International Civil Aviation Organization
South American Regional Office
Twenty Seventh Workshop/Meeting of the SAM Implementation Group SAM (SAM/IG/27) – Regional Project RLA/06/901
(Virtual, 31 May to 3 June 2022)

SAM/IG/27-WP/2.2
12/05/2022

Agenda
Item 2: Report of activities of the GESEA and Subgroups

b) ATM implementation. Progress of the Subgroups

CONCEPT OF OPERATIONS FOR EFFICIENCY AND CAPACITY IN SAM AIRSPACE 2022-2026

(Prepared by Secretariat)

SUMMARY

This working paper presents the progress of activities by GESEA/SG1 and SAM States regarding improvements for the approval of the CONOPS for efficiency and capacity in SAM airspace.

References:

- Report of SAM/IG/25.
- Summary of GESEA/3 Plenary meeting.
- Summary of GESEA/SG1/2 meeting.
- Report of SAM/IG/26.

1. Background

1.1 The third Plenary Meeting of the SAM – GESEA Airspace Study and Implementation Group (GESEA/3) was held by videoconference from 16 to 18 March 2021. The first draft of the Operational Concept for the Efficiency and Capacity of SAM Airspace, prepared by the CONOPS task force, was presented and initially circulated to delegates and members.

1.2 GESEA/3 agreed on the following action to continue the development of the document:

ACTION 3 - That the States and industry participating in GESEA review the first draft of CONOPS, identify improvements and contributions to the text, so that they are discussed at the next meeting of SG1 to proceed with the validation of the document.

1.3 The GESEA/SG1/2 meeting (27-29 April 2021) has received the draft developed by CONOPS, with a view to providing comments and contributions to the document. Based on the comments received, the RAPPORTEUR of the CONOPS WG and the Secretariat have consolidated the document and a meeting of the WG was held, approving the draft.

1.4 The text was presented to meeting SAM/IG/26 (Virtual, 20-23 September 2021), which agreed that the document should be circulated to States for additional feedback. After this process, comments were received from Chile (contributions for editing and writing) and Argentina.

1.5 These comments were analyzed at the GESEA/SG2/3 Meeting (Virtual, 6-8 April 2022), where specialists from ANAC Argentina enhanced the comments on the aforementioned document. The concern that CONOPS generates divergent or overlapping lines of analysis with the activities of developing VOL III of the ANP CAR SAM was highlighted and analyzed in detail, and the lack of clarity of the scope of CONOPS and its use by States or users, in addition to other required improvements, was noted.

1.6 The Rapporteur of the CONOPS GT took note of the analysis of the Meeting, in order to formulate the corresponding amendment to draft 2.1 that is presented in the **Appendix** to this study note.

2. **Discussion**

2.1 GREPECAS is the body accountable for promote regional priorities, as well as to develop and maintain the ANP CAR/SAM Regional Plan in its three volumes. In this sense, the Operational Concept for the efficiency and capacity of SAM airspace (hereinafter CONOPS EC/SAM) aims to support the studies of the ATM specialists of SAMIG and GESEA involved in the formulation of Volume III of the aforementioned Plan, facilitating the understanding of the methodology of Doc. 9883 assumed in the GANP.

2.2 The CONOPS EC/SAM is a document developed collaboratively, for the improvement of the airspace of the SAM Region, emphasizing the solutions proposed through the ASBU elements of the Global Air Navigation Plan - GANP, as well as the planning and implementation of PBN that is in progress in South America, in this case, focusing on the "operational" threads that can generate the agreed performance in two specific areas; Efficiency and Capacity.

2.3 CONOPS EC/SAM will continue to receive input and updates as aviation and regional and global industry scenarios continue to evolve in the face of COVID19. It is expected that CONOPS EC/SAM will be able to extend its scope to other KPA areas (predictability, operational safety, interoperability, etc.) in the future and cover the guiding threads of technology and information of the GANP, as well as the operational scenario of aerodromes.

3. **Suggested action**

3.1 The Meeting is invited to:

a) Analyze the information presented in this working paper;

b) provide comments and inputs on the draft of the Operational Concept for the Efficiency and Capacity of SAM Airspace - CONOPS EC/SAM presented in the **Appendix**; and

c) if the consensus of the Meeting is reached, approve the aforementioned CONOPS.

