Departamento
de Controle do Espaço Aéreo
Department of Airspace Control

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

Radio Navigation Workshop for NAM and SAM Regions
Mexico City, Mexico, 2-4 September 2025

LIEUTENAUNT **MONIQUE** GARCIA **VELTEN** – BRAZIL/DECEA

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

ICAO Recommendations – Concerns about Increasing RFI in GNSS Signals

Tel.: +1 514-315-1872 30 de abril de 2024

Ref.: E 3/5-24/54

Asunto: Preocupaciones de seguridad operacional de la aviación relacionadas con las interferencias en el Sistema Mundial de Navegación por Satélite (GNSS)

Tramitación: a) difundir los textos de orientación; y b) implementar las recomendaciones, según corresponda.

Señora/Señor:

1. Tengo el honor de señalar a su atención la preocupante escalada de las actividades de interferencia deliberada y de simulación de señales dirigidas contra el Sistema Mundial de Navegación por Satélite (GNSS), que en los últimos tiempos se han observado cada vez con más frecuencia en diversas regiones del mundo. El GNSS, en cuanto uno de los principales elementos habilitantes de la navegación basada en la performance (PBN), proporciona guía de navegación para todas las fases de vuelo, desde el vuelo en ruta hasta la aproximación de precisión. Al proporcionar información exacta sobre la posición y la temporización, el GNSS habilita varios sistemas críticos para la seguridad operacional de los vuelos.

2. Desde 2003, la Organización de Aviación Civil Internacional (OACI) ha venido elaborando activamente recomendaciones y orientaciones relativas a la interferencia de radiofrecuencias (RFI) en el GNSS. Cabe recordar la resolución A41-8 de la Asamblea de la OACI, apéndice C: *Resiliencia de los sistemas y servicios CNS/ATM de la OACI*, que es la política más reciente de la OACI sobre la resiliencia del GNSS.

3. Con el fin de llamar la atención hacia la cuestión fundamental de las interferencias en el GNSS y de fomentar los debates sobre la gestión de las vulnerabilidades del GNSS y las posibles medidas de mitigación de las interferencias de radiofrecuencias, la OACI convocó recientemente el Simposio EUR/MID sobre Radionavegación, que se celebró del 6 al 8 de febrero de 2024 en Antalya (Türkiye). Un resultado importante de este simposio es la lista adjunta de recomendaciones relativas a los esfuerzos continuos de las partes interesadas para garantizar la seguridad operacional, fiabilidad y resiliencia de la navegación aérea.

4. Quisiera aprovechar esta oportunidad para referirme a las recientes publicaciones relacionadas con la seguridad operacional, a saber: el *Safety Information Bulletin No. 2022-02R2* (Boletín de información sobre seguridad operacional n.º 2022-02R2), de la Agencia de la Unión Europea para la Seguridad Aérea (AESA), y la *Safety Alert for Operators (SAFO 24002)* [Alerta de seguridad operacional para los explotadores (SAFO 24002)] de la Administración Federal de Aviación (FAA) de los Estados Unidos.

14th AN-CONF 2024

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

Global Navigation Satellite System GNSS Radio Frequency Interference – Sep. 2024 (IATA)

