traffic Controllers.

Environment: Reduce CO2 emissions and noise over sensitive areas serving the states and linking to Vol III.

2.3 Benefits

Help States to comply with Aviation System Block Upgrade (ASBU) airspace optimization requirements.

Increase harmonization between adjacent States.

Reduce aircraft navigational equipment requirements.

Reduce distance travelled from point to point for each aircraft operation.

Improve aircrafts Fuel savings and reduction of CO2 emissions.

Increase continuous climb and descend operations for aircraft.

Reduce the use of holding patterns.

Provide greater access through mountainous areas.

Reduce noise in the vicinity of airports.

Reduce pilot and Air Traffic Control (ATC) workload.

Reduce radio congestion.

Reduce ANSP operational cost through the reduction of the requirement for ground navaids.

Reduce GPWS.

Increase flexible use of airspace.

3. Scope

3.1 This optimized airspace concept is intended for the following States/Organizations of the Caribbean (CAR) Region:

UPPER AIRSPACE	LOWER AIRSPACE
COCESNA (CENTRAL AMERICA)	BELIZE (BELIZE TMA)
	GUATEMALA (LA AURORA TMA)
	HONDURAS (LA MESA TMA; TONCONTIN TMA;ROATAN ATZ; LA CEIBA CTR; PALMEROLA)
	EL SALVADOR (EL SALVADOR TMA)
	NICARAGUA (MANAGUA TMA)
	COSTA RICA (EL COCO TMA; LIBERIA TMA)
MEXICO (MEXICO, MAZATLAN OCEANIC, MERIDA)	ACAPULCO; CANCÚN-COZUMEL; CIUDAD DEL CARMEN; CIUDAD JUAREZ;CIUDAD OBREGON; CIUDAD VICTORIA; CULIACÁN;CHIHUAHUA; DURANGO; GUADALAJARA; HERMOSILLO; IXTAPA-ZIHUATANEJO; LA PAZ; LOS MOCHIS; LEÓN - AGUASCALIENTES; MANZANILLO; MATAMOROS; MAZATLAN; MERIDA; MEXICO CITY; MONTERREY; MORELIA; NUEVO LAREDO; OAXACA; PUEBLA; PUERTO VALLARTA; QUERÉTARO; REYNOSA; SALTILLO; SAN JOSE DEL CABO; SAN LUIS POTOSÍ; TAMPICO; TIJUANA; TORREÓN; TUXTLA GUTIÉRREZ; VERACRUZ; VILLAHERMOSA;
JAMAICA (KINGSTON)	JAMAICA TMA;
HAITI (PORT AU PRINCE)	PORT AU PRINCE TMA
CUBA (HAVANA)	HAVANA TMA; SANTA CLARA TMA; SANTIAGO TMA
CURACAO (CURACAO)	CURACAO TMA; JULIANA TMA; BEATRIX CTR; FLAMENGO CTR;
DOMINICAN REPUBLIC (SANTO DOMINGO)	PUNTA CANA TMA; LAS AMERICAS TMA; CIBAO TMA
UNITED STATES (SAN JUAN)	SAN JUAN
TRINIDAD AND TOBAGO (PIARCO)	TRINIDAD AND TOBAGO (PIARCO CTR)
	ANTIGUA AND BARBUDA (VC BIRD TMA)
	BARBADOS (ADAMS TMA)
	MARTINIQUE (MARTINIQUE TMA)
	ST LUCIA (ST LUCIA CTR)

	ST VINCENT AND THE GRENADINES (ARGYLE TMA)
	GRENADA (MAURICE BISHOP TMA)
	GUADELOUPE (POINTE-A-PITRE-TMA)

Note: Due to the high flow of traffic and airspace complexity that exists between the CAR Region and the Miami Oceanic, Houston Oceanic and New York Oceanic FIRs, it is recommended that a point of contact from these FIRs be established to coordinate with the rest of the Region.

4. Airspace Optimization Concept

4.1 General

4.1.1 The Airspace Optimization Concept is a plan to benefit all current and envisioned users of the airspace by improving safety, capacity and efficiency of operations in the CAR Region.

4.1.2 Airspace Optimization utilizes all available technologies, procedures and concepts, including **harmonized separation standards, airspace restructuring, PBN and FRA.**

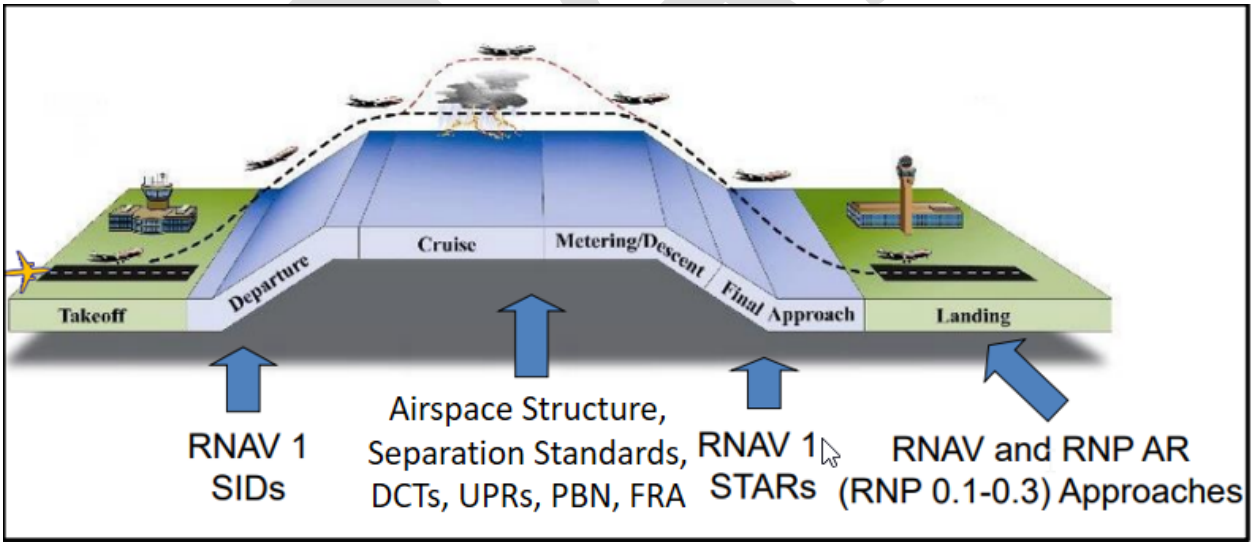

Image 1. Airspace Optimization throughout all phases of flight.

4.2. Goals for the Airspace Optimization

4.2.1 The following table reflects the goals established by the taskforce to meet the Specific Objectives of Airspace Optimization in the Region:

	Specific Objective				Goals
	Saf.	Cap.	Eff.	Env.	
Airspace Optimization		x	x	x	Implementation of RNAV 5 routes as agreed to in the Regional ANP.
		x	x	x	Continue the airspace optimization already begun in point to point trajectories, UPR trials and eventual transition to FRA.
		x	x	x	Conduct an analysis for the implementation of RNP 2 for continental airspace routes.
		x	x	x	Decide upon a date for the regional implementation of RNP 4 for oceanic airspace routes.
		x	x	x	For Oceanic airspace, use of 30 NM longitudinal and lateral separation (WHERE APPLICABLE) and 50 NM separation for all other oceanic areas.
	x				Removal of conventional routes made redundant by PBN route implementation.
	x	x	x	x	Harmonization of upper airspace routes with RNAV/RNP 1 STAR/SIDs (CCOs and CDOs) of TMAs within the FIR.
		x	x	x	For continental airspace, implementation of 20 NM longitudinal separation at FIR Boundaries (WHERE APPLICABLE).
	x	x	x	x	Implementation of RNAV/RNP 1 STAR/SIDs (CCOs and CDOs) to TMAs within the FIRs.
	x				Implementation of LNAV approaches for those International Airports so determined.
	x				Implementation of LNAV/VNAV (BARO VNAV) Approaches if analysis determines a benefit.
	x		x	x	Implementation of RNP AR Approaches/Departures if analysis determines a benefit.
	x		x	x	Implementation of APV (GLS/LPV) Approaches if analysis determines a benefit.

4.3 Harmonized Separation Standards

4.3.1 For continental airspace, implementation of 20NM longitudinal separation at FIR Boundaries (WHERE APPLICABLE).

4.3.1.1 This requirement is based on the Longitudinal Separation Minima based on distance using Distance

Measuring Equipment (DME) and/or GNSS.