— END —

APPENDIX

INTERNATIONAL CIVIL AVIATION ORGANIZATION
SOUTH AMERICAN REGIONAL OFFICE

CONCEPT OF OPERATIONS FOR EFFICIENCY AND CAPACITY IN SAM AIRSPACE

(CONOPS EC/SAM)

2022 - 2026

Draft elaborated by the TF – CONOPS Task Force of Sub-Group 1 of GESEA.

Draft 2.1 dated 1 April 2022

CONCEPT OF OPERATIONS FOR EFFICIENCY AND CAPACITY IN SAM AIRSPACE

(CONOPS EC/SAM)

2021 - 2025

CHANGE CONTROL

Version	Date	Change	Pages
DRAFT 0.1 presented at the GESEA plenary	18 March 2021	Drafting of document	
DRAFT V0.2.0	6 July 2021	Review by the TF. Incorporates inputs by Uruguay, Brazil and IATA	
DRAFT V0.3.0	12 July 2021	Review by the TF. Incorporates inputs by Uruguay, Argentina, Brazil and IATA	
DRAFT V0.3.1	19 July 2021	Consolidation of CONOPS EC/SAM and separation from the PBN part, new roadmap. Secretariat.	
DRAFT 1.0	20 July 2021	Draft to submit at SAMIG/26	
DRAFT 2.0	1 March 2022	Re-Circulated at the request of SAMIG26. Letter SA5499. Contributions from Argentina, Brazil and Chile	
DRAFT 2.1	1 April 2022	Improvements according to analysis of GESEA Meeting SG1/3. Rapporteur and Secretariat.	

CONTENT

1. PROPOSITO

GREPECAS is the competent body to promote regional priorities, as well as to develop and maintain the ANP CAR/SAM Regional Plan in its three volumes. In this sense, the Operational Concept for the efficiency and capacity of SAM airspace (hereinafter CONOPS EC/SAM) aims to support the studies of the ATM specialists of SAMIG and GESEA involved in the formulation of Volume III of the aforementioned Plan, facilitating the understanding of the methodology of Doc. 9883 assumed in the GANP.

The **Concept of Operations for Efficiency and Capacity in SAM Airspace (hereafter CONOPS EC/SAM)** is a collaboratively developed document ~~that considers the needs of all stakeholders of the ATM community in order to provide a reference~~ for improving the airspace of the SAM Region, highlighting the solutions put forth through the ASBU elements of the Global Air Navigation Plan - GANP, as well as PBN planning and implementation underway in South America, in this case, focusing on the "operational" threads that can generate the agreed performance in two specific areas: **Efficiency and Capacity**.

All ICAO Regions have been impacted by the sanitary measures imposed for the control of COVID-19. The contraction of the industry was significant worldwide. It is vital for the industry to normalise its activities as soon as possible, so as to restore air connectivity, which promotes the growth of trade, business and tourism in the SAM Region, and contributes a significant part of GDP, generating numerous jobs. Furthermore, it is crucial that the collaborative decision-making process be strengthened, with a view to finding immediate and short-term solutions that can support the recovery of South American aviation.

~~The GANP, 6th edition, essentially seeks to develop the six-step methodology of Doc 9883 "Manual on global performance of the air navigation system", which allows for a consistent process of analysis, identification and quantification of air navigation solutions, recognising a limiting scarcity of resources (public and private), while considering the efficiency and capacity requirements of airlines and industry.~~

The CONOPS EC/SAM will continue to receive inputs and updates as the regional and global aviation and industry scenarios are ~~not yet fully defined~~ still in evolution in front of the COVID-19. It is expected that the CONOPS EC/SAM may in the future extend its scope to other KPAs (predictability, safety, interoperability, etc.) and also include the technology and information threads of the GANP, as well as the aerodrome operational scenario.

2. INTRODUCTION

2.1 ICAO strategic objectives

This Concept of Operations for Increasing Efficiency and Capacity of SAM Airspace (hereinafter referred to as CONOPS EC/SAM) is directly linked to the strategic objectives of ICAO, as described below:

a) Safety: Enhance global civil aviation safety.

b) Air navigation capacity and efficiency: Increase the capacity and improve the efficiency of the global civil aviation system.

c) Economic development of air transport: Foster the development of a sound and economically-viable civil aviation system.

d) Environmental protection: Minimise the adverse environmental effects of civil aviation activities.

2.2 New aviation scenario

It is recognised that, due to the COVID-19 sanitary emergency, a new scenario has emerged in global aviation. It is estimated that in 2020 the number of passengers carried worldwide dropped by 60%. This entails a strong economic impact for the entire industry, and affected ANSPs due to the significant reduction in the number of air operations.