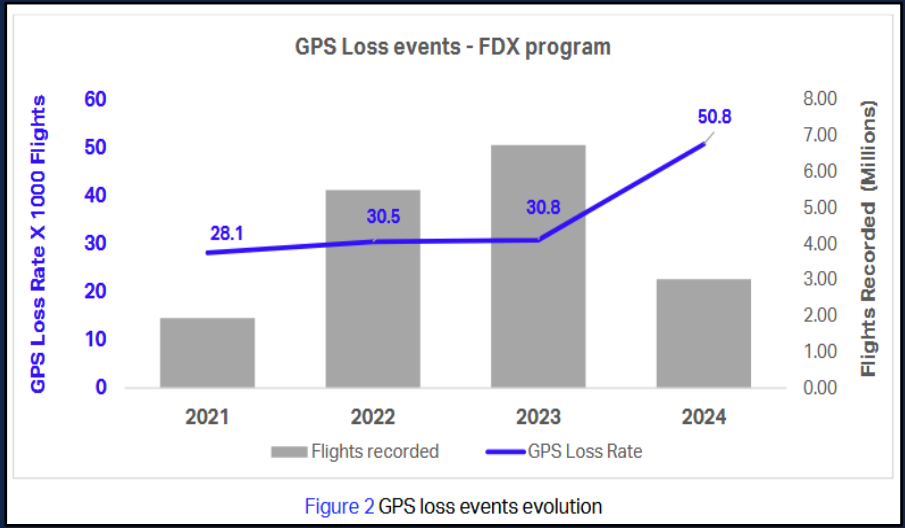


Figure 2 GPS loss events evolution

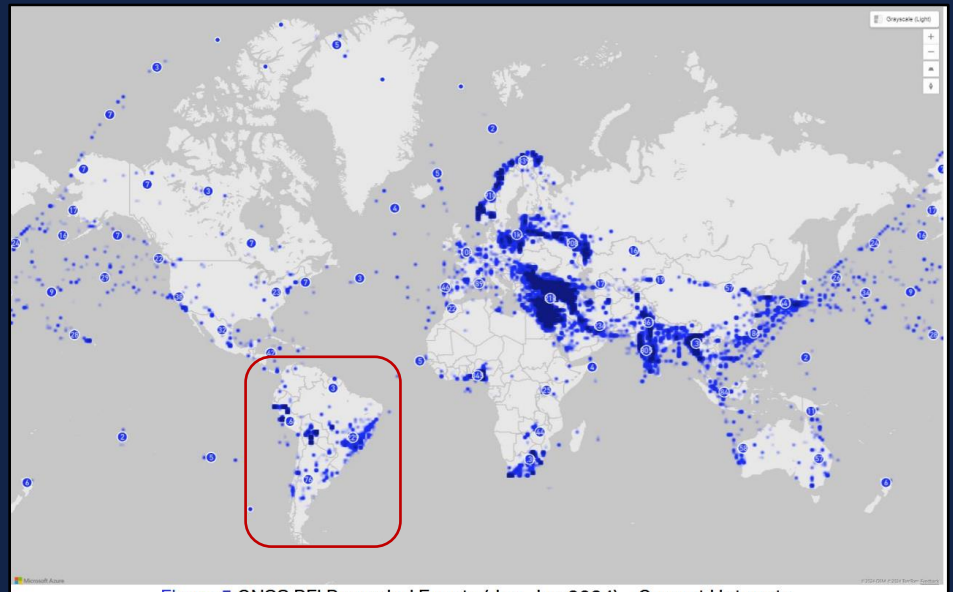
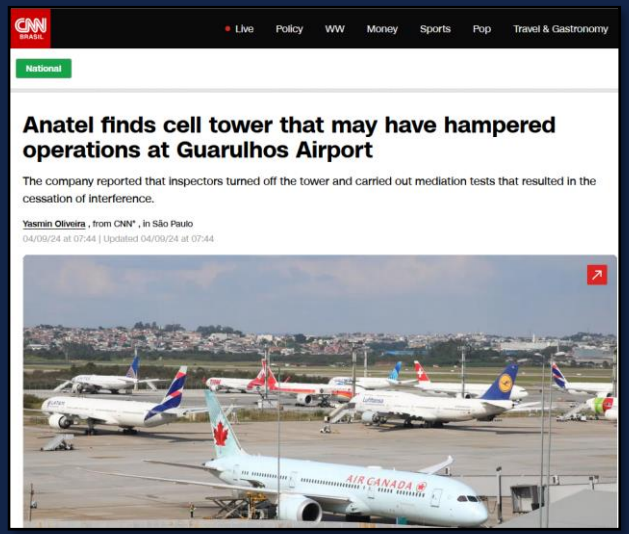


Figure 5 GNSS RFI Recorded Events (Jan-Jun 2024) – Current Hotspots

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

GNSS RFI in Brazil – Example: GRU Airport: 2024



RANKING DE MOVIMENTOS 2024 (DEP + ARR)

				Variação Anual 2023/2024	
1º	SBGR	Guarulhos	289.944	▲	4,7%
2º	SBSP	Congonhas	234.689	▲	1,0%
3º	SBBR	Brasília	147.957	▼	-0,6%

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

Actions – Brazil (2025)

ISTOÉ Dinheiro

That is • Money • Rural Money • People • Planet • Sports • Menu • Motorshow • Woman • Su

LATEST | CAREER | ECONOMY | BUSINESS | TECHNOLOGY

Spin

Navigation system failure affects operations at Guarulhos Airport

ESTADÃO CONTENT
08/29/2024 - 6:35 PM

To share:

A failure in the navigation system at Guarulhos International Airport, in Greater São Paulo, called Global Navigation Satellite Systems (GNSS), caused the delay and cancellation of flights on the morning of this Thursday, the 29th.