4.3.1.2 Separation shall be established by maintaining not less than specified distance(s) between aircraft positions as reported by reference to DME in conjunction with other appropriate navigation aids and/or GNSS. This type of separation shall be applied between two aircraft using DME, or two aircraft using GNSS, or one aircraft using DME and one aircraft using GNSS. Direct controller-pilot VHF voice communication shall be maintained while such separation is used.

4.3.1.3 For oceanic airspace, use of 50 NM lateral separation.

4.3.1.4 RNAV 10 (designated and authorized as RNP 10) supports 50 NM lateral and 50 NM longitudinal distance based separation minima in oceanic or remote area airspace.

4.3.1.5 For oceanic airspace, use of 30 NM longitudinal and lateral separation.

4.3.1.6 RNP 4 supports 30 NM lateral and the 30 NM longitudinal distance based separation minima in oceanic or remote area airspace.

4.3.1.7 The taskforce acknowledges there are varying separation standards utilized by ANSPs across the Region and this leads to inefficient operations. The taskforce will continue the work that has already begun to harmonize the separation standards across FIRs boundaries.

4.3.1.8 An analysis will be conducted to determine the timeline for the implementation of RNP 4 for oceanic airspace. This will required collaboration between the Taskforce, ANSPs and Airline Operators.

4.4 Airspace Structure

4.4.1 The taskforce acknowledges that the current structure of regional airspace may be improved in order to achieve greater efficiencies.

4.4.2 The taskforce will analyze the regional airspace and seek to identify those portions of airspace that may be improved through redesign or gain benefit through functional use of airspace.

4.5 PBN Airspace Standards

4.5.1 Implementation of RNAV 5 routes as agreed to in the Regional ANP.

4.5.1.1 RNAV 5 operations are based on the use of RNAV equipment which automatically determines the aircraft position in the horizontal plane using input from one or a combination of the following types of

position sensors, together with the means to establish and follow a desired path: a) VOR/DME; b) DME/DME; c) INS or IRS; and d) GNSS.

4.5.1.2 The ANSP must assess the navaid infrastructure in order to ensure that it is sufficient for the proposed operations, including reversionary modes. It is acceptable for gaps in navaid coverage to be present; when this occurs, route spacing and obstacle clearance surfaces need to take account of the expected increase in lateral track-keeping errors during the "dead reckoning" phase of flight.

4.5.1.3 Regarding separation, in an ATC surveillance environment, the route spacing will depend on acceptable ATC workload and availability of controller tools, separation is consider as follows:

18 NM for opposite direction routes,

16.5 NM for same direction routes, and

As low as 10 NM where ATC intervention capability permits.

4.5.2 Removal of conventional routes made redundant by PBN route implementation.

4.5.2.1 RNAV/RNP routes are more efficient than conventional routes providing "gate to gate" operations and also don't rely on radioaids installed on ground, improving safety and accuracy. Those are the main reason why it is consider important to replace conventional routes to RNAV/RNP routes, mainly where they are superposed.

4.5.3 Implementation of RNAV/RNP 1 STAR/SIDs (CCOs and CDOs) to TMAs within the FIRs.

4.5.3.1 The main objective is to improve safety, predictability of flights and airspace capacity while reducing noise, fuel consumption, emissions and pilot-controller communications at the same time.

4.5.3.2 CDO is an aircraft operating technique aided by appropriate airspace and procedure design and appropriate ATC clearances enabling the execution of a flight profile optimized to the operating capability of the aircraft, with low engine thrust settings and, where possible, a low drag configuration, thereby reducing fuel burn and emissions during descent. The optimum vertical profile takes the form of a continuously descending path, with a minimum of level flight segments only as needed to decelerate and configure the aircraft or to establish on a landing guidance system (e.g. ILS).

4.5.3.3 Continuous climb operations (CCO) is an aircraft operating technique enabled by airspace design, instrument procedure design and facilitation by ATC, allowing for the execution of a flight profile optimized to the performance of the aircraft. CCO enables the aircraft to attain initial cruise flight level at optimum airspeed and engine thrust settings set throughout the climb, thereby reducing total fuel burn and emissions. Ideally, the departure design is such that arriving traffic is also able to descend based on an optimum descent profile. Where the departure and arrival flows cannot be designed independently, there will need to be a compromise between the needs of the departure and arrival flow optimization; this

compromise should be reached collaboratively.

4.5.3.4 An aircraft's fuel efficiency in terms of fuel burned per kilometre flown in level flight increases with height. However, the fuel used in climbing to that altitude can be a significant part of the overall fuel used for the flight. Therefore, for any given route length, there is an optimum initial cruise flight level which will be dependent upon the aircraft type and mass, as well as on the meteorological conditions of the day. CCO is only one of the tools involved in a complete airspace design. Throughout the design process, CDO, CCO and other route modifications should all be considered.

4.5.4 Implementation of LNAV approaches for those International Airports so determined.

4.5.4.1 RNP APCH LNAV procedures provides lateral guidance and can be defined with fly-by and fly-over waypoints as "T" or "Y" type approach.

4.5.4.2 RNP APCH is defined as an RNP approach procedure that requires a lateral TSE of +/-1 NM in the initial, intermediate and missed approach segments (MAS) and a lateral TSE of ±0.3 NM in the Final Approach Segment (FAS).

4.5.4.3 RNP APCH LNAV procedure do not rely on ground radioaids and are more accuracy than conventional VOR/DME procedures. Also improve access being aligned in most cases with the runway centre line.

4.5.5 LNAV/VNAV (BARO VNAV) Approaches if analysis determines a benefit

4.5.5.1 Baro-VNAV approach procedures are classified as APV procedures in support of Type A 3D approach operations. They utilize a DA/H and not an MDA/H, and neither a FAF nor a missed approach point (MAPt) is identified. They use obstacle assessment surfaces similar to those for ILS, but based on the specific lateral guidance system.

4.5.5.2 Baro-VNAV procedures are used in association with LNAV-only procedures. The LNAV-only FAF and MAPt are needed to define the lateral areas and to support the lateral guidance but they are not used for the vertical navigation function.

4.5.5.3 Baro-VNAV procedures shall not be authorized with a remote altimeter setting.

4.5.5.4 Providing lateral and vertical guidance, BARO-VNAV approaches increase safety, access and accuracy compare with an RNP APCH LNAV procedure.

4.5.6 Implementation of RNP AR Approaches/Departures if analysis determines a benefit.

4.5.6.1 Implementation of RNP AR procedures extends beyond procedure design in that an authorization process for aircraft operators is necessary to ensure that other critical dependencies and associated airworthiness and operational procedure approvals are complete prior to implementation. Guidance on implementation and operational approval is provided in the PBN Manual.

4.5.6.2 RNP AR APCH is defined as an RNP approach procedure that requires a lateral TSE as low as ±0.1 NM on any segment of the approach procedure. RNP AR APCH procedures are only published where significant operational advantages can be achieved while preserving or improving safety of operation.

4.5.6.3 RNP AR APCH are very useful in mountainous and noise sensitive areas to improve access to the airport through radius to fix RF turns.

4.5.7 Implementation of APV (GLS/LPV) Approaches if analysis determines a benefit

4.5.7.1 GBAS is also refer as LAAS (local area augmentation system), It can be used to achieve accuracy required to CAT I-III and is done by locating 4 receivers on the ground at a precisely -surveyed (centimetre accuracy) positions.

4.5.7.2 The cost of one GBAS ground station is less that the cost of multiple ILSs for an airport. Another advantage of GBAS is that the accuracy enhancement is provided for the whole airport.

4.5.7.3 PBN is one of the tools that supports the airspace optimization concept and should continue to be implemented according to the timelines agreed to for the Region, in conjunction with other concepts in the transition to FRA.

4.5.7.4 PBN concept provide a safe and efficient airspace design for terminal areas. SIDs/STARs are the link to the upper airspace and utilizing CCOs/CDOs provide optimal efficiency.

4.6 Move toward FRA

4.6.1 Given the diversity of the CAR Region airspace, the taskforce will develop a methodology to analyze the level of readiness of each FIR within the region and determine the steps required for Airspace Optimization, including the transition to Free Route Airspace, based on the following concepts:

- **Tactical Direct (TDR):** Tactical Directs (TDRs) are established at a national level and based upon a requested by the pilot and is operational advantageous. TDRs should be considered as **an early iteration of the FRA concept**.

- **User Preferred Routings (UPRs):** User Preferred Routings (UPRs) may allow users to **make a request and gain approval by ANSPs** to deviate from the basic requirements of published ATS route network in order to tailor individual flight's routes to achieve more favorable wind conditions and to meet other company objectives.