The ATM community is focused on supporting the revival of air transport in general, as well as restoring the connectivity of the SAM Region. At the same time, the aim is to return to the pre-pandemic trend of sustainable growth in regional air transport. To this end, it is necessary to have the support of a seamless, high-performance, safer, more robust and resilient regional air navigation system.

COVID-19 has revealed that the complex internal and external interfaces of States generate new challenges for collaborative decision-making. CAAs need to adopt a safety risk management approach to decision-making.

2.3 Global and regional trend and status

Due to the severe impact of COVID-19, the framework for projecting the five-year period is highly changing, since it depends on the duration and magnitude of the pandemic, the containment measures of States that are being deescalating, the degree of user confidence and the conditions of the global economy.

The ICAO Aviation Data and Analysis Panel (ADAP) approved in July 2021 a set of traffic forecasts for the 32-year horizon (2018-2050), considering different scenarios for the evolution of operations post COVID-19. According to this work, operations in the SAM region will grow, but at a lower rate than globally.

For example, for routes within the SAM Region, the cumulative annual passenger growth forecast is between 2.2 and 3.2%, depending on the scenario, while the world average would be between 2.9% and 4.2%. For cargo, the work indicates a growth for Latin America and the Caribbean between 0.8 and 1.5% per year, compared to 2.6% to 4.2% for the world average. See ADAP tables at:

https://www.icao.int/sustainability/Documents/post%20covid%20forecasts%20scenarios%20tables.pdf

At the beginning of 2022, a gradual recovery in the demand for operations in several States is identified, although more visible in domestic operations, which are close to reaching the levels of 2019. International operations are still in a slower recovery process, as measures for passenger entry/transit are being de-escalated and the recovery of tourism is strengthened.

2.4 ICAO-driven planning

The International Civil Aviation Organization (ICAO) has developed Doc 9854 "Global ATM Operational Concept", which describes ICAO's vision of an ATM applied worldwide.

It also developed the global "Aviation System Block Upgrade" (ASBU) framework as a programmatic framework to develop a set of air traffic management (ATM) solutions or upgrades that builds on existing equipment and establishes an implementation framework to achieve global interoperability within given timelines.

The Global Air Navigation Plan, 6th edition (GANP - Doc 9750) enables members of the aviation community to participate together to achieve an agile, safe, secure, sustainable, high performance and interoperable global air navigation system.

At the same time, new demands on the aviation system, emerging technologies, innovative ways of doing business and the changing human role pose challenges and also offer opportunities that call for an urgent transformation of the air navigation system in order for aviation to continue to drive social well-being in the South American Region.

The GANP emphasises performance-based air navigation planning, in accordance with the six-step approach of Doc 9883. For reference, Appendix A presents the "Instructions for the use of the template of Volume III of the Regional Air Navigation Plan – ANP CAR/SAM" (approved in October 2021 through the GREPECAS Conclusion 19/05) in which the application of the six-step method is exposed.

2.5 Alignment to GANP and Doc 9883

The CONOPS EC/SAM is aligned with the new four-layer GANP design, specifically, with the second "global technical" layer, recognising the set of threads set forth in the ASBU methodology, that is, the **Operational threads** that, in turn, are supported by the information and technology/CNS services threads. See **Appendix B** for a list of ASBU modules and elements.

> *Note. - This CONOPS EC/SAM basically addresses the operational threads of the GANP. The information and technology/CNS services threads are discussed and defined in the respective regional documentation and other action plans/roadmaps.*

In this context, it is deemed essential to achieve, in the next five years, a South American airspace that is safe, efficient and with adequate capacity (see capacity assumptions in paragraph 2.8), supported by interoperable, resilient and cyber-secure CNS systems/facilities (see note below). At the same time, the objective is to reduce the impact of CO2 emissions and noise pollution on the environment.

> *Note. - ICAO is leading the development of the concept of cybersecurity for air navigation systems.*

Consequently, this CONOPS EC/SAM will make available the desired operational scenario of regional airspace, which could be used in the studies and plans concerning the interoperability of CNS systems and services (focused on the intra-regional and inter-regional scenario), and those for the optimisation of MET/AIM information resources also proposed in the GANP.

The CONOPS EC/SAM focuses on the key performance areas (KPAs) of **airspace efficiency and capacity** defined in the GANP and other related ICAO documents. These KPAs are associated with key performance indicators (KPIs) which are in turn linked to the development of ASBU elements.

