



Agenda Item 4: Report on GESEA and Subgroup activities and deliverables

**EVOLUTIONARY ROADMAP AND IMPLEMENTATION MATRIX
FOR FREE ROUTE AIRSPACE (FRA) IN BRAZIL**

(Prepared by Brazil)

SUMMARY

This working paper presents a detailed historical overview of actions, the regulatory-technological framework, and the future action plan (roadmap) established by the Department of Airspace Control (DECEA) for the progressive implementation of Free Route Airspace (FRA - defined as the specified volume of airspace within which users may freely plan a route between a defined entry point and a defined exit point) to enable Free Route Traffic Operations (FRTO - the operational mode and flexible flight trajectories) within the Brazilian upper airspace, in full alignment with ICAO ASBU Module B1-FRTO.

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1. Background

1.1 The Brazilian journey toward the Free Route Traffic Operations (FRTTO - the operational concept enabling user-preferred trajectories) within designated Free Route Airspace (FRA - the structured airspace volume accommodating these flights) followed an incremental and pragmatic approach, capitalizing on operational windows of opportunity and establishing a solid doctrinal foundation:

a) Phase 1: Implementation of Direct Routing - DCT (Completed): Originally planned to be preceded by extensive structural airspace complexity studies, the Direct Routing (DCT) concept was reactively accelerated due to the drastic reduction in air traffic volume resulting from the COVID-19 pandemic. This scenario enabled the immediate application of the concept across nearly the entire national territory, mitigating economic impacts and validating the initial feasibility of flexible trajectories.

b) Phase 2: Implementation of UPR via Circular CIRCEA 100-114 (Completed): Following the success of DCT routes, a need was identified to extend efficiency to specific city pairs within portions of the airspace where the pure DCT airspace concept was not operational. The Airspace Control Regulatory Circular (CIRCEA 100-114) instituted the formal national process for the request, analysis, and publication of these User Preferred Routes (UPR).

c) Phase 3: Playbook Routes (Completed): DECEA consolidated an accessible electronic catalog of current structures aligned with the ICAO GANP concept, which defines the Playbook as a set of standardized routes for rapid implementation under contingencies. Thus, when UPR become unavailable due to weather, sector saturation, or the activation of segregated areas, ATC possesses a pre-configured matrix of strategic rerouting to accommodate traffic flow with minimal impact on flight efficiency.

d) Phase 4: Airspace Segregation Modernization via Instruction ICA 100-36 (Completed): Recognizing that certain activities, particularly military and national security operations, require segregated areas, this Regulatory Instruction (ICA 100-36) restructured the national application process for activities requiring segregation. Furthermore, the international concepts of Temporary Reserved Area (TRA) and Temporary Segregated Area (TSA) were introduced, establishing the indispensable foundations for the Flexible Use of Airspace (FUA).

e) Phase 5: Operational Capacity Building - ATM049 Course (Completed): To harmonize planning competencies, a specific technical course was created to train personnel in the analysis and design of segregated areas. The focus is to enable staff to apply mitigating measures that reconcile special use airspace with maximum air traffic flow efficiency.

f) Phase 6: FRA Institutionalization via PCA 351-6 Plan (Completed): This Airspace Design Plan officially established the high-level guidelines and the Brazilian State's strategy regarding the structured transition to the FRA concept and FRTTO environment.

2. Analysis

2.1 To achieve the definitive consolidation of ICAO ASBU Module B1FRTTO, DECEA's strategic planning unfolds into three interdependent axes designed to resolve constraints related to civil-military coordination, system interoperability, and air traffic controller (ATCO) workload:

a) Axis 1: The Integrated Regulatory Framework (FUA-FRA)

2.1.a.1 National regulatory maturity will be achieved through a sequence of interconnected deliverables scheduled for the year 2027:

- a) **Airspace Management Regulatory Instruction (ICA ASM):** Will regulate the rules for the dynamic management of airspace volumes, governing the activation of Conditional Routes (CDR), TRAs, TSAs, and conditioned areas (prohibited, restricted, and danger areas), as well as dictating real-time civil-military coordination operational procedures.
- b) **Technical Manual for Airspace Technical Analysis (MCA):** Will standardize the parameters and methodologies consolidated by the ATM049 course, transforming risk mitigation analyses for activities requiring airspace segregation into official, approved doctrine.
- c) **Technical Manual for FRA Implementation (MCA):** Once the FUA ecosystem is secured, this national manual will dictate the premises, safety requirements, and specific monitoring benchmarks for free route design and operations.
- d) **AIP Update:** Will promote international alignment and public dissemination of the new nomenclatures and structures to the global aeronautical community.

b) **Axis 2: Technological Readiness and CNS/ATM Interoperability**

2.1.b.1 The greater trajectory flexibility eliminates the rigid references of traditional airways, requiring advanced automation tools to mitigate the risk of air traffic controller overload:

- a) **System Integration Testing:** A critical phase to ensure that the automated data chain is fully interoperable when processing structured messages for the FRTTO environment. The ecosystem will involve the integrated validation of the following proprietary systems:
 - **SIGMA:** An air traffic flow management system that handles the processing, distribution of flight plans, and management of segregated areas.
 - **SAGITARIO:** The primary radar visualization and advanced surveillance data processing system utilized within control centers.
 - **DASA:** An electronic management system focused on controlling alterations and updates to the fixed airspace structure.
 - **TATIC:** An electronic management system for the automated control of electronic flight progress strips.
- b) **Implementation of MTCD (Medium-Term Conflict Detection):** Defined by DECEA as the mandatory technological prerequisite for the FRA entry into operational service. This tool will provide automated, early detection of traffic conflicts, restoring the necessary predictability to the ATCO within a free route environment.

c) **Axis 3: FUA Operational Activation and Phased FRA Deployment**

2.1.c.1 **FUA Activation (July 2028):** Following the practical training of air traffic controllers based on the rules set forth in the future ICA ASM, the Flexible Use of Airspace concept will enter into full effect, ensuring maximum airspace efficiency regarding the dynamic management of segregated areas and the rerouting resulting from their activation.

2.1.c.2 **Progressive FRA Geographical Transition:** Free Route Airspace will be activated in a phased manner within the upper airspace, mitigating risks and distributing the operational learning curve:

- a) AMAZÔNICA FIR (SBAZ) - November 2028: Amazônia Flight Information Region. A lower conflict complexity environment, ideal for consolidating practical doctrine and collecting real post-implementation metrics.
- b) RECIFE FIR (SBRE) - November 2029: Recife Flight Information Region.
- c) CURITIBA FIR (SBCW) - November 2030: Curitiba Flight Information Region.
- d) BRASÍLIA FIR (SBBS) - November 2031: Brasília Flight Information Region. The pinnacle of the project, encompassing the country's core air traffic and the sectors with the highest traffic flow convergence complexity.

3. **Suggested actions**

3.1 The Meeting is invited to:

- a) analyze and note the roadmap structured by Brazil (DECEA), highlighting the logic of interdependence established between the management of segregated spaces (FUA), the readiness and updates of CNS/ATM automation systems (SIGMA and SAGITARIO), and the orderly, phased transition by FIR complexity level; and
- b) utilize the premises of this implementation plan as a regional reference for the harmonization of cross-border operational concepts within the SAM Region, preparing neighboring States for future long-haul cross-border FRA operations.

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