- **Strategic Direct Routing (SDR):** SDR allows users to plan a route using any named waypoints within a specified volume of airspace as long as the route complies with parameters set by the State. The parameters may include restrictions such as hours in which SDR rules apply, at or above altitude requirements and maximum distance between waypoints. Users must file flights via authorized (i.e., published) routes to the entry and exit point at the boundaries of the SDR airspace volume; that is, the SDR system only applies inside the defined volume of airspace. SDR is considered to be a transition to the implementation of the Free Route Airspace (FRA) concept.

- **Free Route Airspace (FRA):** Free Route Airspace is a specified volume of airspace within which **users may freely plan a route** between defined **entry and exit points**, with the possibility to route via intermediate waypoints, without reference to the ATS route network, subject to airspace availability.

  FRA enables airspace users to fly as close as possible to what they consider the optimal trajectory without the constraints of a fixed route network structure.

Note: These definitions are strictly for the purpose of this document.

4.6.2 In order to classify the capability of a particular portion of airspace to move forward with the Airspace Optimization process and the transition to FRA, the following levels will be utilized:

Level	Description
Level A	A portion of airspace which allows TDRs.
Level B	A portion of airspace which allows UPRs.
Level C	A portion of airspace which allows SDRs.
Level D	A portion of airspace which allows FRA.

Level	Requirements Requirements are a combination of Basic Building Blocks (BBBs) and ASBU Elements ASBU Elements - ICAO GANP Portal
Level A	Direct Controller-Pilot Communications (DCPC) **Currently available throughout CAR Region (Continental airspace)**
Level B	Level A requirements. ATS Surveillance. Collaborative Decision Making (CDM) process (such as CADENA) between airline operators and the ANSP. **Currently available throughout most of the CAR Region (Continental airspace)**
Level C	Level B requirements. ATM Automation System. FRTO-B0/4 -Basic conflict detection and performance monitoring. FRTO-B0/2- (Harmonized) Airspace Planning and Flexible Use of Airspace. **Currently available throughout some of the CAR Region (Continental airspace)**
Level D	Level C requirements. NOPS-B1/5 - Full integration of airspace management with air traffic flow management. FRTO-B1/4 - Dynamic sectorization. FRTO-B1/3 - Advanced Flexible Use of Airspace (FUA) and management of real time airspace data. FICE-B0/1 - Automated basic inter facility data exchange (AIDC). FRTO-B1/5 - Enhanced Conflict Detection Tools and Conformance Monitoring. DAIM-B2/2 - Daily Airspace Management information to support flight and flow Evolution. **In development, expected to be available 2028**

5. Timeline

Steps	Assigned to	Status	Due Date
Establish an Ad Hoc Team to collaborate, prepare and implement the first User Preferred Route (optimized wind route) trial **CIIFRA Team** **Delta Airlines** **ECNA, JCAA, CAA-PANAMA, DGAC-ECUADOR, CORPAC**	CIIFRA Team	**Completed**	02/15/2022
Conduct the first User Preferred Route (optimized wind route) trial: + City pair: **KATL..SPJC..KATL** + Airline volunteer: **DAL** • February 24 [DAL151] • February 25 [DAL150] + Aircraft capabilities (minimum) • RNAV 5 and VHF + ANSPs involved: **ECNA, JCAA, AAC-P, UAEAC, DGAC-E, CORPAC**	CIIFRA Team Ad Hoc Team	**Completed**	02/25/2022
Next Steps: Based on the results of the Feb 24 and 25 trial, coordinate and conduct longer timeframe (up to one-year) User Preferred Route (optimized wind route) trial: + City pair: **KATL..SPJC..KATL** + Airline volunteer: **DAL** • Date: TBD [DAL151] • Date: TBD [DAL150] + Aircraft capabilities (minimum) • RNAV 5 and VHF + ANSPs involved: **ECNA, JCAA, AAC-P, UAEAC, DGAC-E, CORPAC**	CIIFRA Team Ad Hoc Team	**Completed**	12/31/2022
Coordinate with the DGs of the various ANSPs to garner their support for FRA operations	Javier Vanegas Ernie Snyder	**Completed**	12/31/2022

Establish the meeting schedule and Work Plan (initial steps) for the Ad Hoc Team	Ernie Snyder Riaaz Mohammed	**Completed**	11/09/2022
Support SENEAM in conducting their Strategic Direct Routing (SDR) Trial	CIIFRA Team	**In progress**	12/31/2023
Work with the Ad Hoc Team to identify the key considerations for FRA flight plans: + Aircraft capabilities (minimum): • RNAV 5 and VHF + ANSP enroute automation: **Havana ACC, Kingston ACC, Panama ACC, Bogota ACC, Guayaquil ACC, Lima ACC** + SMS: Safety Assessment (**in draft**) + ANSP C/N/S: **Havana ACC, Kingston ACC, Panama ACC, Bogota ACC, Guayaquil ACC, Lima ACC** + ATCO training (enroute, TMA): **Havana ACC, Kingston ACC, Panama ACC, Bogota ACC, Guayaquil ACC, Lima ACC** + Airline training (pilot, dispatch): **Delta Airlines**	Ernie Snyder Riaaz Mohammed Ad Hoc Team CIIFRA Team	**In progress**	06/30/2024
Draft an AIP template for use by the impacted ANSPs to publish FRA in their AIP	CIIFRA Team	**Completed**	07/30/2022
Update the LAC Airspace Capability Table to include all of the FIRs in the SAM Region	CIIFRA Team	**Completed**	12/31/2022

Steps	**Assigned to**	**Status**	**Due Date**
Support SENEAM in conducting their Strategic Direct Routing (SDR) Trial	CIIFRA Team	**In progress**	12/31/2023
Coordinate with the ANSPs to conduct cross-border flight plan trials + COCESNA and SENEAM are coordinating a date for their flight plan trials + JCAA advised on 6/18/21 that they must complete a software upgrade	CIIFRA Team	**In progress**	12/31/2023

before they can conduct AIDC testing with COCESNA. The date for the upgrade is still TBD + ECNA has advised that they are ready to conduct AIDC testing with JCAA when Kingston is ready			
Prepare a regional FRA LOA for ANSP signature	CIIFRA Team	**In progress**	12/31/2023
Develop the procedures that will be included in the CADENA Procedures Manual regarding the application and support of flights that file FRA flight plans	CIIFRA Team	**In progress**	09/30/2023
Outline the training that needs to be presented to pilots and dispatchers to support the CIIFRA project	CIIFRA Team	**In progress**	12/31/2023

Steps	**Assigned to**	**Status**	**Date**
A. Categorization of ANSP's into status	Secretariat/Rapporteur/Ad Hoc Team	**Not begun**	06/30/2024
B. Provide ANS Taskforces update on AO plan and requirements/Assistance	Secretariat/Rapporteur	**In progress**	09/01/2023
C. Provide workshop to ANSP´s on SDR development	CIIFRA Team	**Not Begun**	10/01/2023
D. Begin SDR cross border tests	CIIFRA Team	**Not Begun**	01/31/2024
E. Establish needs from tests for FRA requirements	CIIFRA Team	**Not Begun**	06/30/2024

F. Begin FRA Tests in selected ANSP's	CIIFRA Team	**Not Begun**	01/01/2025

6. Reference Documents

ICAO Reference Documents

1. Performance Based Navigation (PBN) Manual (Doc 9613)
2. Continuous Climb Operations (CCO) Manual (Doc 9993)
3. Continuous Descent Operations (CDO) Manual (Doc 9931)
4. Required navigation Performance Authorization Required (RNP AR) Manual (Doc 9905)
5. Aircraft Operations volume 2- Construction of Visual and Instrument Flight Procedure (Doc 8168)
6. Procedures for Air Navigation Service-Air Traffic Management (Doc 4444)
7. Regional Performance-based Air Navigation Implementation Plan (RPB ANIP) for NAM/CAR Regions.

APPENDIX C
Draft SDR Trial Implementation Guidance and Working Template

Draft SDR Trial Implementation Guidance and Working Template

Introduction

This document is working document and is provided as **guidance material only**. The information contained within is not to be considered a STANDARD and ANSPs may modify or create their own methodology as required by their operations and regulations. These guidelines may be modified over time based on feedback and operational requirements.

The CANSO/IATA/ICAO Free Route Airspace (CIIFRA) Team, as part of the ICAO NACC Airspace Optimization Task Force, developed the guidance material in conjunction with SENEAM.