For the purposes of this document, airspace segments have been defined as follows:

- ✓ En-route operation segment
    - o continental airspace
    - o oceanic airspace

- ✓ Terminal area operation segment

The CONOPS EC/SAM draws from Doc 9883 with respect to the performance-based approach to air navigation optimisation, as set forth in the GANP.

For the deployment of the CONOPS EC/SAM, performance management, as described in the aforementioned document, is implemented through the six-step method, with emphasis on the first 4 steps (see note), as follows:

Step 1: Define/examine scope, context and general ambitions/expectations
Step 2: Identify opportunities and issues, and set (new) objectives
Step 3: Quantify objectives
Step 4: Identify solutions to seize opportunities and solve issues
Step 5: Deploy solutions
Step 6: Assess the achievement of objectives.

Note. - The CONOPS EC/SAM does not elaborate on steps 5 and 6, on implementation of solutions and assessment of the achievement of objectives. These steps will be described theoretically in Appendix A.

Performance objectives

2.6 Safety

Resolution A40-1 "ICAO Global planning for safety and air navigation" endorses the third edition of the GASP and the sixth edition of the GANP as the global strategic directions for safety and air navigation, respectively.

It further resolves that the GASP and GANP plans be implemented and kept current in close cooperation and coordination with all concerned stakeholders, and that these plans provide the frameworks in which regional, sub-regional and national plans will be developed and implemented, thus ensuring consistency, harmonisation and coordination of efforts aimed at improving international civil aviation safety, capacity and efficiency. The full content of the Resolution and its appendices on GASP and GANP matters, can be found at:

https://www.icao.int/Meetings/a40/Documents/Resolutions/a40_res_prov_es.pdf

Appropriate infrastructure to support safe operations

The Global Aviation Safety Plan - GASP (Doc 10004) and the GANP are mutually supportive in recognising the need for appropriate infrastructure to support safe air operations. Coordination of RASG-PA and GREPECAS activities is considered essential for the successful implementation of both global plans, since **increasing air navigation capacity and improving efficiency** must be done in a safe manner and appropriate safety nets are required to prevent accidents.

The Basic Building Block (BBB) framework specified in the second layer of the GANP, independently of the ASBU framework, describes the core structure of any robust air navigation system by defining the essential air navigation services to be provided for international civil aviation in accordance with ICAO SARPs and the procedures for air navigation services (PANS). These are essential services for aerodrome operations, air traffic management, search and rescue, meteorology and aeronautical information.

BBBs do not represent an evolutionary step, but a benchmark defined by the basic services agreed by States under the Convention on International Civil Aviation to enable international civil aviation to develop in a safe and orderly manner.

The ASBU framework defines a set of operational improvements in certain areas of the air navigation system that the aviation community agreed to work on in order to maintain or improve system performance (ASBU threads). An ASBU element is a specific change in operations aimed at improving the performance of its air navigation system under specific operating conditions.

In planning improvements to air navigation systems, the following should be taken into account for the different stages of the pandemic:

a) Risk assessment and prioritisation based on the data collected and analysed;
b) The implementation of safety management principles for risk-based decision-making; and
c) The management and oversight of approvals issued by the CAAs, taking into account the flexibility required throughout the aviation system to maintain safe operations.

Global Safety Plan indicators

Doc 10004 sets out its objectives, targets and indicators related to the aspirational safety goal of "zero fatalities by 2030."

In this regard, the GASP has identified Goal 6, related to the availability of the appropriate infrastructure to support safe operations, whose targets and indicators are shown in the table below:

Goal 6: Ensure the appropriate infrastructure is available to support safe operations	**6.1**	By 2022, all States to implement the air navigation and airport core infrastructure	• Number of States having implemented the air navigation and airport core infrastructure elements

2.7 Resilience and the environment

Regarding operational resilience, the aim is to implement harmonised and optimally managed ATS contingency plans, which in the short term will evolve into consolidated ATM contingency plans (including ATFM and ASM), and will be gradually integrated into plans for all air navigation services.

The CONOPS EC/SAM, at the same time, recognises the contribution of ASBU modules/elements to environmental protection, especially in implementations that result in a reduction of flight distances, the optimisation of aircraft descent/climb speeds and the use of PBN to designate approach/departure paths that avoid impacts on populations near airports.

As shown in Appendix A, several KPIs have been defined in the Efficiency KPA that allow for the generation of **estimated data** on fuel burn reduction, for example, in aircraft taxiing and climb/descent maneuvers.