The FAB reported that an aircraft from the Special Flight Inspection Group (GEIV) carried out "a radio monitoring inspection around the aerodrome" to identify what affected the aircraft's GNSS capabilities, and that Decea has "alternative procedures to the navigation system to continue landing and takeoff operations without interruptions."

"Due to the incident, the air traffic flow was monitored and coordinated by the Air Navigation Management Center (CGNA), an organization subordinate to DECEA, to reduce the impacts caused to air operations," said the FAB, in a statement.

GEIV (Special Flight Inspection Group): Radio Monitoring Flight

CGNA (Air Navigation Management Center): Flow Coordination and SATDIS Query

Ministry of Defense
Air Force Command
Department of Airspace Control – DECEA
Av. General Justo, 160
ZIP Code 20021-130
Rio de Janeiro, RJ – Brazil AFS: SBRJZXIC
http://www.decea.gov.br

Brazil

AIM || Brazil

SATDIS

AIC
A 26/24

Publication Date
10 OCT 24

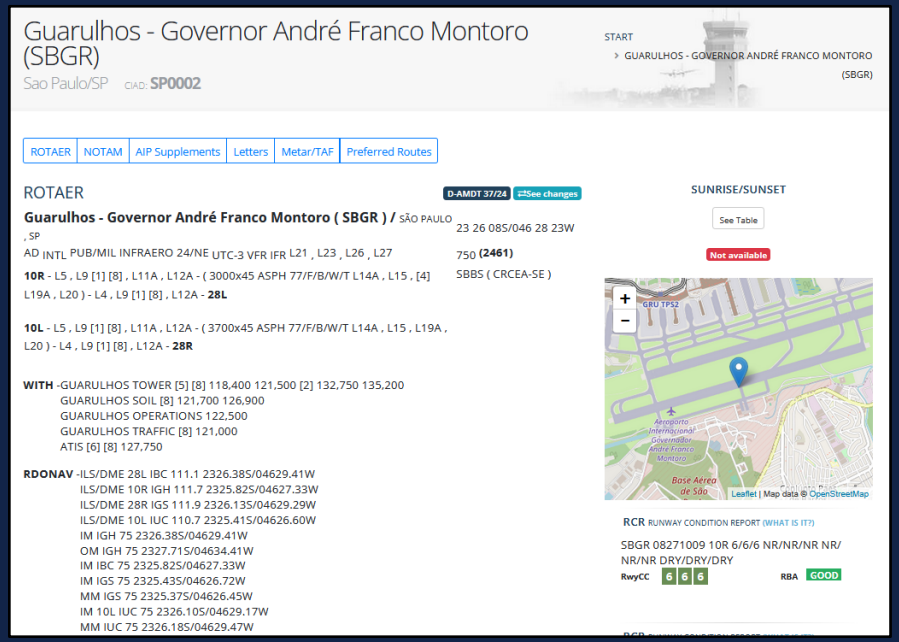
1 PRELIMINARY ARRANGEMENTS

1.1 PURPOSE

This Aeronautical Information Circular (AIC) aims to publicize the use of the SATDIS tool, a tool for predicting the availability of the RAIM (Receiver Autonomous Integrity Monitoring) service at the main domestic airports. The information provided by this tool is essential for the planning of aircraft users or operators who intend to carry out performance-based approach operations (PBN) at Brazilian aerodromes that have an Instrument Approach Chart (IAC) published with RNAV, RNP APCH and RNP (AR) navigation specifications.