SDR Definition

Strategic Direct Routing (SDR): SDR allows users to plan a route using any named waypoints within a specified volume of airspace as long as the route complies with parameters set by the State. The parameters may include restrictions such as hours in which SDR rules apply, at or above altitude requirements and maximum distance between waypoints. Users must file flights via authorized (i.e., published) routes to the entry and exit point at the boundaries of the SDR airspace volume; that is, the SDR system only applies inside the defined volume of airspace. SDR is considered to be a transition to the implementation of the Free Route Airspace (FRA) concept.

Steps involved

Figure 1 below displays the process flow developed by SENEAM to plan, design, validate and implement their SDR trials. It is provided as guidance material for ANSPs to consider in developing their own process.

Table 1 below provides basic guidance on the steps required to plan, develop and initiate SDR Trials. The specific tasks are provided to assist ANSPs on developing their SDR trial planning and are not to be considered as the STANDARD. ANSPs may modify or develop their own methodology as required by their operations and regulations.

Some of the tasks in the trial process are iterative. Feedback loops will be required based on analysis of data and as a resultant, procedures/design parameters/training and publication may need to be refined.

It is important to manage the scope of the trial from the start. It is easier to add new project elements over time than to scale down after the project has already started. The main lesson learned from those already engaged in SDR trials is to “START SLOWLY”.

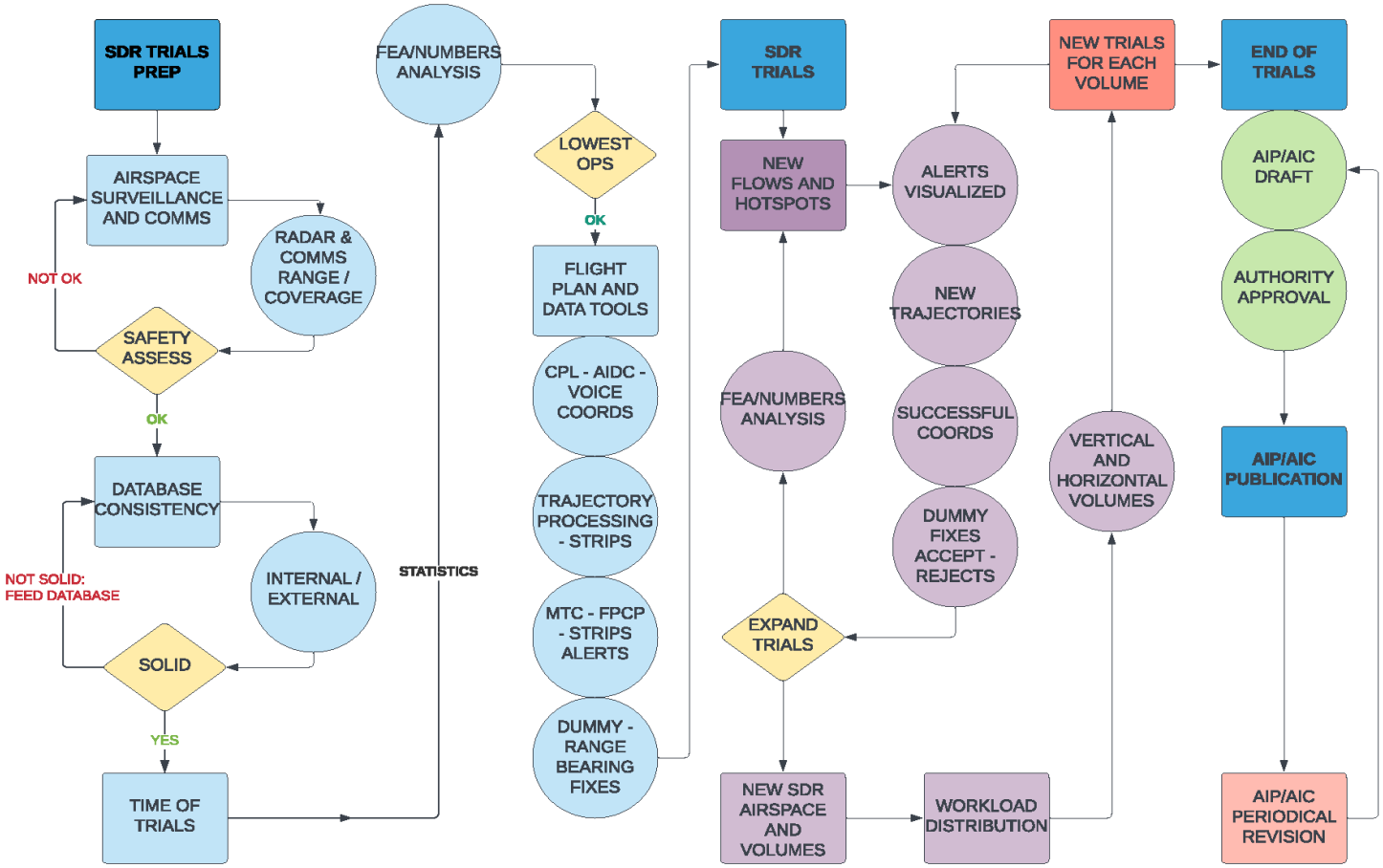

Figure 1 SDR TRIAL PROCESS - SOURCE SENEAM

Table 1 - SDR Implementation Guidelines

STEP	TASK	DESCRIPTION
PLAN	Agree on the operational requirement	Consider the desired outcome: • SAFETY • CAPACITY • EFFICIENCY • ENVIRONMENT
	Create Team	Ensure all stakeholders are involved
	Agree on the scope	• Define the project objectives (Be realistic) • Consider Timeframe • Consider Resources required e.g. (Human/Finance/Tools/Equipment/DATA availability etc.)
	Analyze the current Situation	• Consider Airspace complexity, density etc. • Analyze the CNS infrastructure • Analyze the ATM system capabilities • Analyze the ATS Procedures • Consider portion(s) of airspace that the trials be conducted in • Consider times when trials will be conducted • Collect Data • Perform Analysis • Produce report
	Safety Case	• Define safety criteria • Define the methodology for conducting the Safety Case • Hazard identification/Risk mitigation • Collect data • Conduct Analysis • Produce Report
	Training	• Develop training for ATCOs • Provide training prior to simulation exercises or live trials
	Draft AIC	• Start drafting AIC for trials
DESIGN	Engage with stakeholders	• Discussions with Regulator • Acquire proposed trajectories from Users • Consult with ATS Operations

STEP	TASK	DESCRIPTION
		• CDM with adjacent ATSUs • CDM with TMAs/Aerodromes • Engage with CNS/ATM system providers
	Draft new trajectories	• Plot new requests and analyze the effects based on existing routes
	Decision on trial parameters	• Finalize number of airline operations per day for the test • Finalize airspace sector/Flight level/UTC time period • Determine waypoints in adjacent ATSUs that may need to be in your system database • CDM with selected airline operators on waypoints that must be filed
	Publication of Trials	• Publish AIC with relevant information
VALIDATE	Test ATM System	• Ensure the ATM System database contains the necessary waypoints • Determine if FDP can accept flight plans on random tracks • Engage with CNS/ATM system providers • Test MTCD capabilities
	Validation Methodology	If using simulator: • Design exercises based on proposed trajectories • Conduct exercises • Collect/Analyze data • CDM with ATS Operations • CDM with Users • Amend proposed live trial procedures if required
		Table top exercise: • Internal exercise with Supervisors/ ATCOs on procedures • Hazard identification and risk mitigation • Make necessary changes to procedures as required
	Regulatory Approval	• Provide validation/safety case to regulators • Obtain necessary approvals
Implement	Conducting live trials	• Ensure ATCOs are trained and briefed for the operations • Ensure appropriate publications were made • Ensure Airline operators are aware of all procedures • Supervise the implementation • Collect/analyze data

STEP	TASK	DESCRIPTION
		• Monitor Progress • Make necessary changes to procedures as required
	Adjusting trial parameters	• Based on the results of the initial trials, decide on the trial parameters that can be amended (Number of operations, time of day, flight level etc. • Repeat necessary planning/design/validation steps as required • Implement new parameters • Collect Data/Analyze • Monitor Progress • Make necessary changes to procedures as required

ANSP SDR Trial Assessment Template

The template in this section provides a sample template to assist ANSPs in identifying their capabilities to conduct SDR trials.

The template is provided as guidance material only and is not a STANDARD. ANSPs may modify or develop their own methodology as required by their operations and regulations.

The information filled out in the sample template is provided **as an example**. ANSPS will be required to fill out their own information based on their assessments.

Blank templates will be provided via the AOTF section of the ICAO NACC Website.