Furthermore, consideration should be given to the "Roadmap for PBN implementation in the SAM Region 2022-2026", to give continuity to regional activities for the implementation of the requirements set out in ICAO Assembly Resolution A37-11 entitled "Performance-based navigation global goals."

The initiatives of the SAM Region promote the use of performance-based navigation in the en-route, terminal area and approach segments, and must be consolidated mainly within the scope of the elements of the APTA (Airport Accessibility) module, referred to PBN approach and incorporating the elements related to CCO and CDO.

2.8 Capacity and efficiency

The CONOPS EC/SAM encompasses the challenges that regional and global air navigation will face in the period 2022-2026 and formulates the proposed functionalities and implementations to improve efficiency and keep airspace capacity/demand in balance, contributing to the prompt recovery of civil aviation and restoration of connectivity.

During the period 2020-2022, the hubs of the Region have experienced a reduction in airport capacity (runways and aprons) induced by sanitary measures (social distancing, disinfection of facilities and aircraft, boarding lounge restrictions, etc.) that require increased separation between departure/arrival of aircraft and extended airline turnaround times.

Atypically, there are capacity/demand imbalances in a period marked by a severe reduction in air operations. This capacity/demand imbalance would seem to be of a temporary nature in view of global developments in vaccine availability, which has allowed ~~leads to the assumption~~ that airport measures would be phased out.

Thus, by the period 2022-2023, an airport and ATC capacity scenario in balance with the number of air operations is anticipated. See below for theoretical capacity assumptions. In addition, the temporary scenario of reduced air traffic demand, compared to 2019 values, will favour the gradual implementation of new GANP-based airspace concepts, such as "free route airspace."

To respond to future recovery and growth, the capacity/demand balance in the Region must be maintained, together with increases in efficiency, flexibility and predictability, while ensuring that there are no adverse effects on safety, with due consideration of environmental aspects. The air navigation system must be resilient to service disruptions and the resulting temporary loss of capacity.

Efficiency refers to the operational effectiveness and cost-effectiveness of gate-to-gate flight operations from the perspective of a single flight. In all phases of flight, airspace users want to depart and arrive at their selected time and fly along a path they consider optimal.

For the five-year period, efficiency is considered crucial for the thematic axis Financial Sustainability, set out in the Strategic Framework for the Recovery of International Air Transport in the SAM Region in response to COVID-19. See link below:

https://www.icao.int/SAM/SECURITY-FACILITATION/COVID-19/Pages/COVID19-StrategicFramework.aspx

*Note.- The **predictability** KPA made up by the concepts "punctuality" and "variability" is not addressed in depth in this document. However, its link to the **efficiency** KPA is recognised. The GANP 6ed. lists KPIs linked to this area, which can be associated to ASBU elements for their development within the Aerodromes operational scenario.*

3. THEORETICAL ASSUMPTIONS

Based on a generic operational scenario for the airspace of the SAM Region, and pointing to the ambitions of improvement for capacity and efficiency, this CONOPS proposes below a list of theoretical assumptions, without prejudice to other analyses that can be carried out in the specific scope of each Flight Information Region – FIR and / or State.

a) The primary navigation element of the CONOPS EC/SAM is performance-based navigation (PBN), supported mainly by GNSS.

b) Hub airports and the surrounding TMA airspace will, towards the second half of the five-year period, present capacity/demand imbalances at levels close to those of 2019. ATFM will need to be strengthened in the region to be prepared to manage these imbalances, with a strong emphasis on minimising the impact of flow measures on operators.

c) As a communications element, oral VHF is assumed as the main means of communications, in continental airspace. For oceanic/remote airspace, the use of applications that meet the specific requirements of the PBCS in each case is foreseen, such as CPDLC or SATVOICE, which will be the primary means of communication. HF communications will be used as backup or by users not equipped with the aforementioned systems.

d) It is assumed that the capacity of the ATM system will be expanded to accommodate the growth of IFR traffic.

e) Due to the contraction of air operations and the new economic scenario, older and/or less efficient fleets would be withdrawn. There will remain a small number of commercial and general aviation operators lacking modern (advanced) navigation and communications equipment. However, airspace planning will be carried out on the basis of PBN and PBCS. The concept of *"best equipped, best served"* will be applied.

f) Ground-based navigation aids will continue to be used in support of navigation reversal and contingency procedures. Temporary deviations from the SARPs that have been implemented in States in response to COVID-19 will be considered, taking into account safety and mitigations related to maintenance and in-flight inspection of radio aids.

g) RPAS operations are expected to grow significantly in the coming years, covering various activities and business sectors, and should be considered in airspace planning.

h) States in the region, depending on the economic situation, will continue to make efforts to modernise their air navigation systems in accordance with their operational needs and new developments in the industry.

i) States in the region will continue to take the necessary measures to reduce environmental impacts that could result from civil aviation activities.