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

Actions – Brazil (2025)



Guarulhos - Governor André Franco Montoro (SBGR)

Sao Paulo/SP CIAD: **SP0002**

START › GUARULHOS - GOVERNOR ANDRÉ FRANCO MONTORO (SBGR)

ROTAER | NOTAM | AIP Supplements | Letters | Metar/TAF | Preferred Routes

ROTAER

D-AMDT 37/24 ⇄See changes

Guarulhos - Governor André Franco Montoro (SBGR) / SÃO PAULO , SP

AD INTL PUB/MIL INFRAERO 24/NE UTC-3 VFR IFR L21 , L23 , L26 , L27

10R - L5 , L9 [1] [8] , L11A , L12A - (3000x45 ASPH 77/F/B/W/T L14A , L15 , [4] L19A , L20) - L4 , L9 [1] [8] , L12A - **28L**

10L - L5 , L9 [1] [8] , L11A , L12A - (3700x45 ASPH 77/F/B/W/T L14A , L15 , L19A , L20) - L4 , L9 [1] [8] , L12A - **28R**

WITH -GUARULHOS TOWER [5] [8] 118,400 121,500 [2] 132,750 135,200
GUARULHOS SOIL [8] 121,700 126,900
GUARULHOS OPERATIONS 122,500
GUARULHOS TRAFFIC [8] 121,000
ATIS [6] [8] 127,750

RDONAV -ILS/DME 28L IBC 111.1 2326.38S/04629.41W
ILS/DME 10R IGH 111.7 2325.82S/04627.33W
ILS/DME 28R IGS 111.9 2326.13S/04629.29W
ILS/DME 10L IUC 110.7 2325.41S/04626.60W
IM IGH 75 2326.38S/04629.41W
OM IGH 75 2327.71S/04634.41W
IM IBC 75 2325.82S/04627.33W
IM IGS 75 2325.43S/04626.72W
MM IGS 75 2325.37S/04626.45W
IM 10L IUC 75 2326.10S/04629.17W
MM IUC 75 2326.18S/04629.47W

23 26 08S/046 28 23W

750 **(2461)**

SBBS (CRCEA-SE)

SUNRISE/SUNSET

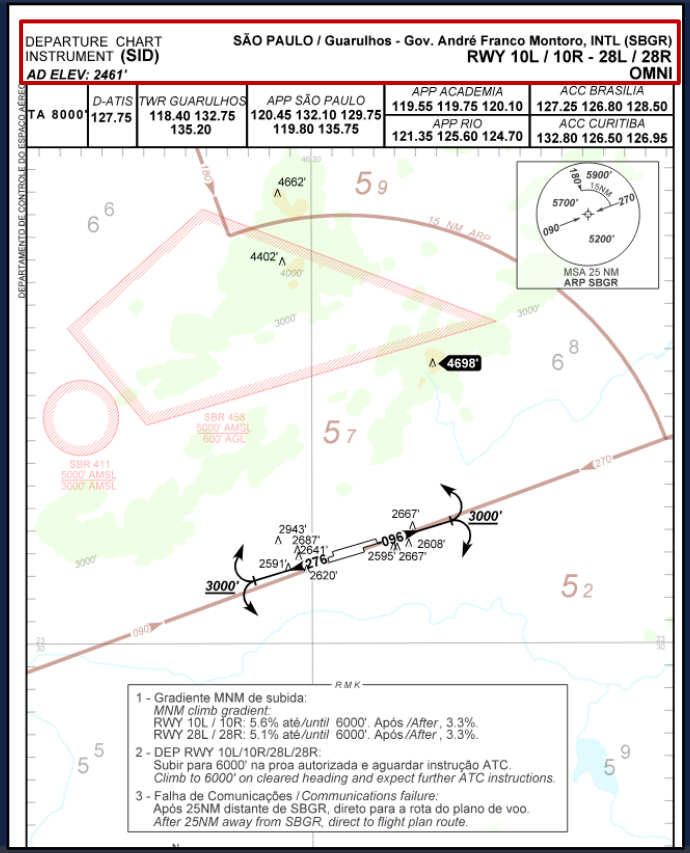
See Table

Not available

RCR RUNWAY CONDITION REPORT (WHAT IS IT?)

SBGR 08271009 10R 6/6/6 NR/NR/NR NR/ NR/NR DRY/DRY/DRY

RwyCC 6 6 6 RBA GOOD



BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

Actions – Brazil (2025)

Minimum Operational Network (MON) Implementation Plan in response to GNSS failure

In force on **May 15, 2025** / PCA 100-5 / Air Traffic

VIEW

Art. 1° This Plan establishes the actions and guidelines to ensure the continuity and safety of air operations in situations of GNSS (Global Navigation Satellite System) failure, involving the activation of a Minimum Operational Network - MON with infrastructure resources and alternative air navigation procedures (DME/DME, DME/DME/IRU, VOR/DME, ILS and SID OMNI), in addition to actions for operational adaptation. Entry into force on May 15, 2025. Published in BCA No. 074 of April 22, 2025.