SDR Trial Assessment Template

Section 1 – Basic Airspace Definition

NAME OF STATE/ANSP/ORGANIZATION	****
AIRSPACE BOUNDARY DEFINITION	(Coordinates)
NUMBER OF SECTORS	***

Section 2 – Airspace Density

SECTOR	TYPE OF AIRSPACE	UTC PERIOD	DENSITY	COMPLEXITY	COMMENTS
1	*OCEANIC*	*0000 - **** *	*LOW*	*LOW*	
		*** * - **** *	*HIGH*	*MEDIUM*	
		*** * - **** *	*MEDIUM*	*HIGH*	
2	*CONTINENTAL*	*** * - **** *	*LOW*	*LOW*	
3	*CONTINENTAL*	*** * - **** *	*MEDIUM*	*HIGH*	
4	*OCEANIC*	*** * - **** *	*MEDIUM*	*HIGH*	
***	***	*** * _ **** *	***	***	

Section 3 – CNS Capabilities

SECTOR	COMMUNICATIONS	SURVEILLANCE/ADS-C	AIDC WITH ADJACENT ANSP	COMMENTS
1	*CPDLC/HF*	*ADS-C*	*NO*	• *AIDC Planned with 2 Adjacent Units for 2024* • *ADS-B SAT planned for 2025*
2	*VHF*	*SSR/ADS-B*	*With 1 Unit*	• *Full VHF coverage and redundancy* • *Full Surveillance Redundancy* • *ADS-B planned for 2025* • *AIDC with 1 additional units planned for 2024*
3	*VHF/CPDLC*	*SSR/MLAT*	*NO*	• *No VHF Redundancy* • *Partial Surveillance* • *ADS-B SAT planned for 2025* • *AIDC with 2 additional units planned for 2024*
4	*CPDLC*	*ADS-C*		• *ADS-B SAT planned for 2025*
***	****	****	****	• ****

Section 4 – ATM System Capabilities

ATM SYSTEM CAPABILITY	PROVIDE DETAILS	ADDITIONAL COMMENTS IF NECESSARY
	*Fully automated/Partially automated (Vendor - ****)*	*ATM System upgrade planned for 2025; FDP has issues accepting flights that do not file a named entry waypoint*
MEDIUM TERM CONFLICT DETECTION (STCA)	***PROVIDE DETAILS***	***ADDITIONAL COMMENTS IF NECESSARY***
	Available and tested	*MTCD provides resolutions for flights on random routes*
SHORT TERM CONFLICT ALERT (STCA)	***PROVIDE DETAILS***	***ADDITIONAL COMMENTS IF NECESSARY***
	Available and tested	*No comment*
ATM SYSTEM DATABASE	***PROVIDE DETAILS***	***ADDITIONAL COMMENTS IF NECESSARY***
	Waypoints up to 200 nm in adjacent ATSUs airspace are included	

Section 5 – ATS Procedures

LETTERS OF AGREEMENTS WITH ADJACENT ATSU's	PROVIDE DETAILS	ADDITIONAL COMMENTS IF NECESSARY
	All LOAs are up to date	*There is an established procedure for periodic reviews and for dealing with critical issues that may develop and require attention*
SURVEILLANCE HAND-OFF	***PROVIDE DETAILS***	***ADDITIONAL COMMENTS IF NECESSARY***
	Not implemented	*Discussions with adjacent units. Lack of harmonization of ATM systems is a challenge*
SEPARATION STANDARDS	***PROVIDE DETAILS***	***ADDITIONAL COMMENTS IF NECESSARY***
	Separation Standards are not harmonized across FIR Boundaries	*CDM with adjacent ATSUs on harmonizing lateral separation standards*

Section 6 – DATA ANALYSIS/SAFETY CASE

DATA AVAILABLE TO ANALYSE TRAFFIC SCENARIOS	**PROVIDE DETAILS**	**ADDITIONAL COMMENTS IF NECESSARY**
	Some data available	*Discussions with AIM/CNS/ATM system vendors to acquire additional information*
SIMULATOR AVAILABLE TO TEST PROPOSED SDRs	***PROVIDE DETAILS***	***ADDITIONAL COMMENTS IF NECESSARY***
	Not available	*Table top assessment will be utilized*
PERSONNEL AVALABLE TO CONDUCT SAFETY CASE	***PROVIDE DETAILS***	***ADDITIONAL COMMENTS IF NECESSARY***
	ATS Safety Unit trained and capable of conducting safety case	

End

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APPENDIX D

The PBN statistics presented by iSTARS cover 13 SAM States; does not include French Guyana

Table 1.- Progress in the implementation of PBN in Regional SAM routes.

Year	Total SAM Regional routes - Upper	Conventional routes	PBN routes	% Implemented PBN routes
2019	163	25	138	84.7
2020	163	25	138	84.7
2021	160	22	138	86.2
2022	160	20	140	87.5
2023	**160**	**18**	**142**	**88.8**

Table 2.- Progress in the implementation of PBN in departures/arrivals.

Date iSTARS	SAM Estados	TOTAL THR Intl.	% SID PBN	% STAR PBN
DEC 2019	13	215	66.0	50.7
DEC 2020	13	217	67.7	52.5
DEC 2021	13	222	68.9	51.8
OCT 2022	13	224	68.8	53.1
SET 2023	**13**	**223**	**69.1**	**54.7**

Source iSTARS 4.0

Table 3.- Advances in PBN implementation in Approximation

Date iSTARS	SAM Estados	THR PBN	TOTAL THR Intl.	% Aproximaciones PBN implementadas
DEC 2019	13	189	215	87.9
DEC 2020	13	192	217	88.5
DEC 2021	13	201	222	90.5
OCT 2022	13	203	224	90.6
SET 2023	**13**	**206**	**223**	 **92.4**

Source iSTARS 4.0

APPENDIX E

PROJECT A1 FOR THE SAM REGION – PBN OPERATIONAL IMPLEMENTATION

SAM Region	**PROJECT DESCRIPTION (PD)**	PD N° A1	
Programme	**Project Title**	**Start**	**End**
SAM airspace optimisation *(Programme coordinator: ATM RO Fernando Hermoza Hübner)*	PBN operational implementation *Project coordinator:* *Julio Cesar de Souza Pereira (IATA)*	2011	2026
Objective	Support the optimisation of the SAM airspace structure through the optimisation of the ATS route structure in terminal airspace (RNAV/RNP SIDs/STARs) and en-route (RNAV/RNP), as well as the implementation of PBN approaches in accordance with ICAO Assembly Resolution A37-11, with a view to attaining the goals set forth in the Declaration of Bogota.		
Scope	The implementation project contemplates the optimisation of the SAM airspace through PBN implementation and the application of the flexible use of airspace (FUA) concept, as well as phased optimisation of the ATS route network of the Region.		
Metrics	• Reduction of CO_2 emissions per each route optimisation version, in tonnes. • Percentage of international airports with RNAV and/or RNP SIDs/STARs implemented. • Percentage of international airports with continuous descent and climb operations implemented. • Number of RNAV/RNP routes implemented, realigned and/or eliminated. • Percentage of thresholds with APV approaches at international airports.		

Strategy	Project activities will be coordinated among Project members, the Project coordinator and the Programme coordinator through SAM/IG meetings, ATS route optimisation (ATS/RO) meetings and other events deemed necessary (PBN workshops, hiring of experts, etc.). The Project coordinator will coordinate with the Programme coordinator the incorporation of additional experts if so required by the tasks and work to be performed. Likewise, States must review their respective national PBN implementation programmes to ensure they are compatible with the SAM PBN project. Activities to review, implement, modify or eliminate routes in the SAM Region have been scheduled in order to continue optimising the ATS route structure.
Goals	• Implementation of Version 3 of the PBN-based ATS route network in order to respond to current airspace user requirements by the end of 2017. • Achievement of the goals set forth in the Declaration of Bogota. • PBN-based redesign of 30% of the main SAM TMAs by 2016, 50% by 2018. • Development of Version 4 of the PBN-based ATS route network and design of PBN-based TMAs. • Optimisation of longitudinal separation.