4. CONOPS EC/SAM ENABLING ELEMENTS

4.1 Air navigation plans

The five-year period will be marked by difficulties in accessing financial resources for ANSPs, making it more relevant for States to manage their national plans, seeking to identify performance improvement needs and priorities, so that investments are clearly based on cost-benefit aspects.

National air navigation plans (NANPs) are considered as the fourth layer of the GANP, 6th edition, and it is foreseen that templates will be developed in the short term to facilitate and standardise the drafting of these plans.

Only one third of SAM States have updated their NANP, and it is felt that the drafting and implementation of Volume III of the CAR/SAM ANP, using the template and process set forth in the GANP, will facilitate the formulation of these national plans.

4.2 Airspace optimisation plans

SAM States have been developing airspace optimisation plans based on the GANP ASBUs, Doc 9613 and Doc 9992, which clearly set out the strategies to be applied in airspace optimisation. These plans are in line with the regional PBN implementation objectives, which in turn are developed in accordance with the guidance contained in the GANP. The "Roadmap for PBN implementation in the SAM Region 2021-2025" guides PBN implementation.

4.3 Communications

To date, almost all communication between the cockpit and the controller is mainly through VHF voice communications on continental airspace. However, with the increasing number of flights, it will be necessary to evolve the way pilots and controllers communicate to support improved and more robust information exchange, without affecting pilot or controller workload.

The concept of operations considers data link communications (CPDLC) or SATVOICE in oceanic airspace to support the implementation of optimised separations, with the application of RNP4/2 and PBCS. Some States in the Region have implemented ADS-C with CPDLC in their oceanic airspace, and it is expected that beyond 2024 an increasing number of digital data communication applications and services will be incorporated to become the primary means of communication, but circumstances will continue to exist where clearances and instructions are issued by voice.

In accordance with the global air traffic management (ATM) operational concept, communication specifications will be established in accordance with the required communication performance (RCP) and the airspace in which operations are conducted.

4.4 ATS surveillance

ATS surveillance plays an important role in air traffic. The ability to accurately determine, track and update the position of aircraft helps to optimise aircraft separations and positively impacts the degree of efficiency with which a given airspace can be used.

ATS surveillance will be implemented taking into account the operational requirements for the airspaces under consideration. States in the region, especially those with rugged terrain, are expected to consider the possibility of ATS surveillance coverage through ADS and/or MLAT systems.

In the same way as RCP, ATS surveillance specifications will be established in accordance with the required surveillance performance (RSP) and the airspace in which operations are conducted.

4.5 Flexible use of airspace

Aviation covers a wide range of users, from commercial aviation to military and recreational operations, each with its own mission or business objectives.

The Implementation Group (SAMIG) developed "GUIDELINES FOR IMPLEMENTATION OF THE FLEXIBLE USE OF AIRSPACE (FUA) CONCEPT IN THE SOUTH AMERICAN REGION, which, like the CONOPS EC/SAM, considers SAM airspace as a single resource shared by all airspace users, with diverse and sometimes conflicting interests and requirements, which should be taken into account and addressed to the extent possible.

Flexible use of airspace is a concept of airspace management based on the principle of accommodating all airspace users to the extent possible, considering effective communications, cooperation and necessary coordination to ensure safety, efficiency and environmental sustainability.

Where conditions permit, standard arrival and departure procedures and non-permanent or conditional routes (CDR) will be implemented for more efficient use of airspace.

4.6 KPI application and data management

The GANP 6th ed. details 19 key performance indicators, as shown in the following link:

https://www4.icao.int/ganpportal/ASBU/KPI

In each of the 19 formats presented, the following KPI components are explained:

- Definition
- Measuring units
- Operations to be measured
- KPI variants
- Characterised objects
- Usefulness of the KPI
- Parameters
- Data requirements
- Data providers
- Formula/Algorithm

It is highlighted that the management of the KPIs and their use to measure the extent to which the expected performance was achieved as part of the improvement for the ASBU element requires the collaborative action of various actors in the system, such as airports, ATFM services, ANS providers, airlines, itinerary databases, ADS-B providers, etc. The present CONOPS EC/SAM does not elaborate on airport service improvements as its scope is the airspace of the Region. However, the associated KPIs are shown in Appendix A as a reference for future joint development with GANP initiatives in the airport scenario.