ANAC

ASO Alerta de Segurança Operacional

ANAC SAFETY

Publication:	05/08/2025
ASO ID:	0002-0/2025
Update:	Revision 00

The ASO contains important information about operational safety and may include recommendations for actions to be taken by operators. However, even if a recommendation is published in an ASO, an alternative action may be equally or more effective for each operator's specific case and their particularities. The content of this document is for guidance only and has no legal force or effect, and is not intended to be binding on the public.

Interference and falsification in the GNSS signal

This ASO provides warning information to the civil aviation community about Global Navigation Satellite System (GNSS) signal jamming and spoofing.

INSTITUTIONAL RELATIONS

Anatel and Decea sign Technical Cooperation Agreement to improve the fight against interference in air traffic control

Joint actions are planned in four main areas: infrastructure, procedures, data sharing and training.

Published on 08/14/2025 2:32 PM Updated on 08/14/2025 2:42 PM

Share:

Air Force Lieutenant Brigadier Maurício Augusto Silveira de Medeiros, Director General of the Department of Airspace Control (DECEA), and Carlos Baigorri, President of Anatel

The National Telecommunications Agency (Anatel) and the Department of Airspace Control (Decea) signed, this Thursday (14/8), in Rio de Janeiro, a Technical Cooperation Agreement (ACT) with the objective of improving the treatment of radio interference that affects the Brazilian Airspace Control System (Sisceab), ensuring greater effectiveness in identifying and resolving these problems.

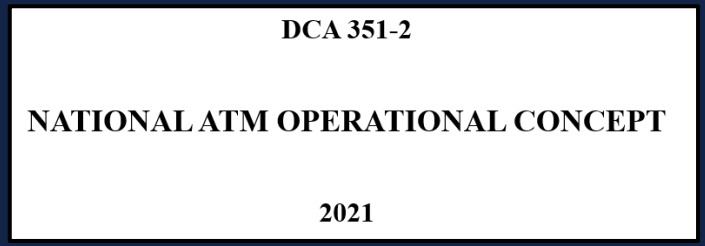
BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

DECEA's Plan – History (Strategic Concept)

SIRIUS BRASIL

DCA 351-2 – Previously published in 2010

- The implementation of Performance-Based Navigation (PBN) using GNSS and other navigation systems should be improved as the foundation for the SISCEAB transition process.



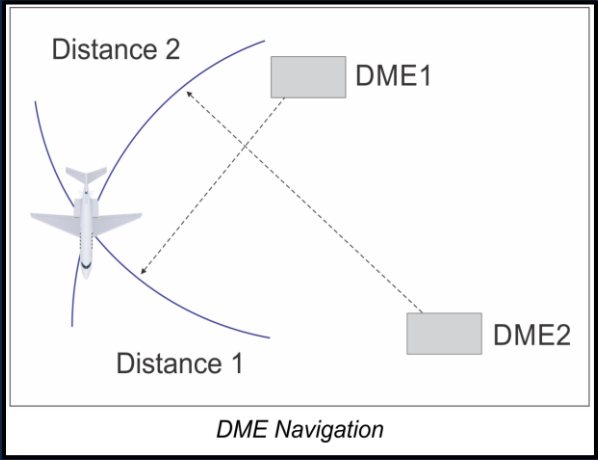
DCA 351-7 – Published in 2025 (in force)

- Using the PBN concept, based on GNSS sensors and the DME/DME, DME/DME/IRU compositions; and
- Minimum Operating Network (MON) of conventional navigation aids should be maintained to preserve the necessary levels of resilience in the navigation infrastructure against potential GNSS failures, including those caused by interference.