Rationale	The 37th ICAO General Assembly formulated Resolution A37-11 (*Performance-based navigation global goals*) in which it took note that the Planning and Implementation Regional Groups (PIRG) had completed regional PBN implementation plans and urged States to implement RNAV and RNP air traffic service (ATS) routes and approach procedures in accordance with ICAO PBN concept laid down in the Performance-based navigation (PBN) manual (Doc 9613), and resolved that States should complete a PBN implementation plan as a matter of urgency to achieve: 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 and 70% by 2014; and 3) 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 certified take-off mass of 5 700 kg or more. Furthermore, the Global air navigation plan (GANP), Chapter 2 (implementation) defines performance-based navigation as its main priority. The GANP specifies that "*the introduction of PBN met the expectations of all the aviation community. Current implementation plans should help provide additional benefits, but they are still subject to the availability of proper training, the provision of specialised support by the States, continuing maintenance and development of international standards and recommended practices (SARPs) and closer coordination between States and aviation stakeholders."* Accordingly, this project provides specialised support and close coordination between States and other stakeholders to ensure harmonised PBN implementation in all the corresponding flight phases: en-route, TMA and approach.
Related projects	• Flexible use of airspace • Automation • Air navigation systems in support of PBN

Project deliverables	Relationship with the regional performance-based plan	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.	B0-FRTO	Alexandre Luiz Dutra Bastos	FINALISED	October 2010 FINALISED	
Implementation of RNAV5 in the SAM Region	B0-FRTO	Alexandre Luiz Dutra Bastos	FINALISED	October 2011 FINALISED	
Action plan for the implementation of Version 2 of the ATS route network optimisation programme	B0-FRTO	Alexandre Luiz Dutra Bastos	FINALISED	ATSRO/3 FINALISED	

Traffic data to understand airspace traffic flows	B0-FRTO	ICAO coordinator	FINALISED	SAM/IG/6 FINALISED	
Navigation capacity of the fleet	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos	FINALISED	SAM/IG/9 FINALISED	
List of gateways of the main SAM TMAs	PFF SAM ATM 02	Alexandre Luiz Dutra Bastos	FINALISED	SAM/IG/9	Assistance was provided to States for the redesign of their TMAs in order to expedite PBN implementation, by training their experts in airspace planning. Several States are delayed in their projects.
Letters of agreement and contingency with adjacent States	PFF SAM ATM 01	Alexandre Luiz Dutra Bastos	FINALISED	SAM/IG/10 FINALISED	
Detailed study of the SAM ATS route network with a view to developing Version 2 of the route network	B0-FRTO	Alexandre Luiz Dutra Bastos	FINALISED	April 2012 FINALISED	
Risk analysis for the implementation of Version 2 of the ATSRO programme	B0-FRTO	External consultants	FINALISED	SAM/IG/10 FINALISED	

SAM Route Network Optimisation					
Planning of Version 3 - Stage 1	B0-FRTO	External consultants	FINALISED	SAM/IG/14 FINALISED	
Implementation Version 3 - Stage 1 - Flow 1 (Argentina -Chile - Paraguay)	B0-FRTO	States SAM Regional Office	FINALISED	April 2015 FINALISED	
Implementation Version 3 - Stage 1 - Flow 2 (Argentina –Brazil - Uruguay)	B0-FRTO	States SAM Regional Office	FINALISED	March 2017 FINALISED	The optimisation of this traffic flow is delayed.
Implementation Version 3 - Stage 1 - Flow 3 (Panama - CENAMER - Caribbean)	B0-FRTO	States SAM Regional Office	FINALISED	March 2017 FINALISED	Coordination started with CAR States. The optimisation of this traffic flow is delayed. Panama will start the TMA and FIR airspace optimisation process. Improvements between Panama – Jamaica were coordinated at ATSRO/8.
Implementation Version 3 - Stage 1 - Flow 3 (Brazil -Guyana – French Guiana - Suriname - Venezuela - Caribe)	B0-FRTO	States SAM Regional Office	FINALISED	October 2016 FINALISED	The optimisation of the main flows has been coordinated.
Airspace concept Version 3 – Stage 2	B0-FRTO	States SAM Regional Office	FINALISED	ATSRO/7 FINALISED	The validated PBN airspace concept of the main SAM TMAs was agreed upon

Implementation Version 3 – Stage 2	B0-FRTO	States SAM Regional Office	FINALISED	November 2017 FINALISED	In October 2016. Routes not directly related to TMA re-structuring were implemented. The remaining initiatives were transferred to Version 4.
Development of the PBN route structure operational concept (ATS routes, SIDs, STARs) for the period 2017-2019	B0-FRTO	States SAM Regional Office	FINALISED	November 2016 FINALISED	Hiring of experts and invitation to States to contribute with human resources. The CONOPS has been presented at the SAM/IG/19 and ATSRO/8 meetings
Regional strategy and work programme for the implementation of the flexible use of airspace through a phased approach, starting with an increasingly dynamic sharing of reserved airspace.	B0-FRTO	States SAM Regional Office		2013-2024	The flexible use of airspace is being enhanced through route optimisation. SAMIG/28 has programmed a workshop on FUA, that was delivered in June 2023. See details in website: icao.int/SAM/Pages/MeetingsDocumentation.aspx?m=2023-RLA06901-FUA&t=1
Reduction of conventional longitudinal separation from 80 to 40 NM for GNSS-equipped aircraft.	B0-FRTO	States SAM Regional Office		2016-2024	Significant progress has been made in this task, which is expected for completion on time. Some States like Venezuela depend on action taken by adjacent CAR States. A regional workshop was held in November 2017, where activities were designed to consolidate implementation. Implemented since 2019 in continental airspace. On going, activities in oceanic airspace and CAR SAM interfaces.
Reduction of conventional longitudinal separation from 40 to 20 NM for GNSS-equipped aircraft.	B0-FRTO	States SAM Regional Office		2017-2024	A proposal of Action Plan for the implementation of 20-NM separation minima was agreed at the regional workshop held in November 2017. Brazil started applying this minimum ONLY for aircraft

					ENTERING its FIRs, on continental airspace. In the SAM SUR (September 2022) and SAM NORTE (October 2022) Workshops, agreements on the application of 20NM have been signed and included in the LOA ATS.
Reduction of conventional longitudinal separation from 20 to 10 NM for scenarios in which ATS surveillance systems are used that cover the boundaries of the FIRs under consideration.	B0-FRTO	States SAM Regional Office		2020 - 2026	
Updating of the status of implementation of RNAV5 Regional Routes	B0-FRTO	States SAM Regional Office		On-going task	
Integration within eANP VOL III management project	B0-FRTO	GREPECAS		4Q - 2023	

PBN TMA					
Updating of action plans. PBN implementation in the main TMAs	PFF SAM ATM 02	States	FINALISED	May 2017 FINALISED	. Conclusion SAM/IG/14-6. 100% of States have updated their action plans.
Updating of the status of implementation of PBN SIDs/STARs	PFF SAM ATM 02	States		On-going task	Yearly update prior to 30 June and prior to 31 December, in accordance with Conclusion SAM/IG/14-4. Tables were updated at the ATSRO/08 meeting. No information is available for French Guiana. December 2021; iSTARS has updated data of implementation, information of Thresholds in international airports has been harmonized. iSTARS presents updated data.
Updating of Table AOP-1	PFF SAM ATM 02	States		On going	Conclusion SAM/IG/15-3.
Integration within eANP VOL III management project	PFF SAM ATM 03 B0 APTA	GREPECAS		4Q - 2023	

Approach					
Updating of the status of implementation of APV IAC	PFF SAM ATM 03 B0 APTA	States		On-going task	Yearly update prior to 30 June and prior to 31 December, in accordance with Conclusion SAM/IG/14-4. Implementation of RNP APCH procedures with Baro-VNAV vertical guidance or RNP AR APCH must be reported. Tables were updated at the ATSRO/8 meeting. No information is available for French Guiana. December 2021; iSTARS has updated data of implementation, information of Thresholds in international airports has been harmonized. iSTARS presents updated data. SAM Region implementation 90.5% October 2022, implementation 90.6%
Integration within eANP VOL III management project	PFF SAM ATM 03 B0 APTA	GREPECAS		4Q - 2023	

Meetings/Workshops					
SAM/IG/07	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2011	SAM PBN implementation group
SAM/IG/08	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2011 FINALISED	SAM PBN implementation group
SAM/IG/09	PFF SAM ATM	States SAM Regional Office	FINALISED	Mayo 2012 FINALISED	SAM PBN implementation group
SAM/IG/10	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2012 FINALISED	SAM PBN implementation group
SAM/IG/11	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2013 FINALISED	SAM PBN implementation group
SAM/IG/12	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2013 FINALISED	SAM PBN implementation group
SAM/IG/13	PFF SAM ATM	States SAM Regional Office	FINALISED	Mayo 2014 FINALISED	SAM PBN implementation group
SAM/IG/14	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2014 FINALISED	SAM PBN implementation group

