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

WORKING PAPER

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Fifth GREPECAS–RASG-PA Joint Meeting (GREPECAS-RASG-PA/5) and Twenty-Third Meeting of the CAR/SAM Regional Planning and Implementation Group (GREPECAS/23)

Virtual Phase (Asynchronous, 19 January to 17 February 2026)
In-Person Phase (Mexico City, Mexico, 4 to 6 March 2026)

Agenda Item 8: CAR/SAM Air Navigation Implementation

SUSTAINABILITY: REDUCING FUEL CONSUPTION AND CO2 EMISSIONS THROUGH OPERATIONAL IMPROVEMENT MEASURES

(Presented by Brazil)

EXECUTIVE SUMMARY

The ECO Norte Project is performance-based initiative aimed at modernizing airspace organization and air traffic management (ATM) operations within the Amazon FIR and its associated TMAs (Belém, Manaus, and Cuiabá). The project combines collaborative decision-making (CDM), accelerated and real-time simulations, operational validation, structured training, and post-implementation performance monitoring. Consolidated results demonstrate tangible operational and environmental benefits, including increased capacity, improved predictability, reduced air traffic controller workload, estimated fuel savings of approximately 28 tonnes per year in the initial TMAs, and a corresponding reduction of around 88 tonnes of CO_2 emissions. Further information on this topic is available in two additional Information Papers: VIRACO₂POS PROJECT: OPERATIONAL EFFICIENCY AND ENVIRONMENTAL BENEFITS IN THE SÃO PAULO TMA and AIRSPACE CONCEPT DEVELOPMENT IN THE RIO DE JANEIRO AND BELO HORIZONTE TMAs: OPERATIONAL OPTIMIZATION AND ENVIRONMENTAL BENEFITS.

Action:	a) encourage efforts toward the development and application of environmental assessment tools to support the mitigation of CO_2 emissions; b) promote the linkage between operational measures in force and applicable KPIs, supported by available national systems, in order to assess and enhance their environmental potential; and c) encourage the sharing of knowledge, best practices and training activities among States of the SAM Region.
Strategic Objectives 2026-2050:	• Every flight is safe and secure • Aviation is environmentally sustainable • Aviation delivers seamless, accessible, and reliable mobility for all • No country left behind • The International Civil Aviation Convention and Other Treaties, Laws and Regulations Address All Challenges

	• The Economic Development of Air Transport Assures the Delivery of Economic Prosperity and Societal Well-Being for All •
References:	• ICAO Assembly – 42nd Session; • Global Air Navigation Plan (GANP); and • Scoping Report on Environmental Metrics of Relevance to the Global Aviation System – ICAO CAEP – 2022.

1. Introduction

1.1 The ECO Norte Project was conceived to address the increasing operational complexity and traffic demand in the Amazon FIR, while aligning national airspace modernization initiatives with the ICAO GANP and the Aviation System Block Upgrade (ASBU) framework.

1.2 The initiative adopts an integrated ATM performance-based approach, combining airspace design, human factors, validation activities, training, and performance monitoring, thereby ensuring a safe and sustainable transition to new operational concepts.

2 Project Objectives

2.1 Optimize airspace structures and procedures to improve safety, efficiency, and predictability in high-complexity operational environments.

2.2 Increase capacity and traffic flow efficiency through structured and collaborative decision-making processes.

2.3 Reduce environmental impact by enabling more efficient trajectories, the expanded application of continuous climb and descent operations (CCO/CDO) and reduced tactical vectoring.

2.4 Strengthen operational resilience through simulation-based validation and competency-based training.

3 Methodological Approach

3.1 Collaborative Decision-Making (CDM).

3.1.1 The project was developed under a collaborative framework involving DECEA, operational units, technical specialists, and key stakeholders. This approach ensured shared situational awareness, transparency, and operational feasibility throughout all project phases.

3.2 ATM Simulation

3.2.1 Accelerated-time simulations were conducted to evaluate capacity, demand scenarios, sector configurations, and traffic flows. These simulations supported strategic decision-making and optimization of airspace design alternatives prior to operational validation activities.

3.2.2 Real-time simulations were conducted to validate controller workload, sectorization, operational procedures, human–machine interfaces, and contingency scenarios under realistic operational conditions.

3.3 Operational Validation

3.3.1 Simulation results supported operational validation, the identification of safety risks, and the definition of mitigation measures prior to implementation.

4 Training and capacity building

4.1 The ECO Norte Project incorporated structured training programmes for air traffic controllers, supervisors, and technical personnel.

4.2 Training activities were aligned with the new airspace concepts, operational procedures, and system functionalities, ensuring a standardized and safe operational transition.

5 Performance indicators and monitoring

5.1 Performance monitoring is aligned with GANP Key Performance Areas (KPAs), particularly Safety, Efficiency, Capacity, Predictability, and Environmental Sustainability.

5.2 Consolidated indicators derived from national systems demonstrate:

a) reduction in track miles flown;
b) improved vertical and lateral profile adherence;
c) reduction in tactical interventions;
d) fuel savings estimated at approximately 28 tonnes per year (initial implementation phase); and
e) corresponding CO_2 emission reduction of approximately 88 tonnes per year.

5.3 These indicators support continuous improvement and data-driven decision-making.

6 Conclusions

6.1 The implementation of the ECO Norte Project has resulted in a set of consolidated operational, safety, environmental and network-related benefits. These gains reflect the effectiveness of a performance-based and collaborative approach to airspace modernization and demonstrate tangible improvements in the provision of ATM services within the Amazon FIR and its associated TMAs.

a) Increased airspace capacity and operational efficiency in the Terminal Control Areas of Belém, Manaus and Cuiabá, supporting the accommodation of future traffic demand;
b) Enhanced safety margins and improved controller situational awareness, resulting from optimized airspace design, clearer traffic flows and validated operational procedures;
c) Measurable environmental benefits, achieved through reduced fuel consumption and corresponding reductions in CO_2 emissions, enabled by more efficient trajectories and improved vertical and lateral profiles; and
d) Improved predictability and network resilience, contributing to more stable traffic flows and providing a robust foundation for the future scalability and replication of the concept in other airspace environments.

6.2 The ECO Norte Project confirms that structured planning, collaborative decision-making, simulation-based validation, and performance monitoring constitute effective tools for sustainable ATM modernization. The consolidated results demonstrate alignment with ICAO strategic objectives and provide a replicable and scalable model for other complex airspace regions.

7 Suggested actions

7.1 The Meeting is invited to:

a) Encourage efforts toward the development and application of environmental assessment tools to support the mitigation of CO_2 emissions;

b) promote the linkage between operational measures in force and applicable KPIs, supported by available national systems, in order to assess and enhance their environmental potential; and

c) encourage the sharing of knowledge, best practices and training activities among States of the SAM Region.

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