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

WORKING PAPER

GREPECAS/23 — WP/8.26
14/01/26

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

ENVIRONMENTAL ANALYSIS OF OPERATIONAL IMPROVEMENTS IN BRAZILIAN AIR NAVIGATION

(Presented by Brazil)

EXECUTIVE SUMMARY

The GANP began incorporating the environment as a key performance area (KPA) in 2019, leading ICAO CAEP to recommend KPI as indirect metrics for environmental assessment. In alignment with these guidelines and ICAO Resolution A42-21, DECEA has implemented actions to monitor the environmental impact of operational improvements. In Brazil, KPI associated with the KPA Efficiency are used to estimate CO_2 emissions. Based on these data, DECEA developed the Environmental and Sustainability Indicators (IMAS), using its own methodology to calculate emissions in the LTO cycle. These indicators use data processed by national systems. Although they provide quantitative values, they require qualitative analysis of associated operational improvements. Thus, the IMAS are consolidated as a strategic tool for environmental monitoring and decision-making in the ATM system.

Actions:	The Meeting is invited to: a) recognize that air navigation activities generate environmental impacts, including CO_2 emissions; b) focus efforts on developing environmental assessment tools to help mitigate CO_2 emissions; c) relate operational measures in force with KPIs and available systems in the national context, in order to explore the environmental potential of each; and d) share knowledge and training with SAM Region States.
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 inclusion of the environment as a key performance area (KPA) in the Global Air Navigation Plan occurred in 2019, in the 6th edition of the plan. However, due to the absence of direct environmental assessment metrics in the context of air navigation, ICAO's Committee on Aviation Environmental Protection (CAEP) issued the document "Scoping Report on Environmental Metrics of Relevance to the Global Aviation System," guiding the use of Key Performance Indicators (KPIs), including the operational ones foreseen in the GANP, as indirect metrics to measure environmental actions carried out by each stakeholder.

1.2 Based on these guidelines, the Department of Airspace Control (DECEA) initiated a set of actions to enable the evaluation of the environmental performance of ongoing operational improvements, in accordance with Resolution A42-21 — Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate Change, which invites the international civil aviation community to recognize:

> *"Recognizing that air traffic management (ATM) measures under the ICAO Global Air Navigation Plan contribute to enhanced operational efficiency and the reduction of aircraft CO_2 emissions."*

1.3 These actions help align operational performance with ICAO's global strategic objectives, particularly those related to environmental sustainability.

2. GANP KPI Used

2.1 Air Navigation Service Providers (ANSPs) should prioritize metrics and indicators that best align with the characteristics of their airspace and traffic volume, ensuring that these parameters can be supported by available data collection resources and allow effective performance monitoring.

2.2 In the context of Brazilian air navigation, the KPIs foreseen for environmental protection are concentrated within the KPA Efficiency. Initially, KPI 02 (Additional taxi-out time) and KPI 13 (Additional taxi-in time) are being used as indirect metrics for estimating CO_2 emissions in these phases of flight.

3. Environmental and Sustainability Indicators (IMAS)

3.1 The IMAS were developed by DECEA as a mechanism to clarify the environmental performance of operational improvements, with the objective of quantifying CO_2 emissions associated with air navigation activities.

3.2 Following the guidelines stated in item 1.1 of this Working Paper, the methodology for quantifying CO_2 emissions per flight phase within the Landing and Take-Off (LTO) cycle was established.

Additionally, a proprietary mathematical model was developed for calculating these environmental indicators.

3.3 The data used as the basis for calculating the IMAS are processed by Brazilian systems. KPI 02, for example, uses additional taxi-out time recorded by the BIMTRA and VRA systems as one of its variables; the final KPI result will then be used as a metric for calculating IMAS 01 (CO_2 Emissions in Taxi-Out).

3.4 Although IMAS produce quantitative results, these alone do not allow a conclusive environmental analysis. Therefore, deeper analysis is required, considering the qualitative aspects of operational improvements that directly affect each indicator, as foreseen in the National Air Navigation Plan and based on the Aviation System Block Upgrade (ASBU) modules of the GANP.

4. Conclusion

4.1 The calculation of IMAS, derived from GANP KPIs, is an essential tool for monitoring the environmental performance of the ATM system. It enables DECEA to identify critical points, guide continuous improvement actions, and support data-driven decision-making.

5. Suggested actions

5.1 The Meeting is invited to:

a) Recognize that air navigation activities generate environmental impacts, including CO_2 emissions;

b) focus efforts on developing environmental assessment tools to help mitigate CO_2 emissions;

c) relate operational measures in force with KPIs and available systems in the national context, in order to explore the environmental potential of each; and

d) share knowledge and training with SAM Region States.

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