SAM/IG/15	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2015 FINALISED	SAM PBN implementation group
SAM/IG/16	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2015 FINALISED	SAM PBN implementation group
SAM/IG/17	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2016 FINALISED	SAM PBN implementation group
SAM/IG/18	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2016 FINALISED	SAM PBN implementation group
SAM/IG/19	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2017 FINALISED	SAM PBN implementation group
SAM/IG/20	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2017 FINALISED	SAM PBN implementation group
SAM/IG/21	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2018 FINALISED	SAM PBN implementation group
SAM/IG/22	PFF SAM ATM	States SAM Regional Office	FINALISED	November 2018 FINALISED	SAM PBN implementation group
SAM/IG/23	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2019 FINALISED	SAM PBN implementation group
SAM/IG/24	PFF SAM ATM	States SAM Regional Office	FINALISED	Nov 2019 FINALISED	SAM PBN implementation group

SAM/IG/25	PFF SAM ATM	States SAM Regional Office	FINALISED	Nov 2020 FINALISED	SAM PBN implementation group
SAM/IG/26	PFF SAM ATM	States SAM Regional Office	FINALISED	Sep 2021 FINALISED	SAM PBN implementation group
SAM/IG/27	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2022	SAM PBN implementation group
SAM/IG/28	PFF SAM ATM	States SAM Regional Office	FINALISED	Sep 2022	SAM PBN implementation group
SAM/IG/29	PFF SAM ATM	States SAM Regional Office	FINALISED	May 2023	SAM PBN implementation group
SAM/IG/30	PFF SAM ATM	States SAM Regional Office	FINALISED	October 2023	SAM PBN implementation group
ATSRO/03	PFF SAM ATM 03	States SAM Regional Office	FINALISED	July 2011 FINALISED	SAM route network optimisation
ATSRO/04	PFF SAM ATM 03	States SAM Regional Office	FINALISED	July 2012 FINALISED	SAM route network optimisation
ATSRO/05	PFF SAM ATM 03	States SAM Regional Office	FINALISED	July 2013 FINALISED	SAM route network optimisation
ATSRO/06	PFF SAM ATM 03	States SAM Regional Office	FINALISED	October 2014 FINALISED	SAM route network optimisation

ATSRO/07	PFF SAM ATM 03	States SAM Regional Office	FINALISED	October 2015 FINALISED	SAM route network optimisation
ATSRO/08	PFF SAM ATM 03	States SAM Regional Office	FINALISED	September 2017 FINALISED	- Held on 11-15 September 2017. Implementation of Version 4 of the route network was begun.
ATSRO/09	PFF SAM ATM 03	States SAM Regional Office	FINALISED	July 2018 FINALISED	SAM route network optimisation
ATSRO/10	PFF SAM ATM 03	States SAM Regional Office	FINALISED	June 2019 FINALISED	SAM route network optimisation Version 10 of ATS routes; Implemented between 2019 – 2021.
Hiring of experts for consolidation of Version 4 of the SAM ATS route network	PFF SAM ATM 03	States SAM Regional Office	FINALISED	June 2017 FINALISED	- Two experts from the Region were hired. The Route Network Version 4 deliverable was developed with 91 route improvement initiatives.
Hiring of experts for consolidation of Version 5 of the SAM ATS route network	PFF SAM ATM 03	States SAM Regional Office	FINALISED	February 2019 FINALISED	SAM route network optimisation
Workshop on PBN airspace planning	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	March 2013 FINALISED	Initial training in the PBN airspace planning process.
PBN/1 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	May 2014 FINALISED	Objective: Preliminary PBN training and design of the Asunción and Bogota TMAs.
PBN/2 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	September 2014 FINALISED	Objective: Preliminary PBN design of the main South American TMAs.

PBN/3 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	March 2015 FINALISED	Objective: Validation of the preliminary PBN design of the main South American TMAs.
PBN/4 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	September 2015 FINALISED	Objective: Guide PBN implementation at the main South American TMAs.
PBN/IMP/1 workshop	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	April 2016 FINALISED	Review the status of implementation in States whose implementation date was the first semester of 2016.
PBN/IMP/2 workshop and related PANS-OPS activities	B0 APTA B0 CCO B0 CDO	States SAM Regional Office	FINALISED	September 2016 FINALISED	Review the status of implementation in States whose implementation date is the second half of 2016 and carry out the related PANS-OPS activities.

Others					
Updating and submission of the National PBN implementation plan to the Regional Office	B0 APTA B0 CCO B0 CDO	States	FINALISED	SAM/IG/15 FINALISED	93% of States have completed the task. French Guiana is still pending. Headquarters has requested the delivery of the national PBN implementation plans. 2012: PBN PLAN of France is available.
Resources needed	Designation of experts for completion 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 will be implemented on time***
Red ***Activity not implemented on time; mitigation measures are required***

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APPENDIX F

PROJECT A2 – AIR NAVIGATION SYSTEMS IN SUPPORT OF PBN

SAM Region	**PROJECT DESCRIPTION (DP)**	**DP N° A2**	
Programme	**Project Title**	**Start**	**End**
PBN (*Programme coordinator: ATM RO Fernando Hermoza)*	Air navigation systems in support of PBN *Project coordinator:* *Julio César de Souza Pereira Pereira (IATA)* *Experts contributing to the Project: Alessander Santoro, Andre Jansen, Fabio Augusto Andrade (Brazil), Paulo Vila, Tomas Macedo (Peru) and SAM/IG SAM PBN Group*	January 2011	December 2021
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: • 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	• Drafting of a practical guide for the implementation of a GBAS system. • DME/DME coverage in the SAM Region. • Availability of a RAIM availability prediction service. • % States providing the RAIM availability service.		
Strategy	• All activities will be conducted by experts designated by SAM States and organisations participating in the project entitled "*Air navigation systems in support of PBN"*, 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, the project coordinator and the contributing experts can meet 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	Guide for the implementation of a GBAS system, by October 2012. (Revision November 2016). • 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	• 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 *SAM Performance-based navigation system implementation plan (SAM PBIP).*
Related projects	• 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**
Develop a practical guide for the implementation of the GBAS system					
Review of practical guide for the implementation of GBAS systems SUSPENDED	SAM PFF CNS 03 ANRF B0-APTA (65)	Alessander Santoro (Brazil)		December 2018 SUSPENDED	The practical guide for the implementation of GBAS systems was presented for review at SAM/IG/8 meeting. It 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, joint work was undertaken using the SLS-4000 station and other 110 GPS L1 and L2 stations installed in Brazil.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
					Data was collected over a period of maximum solar activity, although it was the lowest in the last 100 years. From the data obtained, Brazil concluded that so far, the SLS-4000 station may not be used in full for CAT I operations in low latitude regions. Accordingly, ICEA (*Instituto de Control del Espacio Aéreo*) will continue research in cooperation with the FAA and the supplier (Honeywell), seeking to develop a risk model capable of withstanding ionosphere behaviour in low latitudes. The Workshop on the implementation of the navigation Infrastructure in support of the PBN in NAM/CAR/SAM Regions held in august 2016 continued analysis on this matter. Technical papers are available at the link: https://www.icao.int/SAM/Pages/MeetingsDocumentation.aspx?m=2016-GBAS As of December 2017, the SLS-4000 station does not meet ICAO's integrity and availability requirements. Brazil continues research in collaboration with universities and Honeywell, seeking to develop a risk model applicable to the SAM Region.

Project deliverables	Relationship with the performance-based regional plan and ASBU block 0 modules	Responsible party	Status of implementation	Delivery date	Comments
					A review of the practical guide for the implementation of the GBAS system will follow after completing the development of a risk model capable of withstanding ionosphere behaviour at low latitudes. This is to be completed by the last quarter of 2018. SAMIG/23 meeting, may 2019, updated the information In 2021 Brazil and Argentina has decommissioned the projects due new priorities on air navigation implementation.

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Analyse DME/DME and GNSS infrastructure and coverage needed to support PBN implementation					
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 Vila and Tomás Macedo (Peru)	FINALISED	Coverage study to support RNAV-5 completed (SAM/IG/8, October 2011)	A *DME/DME coverage study* 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.

Development of guidance on the use and availability of GNSS performance forecast/validation tools.					
Implementation of a RAIM availability prediction service	SAMPFF CNS/03 SAM PFF ATM/01 ATM/02 ATM/03 ANRF B0-APTA (65), B0-FRTO(10) B0-CDO(05) and B0-CCO(20)	Project coordinator SAM/IG PBN Group	FINALISED	Delivery to States and user access (October 2022)	Two web-based remote 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 RAIM availability prediction service website (SATDIS), the code assignment procedure, data import and export, and the query and failure 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. The SATDIS website in three languages (Spanish, Portuguese and English), became operational on 17 September 2014. The SATDIS FSAT was conducted on 18 November 2014. The RAIM availability prediction service is operating since 16 November 2014. In 2019, the SATDIS service contract expired via the web. RLA 06 901 has supplied the second version of SATDIS at the end of June 2022. The focal points of each State are being trained to assign access to air operators and users. The new version has more access facilities and new tools.