Note.- The present CONOPS EC/SAM does not delve into the improvements of airport services since its scope is the airspace of the Region, however, the related KPIs are shown in Appendix A, as a reference for a future joint development with the ganp initiatives in the airport scenario.

The tables in Appendix A show how the KPIs are associated with each selected KPA in order to determine the ASBU elements that, when implemented, will contribute to the performance improvement measured by the selected KPI.

FOQA data and big data

When FOQA (flight operations quality assurance) is available, this information will be used for the design of procedures, routes and mainly for the post-implementation assessment of an optimised airspace concept because it provides real data on the benefits derived from the implementation.

The information provided by the Big Data Project on air traffic movement represents a valuable input for airspace planning tasks. This information is derived from the analysis of data provided by aircraft ADS equipment and transmitted to a network of receivers on the ground and then analysed to produce safety or statistical indicators that can be used for airspace measurement and planning. The information can be updated every three hours, providing constant, accurate and low-cost information.

The indicators that have been defined for use in airspace planning within a PBN operational concept include, *inter alia,* the following:

a) SID utilisation rate: it is possible to determine how many flights were performed for each SID within a given period of time, for example, one month.
b) STAR utilisation rate: it is possible to determine how many operations were performed for each STAR within a given period of time.
c) APCH utilisation rate: it is possible to determine how many operations were performed for each APCH within a given period of time.
d) Average top of descents: the average of where aircraft begin descent at a STAR can be obtained, sorted by airway category, by time period, etc.
e) Average deviations in PBN airspace: information on the percentage of STAR, SID or APCH deviations can be provided.
f) Number of ACAS RAs: a measure of RAs can be obtained and filtered by altitude level or airspace segment.

In addition, the information captured by Big Data can be used to determine aircraft flows for input into airspace design, quite useful for noise segregation procedures or other uses.

These are just some of the indicators that will be available to users of the Big Data project, and that will directly support airspace planning tasks.

4.7 PBN and PBCS certification of air operators

It is expected that, given the post-COVID scenario, the older and more inefficient fleet will be decommissioned and users without PBN/PBCS certification will be significantly reduced. The benefits derived from the operational concept are based on the modern navigation capabilities of most of the commercial air fleet operating in the Region.

4.8 Human factors

As we move towards the global ATM operational concept, an increasing level of automation will be required. However, the human being will at all times continue to manage automation. In basic terms, this means that the human will decide what is to be done, will delegate the execution of tasks to automation, and will be able to intervene when necessary.

4.9 Training

People with the appropriate skills and competencies, properly certified and trained, will continue to be the backbone of ATM/CNS operation and support services. With the expected recovery and growth of aviation, it is critically important to have duly qualified and competent personnel to ensure a safe and efficient aviation system.

States should incorporate human performance into the planning and implementation phases of new systems and technologies within the framework of the GANP and the regional and national plans. Early involvement of operational staff is also essential.

In this regard, it is necessary to emphasise the importance of incorporating **Human Performance** in the programmes and content of the courses delivered in the aeronautical training centres in the States of the region. The training of aeronautical personnel is fundamental for the purposes of this document.

4.10 Other factors to be considered in the implementation

4.10.1 Cost-benefit analysis

The States of the region should conduct a cost/benefit analysis of airspace modifications and of planned infrastructure and modernisation investments. GANP/6, in the AN-SPA tool and in the fourth NANP layer, presents some basic considerations and a checklist (CBA Checklist) for this analysis.

4.10.2 Pre-operational analysis and accessibility

It should be noted that, in route optimisation, there are user factors such as: aeronautical charges, routes in case of depressurisation (escape routes), distance to alternate aerodromes, weather conditions, etc., which may determine that the shortest distance between two points is not necessarily the optimal path in a given circumstance.

The effect of publishing meteorological minima as an alternate airport that are higher than the published instrument approach procedure minima for the same aerodrome should also be considered to ensure accessibility.

4.10.3 Safety assessment

Safety must be guaranteed in any modification of airspace design or procedures contemplated in its optimisation. This includes compliance with ICAO SARPs and relevant State regulations.

Following changes in airspace, the system should be monitored and operational data collected to ensure that safety is preserved, to determine whether strategic objectives have been achieved, and to identify opportunities for improvement.

5. CHALLENGES FOR THE SAM REGION

All ICAO Regions, including the SAM Region, have been impacted by the sanitary measures imposed to control the pandemic. The contraction of the industry is noticeable globally, and it is estimated that, approximately between 2023 and 2024, some regions could be recovering to the RPK rates registered in December 2019, which will have an impact on the operations and revenues of airlines, airports and ANSPs.

The impact on the GDP of States is notorious, with jobs in the sector having been significantly affected. The post-pandemic scenario is taken into account in the SWOT analysis in Appendix A.

As a result of the aforementioned SWOT analysis, and given the scenario described above, the main challenges for the SAM Region are as follows:

- Emphasise the implementation of the CAR/SAM ANP and the respective NANPs aligned with the GANP, under a cost-benefit approach and addressing the need for performance-based improvements in air navigation.
- Support the recovery of the aviation system and the connectivity of the Region, and contribute to the financial sustainability of airlines, airports and ANSPs.
- Strengthen the interoperability of systems and services at regional and inter-regional level.
- Strengthen the training and competencies of aviation professionals.
- Foster resilience in ATM/CNS services and facilities.
- Improve safety levels.

6. PLANNING PRINCIPLES

Given the uniqueness of the regional challenges outlined above, it will be important to define planning principles within the operational concept set out in this document, as follows:

- Efficient use of ATM/CNS capacity installed in the Region, as well as of the communication and navigation capabilities of the regional fleet.
- Integration, participation and horizontal cooperation among States, as well as with the industry, ANSPs, airlines and airports.
- Alignment with documents:
    - Strategic framework in response to COVID-19 in the SAM Region.
    - ICAO CART (Council Aviation Recovery Taskforce) report and “Take-off” document
- Emphasis on the management of performance indicators (KPIs) to be generated from the implementation of regional plans and national air navigation plans.

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Appendix A. Performance based planning according 6 steps method

Available at the following link of the GESEA Channel:

https://oaci.sharepoint.com/:b:/r/sites/SAM-CAR-ANS-GESEA/Shared%20Documents/GESEA/SG1%20PLAN%20EA/3%20CONOPS%20Espacio%20Aereo/APn%20F%20eCRPP%203%20_%20Instructivo%20de%20plantilla%20VOLIII.pdf?csf=1&web=1&e=S5KLvO

Optionally, the instructions are incorporated in the Final Report of the eCRPP/03, available at the following link:

https://www.icao.int/NACC/Documents/Meetings/2021/PPPRC3/eCRPP03-Minuta.pdf

Appendix B. ASBU Modules/Elements

See ICAO GANP PORTAL, at the following link:

https://www4.icao.int/ganpportal/ASBU

Appendix C. Acronyms y Abbreviations

A-CDM	Airport collaborative decision-making
AN-SPA	Air navigation system performance assessment
ASBU	Aviation system block upgrades
DCB	Demand-capacity balancing
FUA	Flexible use of airspace
GANP	Global air navigation plan (Doc 9750)
GASP	Global aviation safety plan (Doc 1004)
KPI	Key performance indicator
KPA	Key performance area
PBA	Performance-based approach
PBN	Performance-based navigation

Apéndice D. References

The following ICAO Documents are related to CONOPS EC/SAM – SAM

- GANP, sixth edition 2019, Doc. 9750
- Doc. 9854 GATMOC
- Doc. 9883 Manual on Global Performance of the Air Navigation System
- Doc. 9882 Manual on Air Traffic Management System Requirements
- Doc. 4444 Procedures for Air Navigation Services (PANS) - Air Traffic Management (Doc 4444)
- Doc. 8168 Procedures for Air Navigation Services (PANS) - Aircraft Operations - Volume II
- Doc. 9613 Performance Based Navigation (PBN) Manual
- Doc. 9905 Required Navigation Performance Authorization Required (RNP AR)
- Doc. 9924 Aeronautical Surveillance Manual
- Doc. 9931 Continuous Descent Operations (CDO) Manual
- Doc. 9992 Manual On The Use Of Performance-Based Navigation (PBN) In Airspace Design
- Doc. 9993 Continuous Climb Operations (CCO) Manual
- Doc. 9997 Performance-Based Navigation (PBN) Operational Approval Manual
- Resolutions adopted by the Assembly - 40th session (Montreal, 24 September - 4 October 2019)

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