Monitor activities for the implementation of air navigation systems in support of PBN	SAMPFF CNS/03 SAM PFF ATM/01 ATM/02 ATM/03 ANRF B0-APTA (65), B0-FRTO(10) B0-CDO(05) and B0-CCO(20)	ICAO		On-going task	
Resources needed	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 *– I has not been possible to implement this activity as scheduled; mitigating measures are required*

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APPENDIX G

SAM REGION; PROJECT B1 – IMPROVE DEMAND-CAPACITY BALANCING

SAM Region	**PROJECT DESCRIPTION (DP)**	DP N° B1	
Programme	**Project Title**	**Start**	**End**
Air traffic flow management (ATFM) *(Programme coordinator: ATM RO Fernando Hermoza Hubner)*	*Improve demand-capacity balancing* *Project coordinator: Bruno Antunes (Brazil)*	2012	2026
Objective	Avoid overloading the ATC and airport systems, strengthening safety, taking into consideration the reduction in the number of delays caused by meteorological and traffic conditions, thus reducing fuel consumption and contaminating emissions. Likewise, improve prediction and management of surplus demand for services in ATC sectors and aerodromes.		
Scope	The scope of this project establishes that ATFM implementation should start with airport and airspace monitoring in order to identify significant increases in ground delays and in-flight holding, as well as bottlenecks (ATC sector, runway, apron, and airport facilities). Furthermore, capacity calculation and air traffic demand analysis are important elements to improve demand/capacity balancing.		
Metrics	• % States that have calculated runway and ATC sector capacity • % States that have implemented ATFM in flow management units (FMUs) or flow management positions (FMPs) • % States complying implementation by Phases, according ATFM implementation regional guidance.		

Strategy	Project activities define ATFM implementation in the SAM Region through an airspace demand and capacity analysis, taking into account that States that are in the process of implementation shall coordinate with the ATM community to define the actions required for ATFM implementation. The infrastructure and the database, as well as the policy, standards, and procedures, are important components for the execution of this Project.
Goals	• SAM States with experts trained in runway and airspace capacity (ATC sector) calculation • ATFM performance oversight plan • CAR/SAM inter-regional coordination
Rationale	GREPECAS considered that early ATFM implementation should ensure optimum air traffic flow to or through certain areas during periods in which demand exceeded or was expected to exceed the available capacity of the ATC system. Therefore, the ATFM system should reduce aircraft delays, both in flight as well as on the ground, and avoid system overload.
Related projects	• Automation.

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
1. Assess the progress made in the ATFM implementation work programme	B0-NOPS	Programme coordinator		2026	On-going task
2. Calculation of airspace (ATC sector) capacity	B0-NOPS	Juarez Franklin Gouveia	FINALISED	SAM/IG/9 FINALISED see ITEM 9	Brazil and Colombia submitted their studies.
3. List of airspace sectors that have periods in which demand exceeds the existing capacity, including, if necessary, simulations by the States	B0-NOPS	Juarez Franklin Gouveia	FINALISED	SAM/IG/9 SAM/IG/10 FINALISED see ITEM 9	Brazil and Colombia submitted their studies.
4. List of operational factors affecting demand and airspace capacity for the optimisation of existing capacity, including simulations, if necessary.	B0-NOPS	Juarez Franklin Gouveia	FINALISED	SAM/IG/9 FINALISED see ITEM 9, 14 y 15	Brazil and Colombia submitted their studies. Brazil, Paraguay, and Peru presented data at the SAM/IG/11 meeting.
5. Definition of the common elements of situational awareness	B0-NOPS	Paulo Vila	FINALISED	2012 FINALISED see ITEM 14	The States that exchange information are: Chile, Colombia, Paraguay, and Venezuela.

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
6. Training of personnel in strategic ATFM airspace measures	B0-NOPS	Project RLA/06/901		2022	In 2010, an ATFM/CDM course was conducted in Brazil with the participation of several States. In March 2009, a course on runway and ATC sector capacity calculation was conducted in Brazil. In 2012, a course for instructors on runway and ATC sector capacity calculations was conducted in Lima. An ATFM seminar has been delivered in June 2018. A Workshop/Meeting on ATFM Regional Data Management and Indicators is scheduled for 2022
7. List of factors affecting the implementation decision	B0-NOPS	Programme coordinator	FINALISED	2010 FINALISED see ITEM 15	The following causes were identified at the SAM/IG/11 meeting: - States that do not have the requirement or the need to implement ATFM; - Budgetary and organisational reasons; - Lack of personnel specifically devoted to ATFM activities; - The personnel responsible for ATFM are involved in other functions.

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
8. Updating of runway capacity calculations	B0-NOPS	Programme coordinator		2024	2018: 85% of States have updated runway capacity calculations. Guyana and Suriname are still lacking capacity calculations. Due to the pandemic, in the period 2020-2021 the capacities and characteristics of demand have evolved throughout the Region. An update on runway capacity calculations is required in all States. The draft of the ATC Sector and runway Capacity Calculation Manual is being updated for 2022, it is expected to be adopted in May 2022. A Workshop/Meeting on Capacity Calculation Methodology for the ATFM is scheduled for 2022
9. Updating of airspace (ATC sector) capacity calculations	B0-NOPS	Programme coordinator		2024	2018: 6 States of the Region have performed ATC sector capacity calculations prior to implementation, 5 have not performed the activity, and information is still to be received from 3 States. Due to the pandemic, in the period 2020-2021 the capacities and characteristics of demand have evolved throughout the Region. An update on airspace capacity calculations is required in all States.

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
					The draft of the ATC Sector and runway Capacity Calculation Manual is being updated for 2022, it is expected to be adopted in May 2022. A Workshop/Meeting on Capacity Calculation Methodology for the ATFM is scheduled for 2022
10. Airspace monitoring processes Traffic demand analysis processes Standards on FMU/FMP procedures Implementation of preliminary ATFM measures Implementation of TMIs ATFM messaging Coordination of special events Civil/military exemptions and coordination	B0-NOPS	CGNA course Project RLA/06/901	FINALISED	November 2014 FINALISED	Completed on time
11. Replication of ATFM courses at national level	B0-NOPS	States	FINALISED	15/05/2015 FINALISED	The States replicated ATFM courses at national level.
12. ATFM measures during the Rio 2016 Olympic and Paralympic Games in Brazil	B0-NOPS	Brazil	FINALISED	13/05/2016 FINALISED	Details of the AIC of Brazil can be found in: http://publicacoes.decea.gov.br/?i=publicacao&id=4339

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
13. CONOPS ATFM CAR SAM updated and approved by GREPECAS	B0-NOPS	Coordinador de Programa	FINALISED	July 2019 FINALISED	SAMIG/23 (June 2019) reviewed the draft. Approved by CRPP/5 meeting
14. ATFM operations Plan	B0-NOPS	Programme coordinator	FINALISED	September 2021 FINALISED	Plan adopted at SAMIG/26 Meeting, September 2021
15. Guide for the implementation of the ATFM in the SAM Region 2022- 2026	B0-NOPS	Programme coordinator	FINALISED	September 2021 FINALISED	Guide adopted at SAMIG/26 Meeting, September 2021 Stipulates implementation by phases
16. Manual for calculating Runway Capacity and ATC Sector for the SAM Region	B0-NOPS	Programme coordinator	FINALISED	May 2022 FINALISED	Manual was adopted SAMIG/27. A workshop was released in august 2022.
17. PHASE ATFM I implementation	B0-NOPS	Programme coordinator		On going	
18. PHASE ATFM II-A implementation	B0-NOPS	Programme coordinator		On going	
19. PHASE ATFM II-B implementation	B0-NOPS	Programme coordinator		31 December 2022	

Project deliverables	Relationship with the performance-based regional plan (PFF) or ASBU module	Responsible party	Status of implementation*	Delivery date	Comments
20. PHASE ATFM III implementation	B0-NOPS	Programme coordinator		31 December 2023	
21. PHASE ATFM IV implementation	B0-NOPS	Programme coordinator		31 December 2025	
22. Integration within eANP VOL III management project	B0-NOPS	GREPECAS		4Q - 2023	
Resources needed	Designation of experts for the execution of some of the deliverables.				

*Status of implementation; according colors in fourth column

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; mitigation measures are required**

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