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

DECEA's Plan – DME/DME/Inertial Project

SIRIUS BRASIL

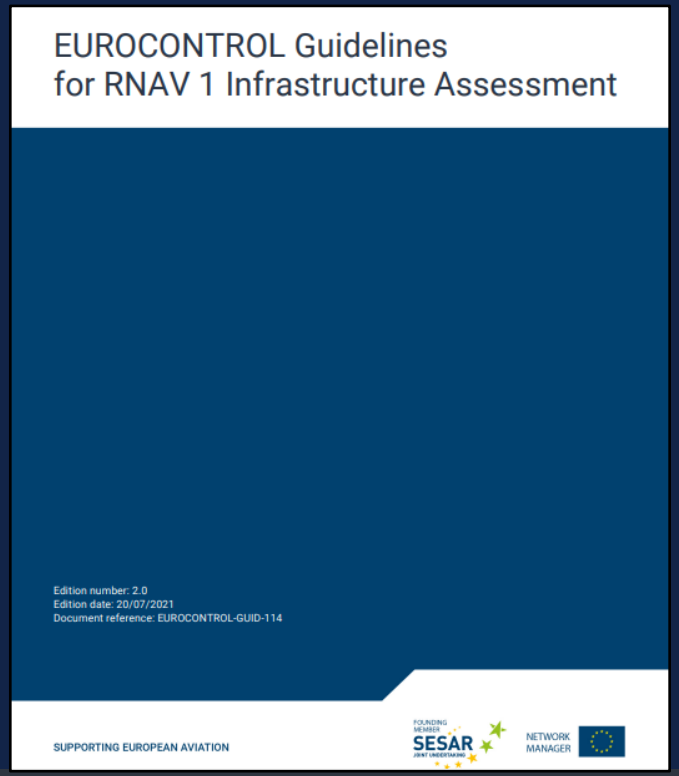


DME Navigation

- PBN Infrastructure Complementary to GNSS
- Enhancement of Situational Awareness and Flight Safety
- Rationalization of NDB and VOR, and Associated Procedures
- Efficient Routes
- Lower Fuel Consumption and Reduced Emission of Pollutant Gases

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

DECEA's Plan – DME/DME/Inertial Project



ANNEX B - Example guidance on use of INS to support RNAV SID

This guidance is provided as an example basis for using INS Runway Updating to support RNAV-1 Standard Instrument Departures. This text has not been published or endorsed by the UK CAA.

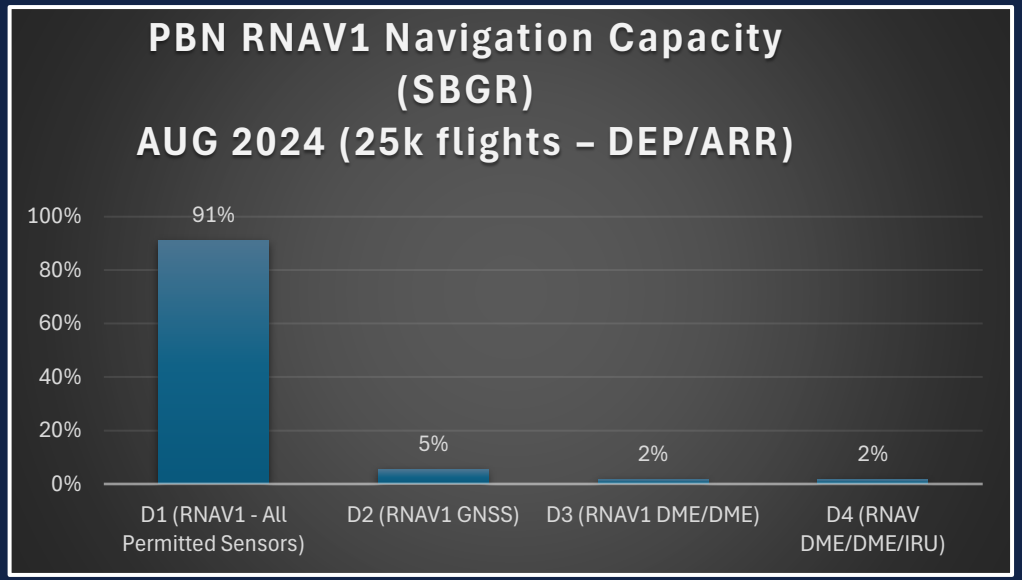
DME Assessment Criteria in Support of the Implementation of RNAV 1 Standard Instrument Departures (SIDs) at UK Airports

1.0 Purpose

The purpose of this Policy Statement is to detail the DME assessment criteria, including low level DME/DME coverage, in the support of RNAV 1 departures implemented at UK airports. The policy also details the rationale for determining the acceptable boundary of low level DME/DME coverage taking due account of the aircraft's Inertial capability.

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

DECEA's Plan – DME/DME/Inertial Project



	RNAV SPECIFICATIONS
A1	RNAV 10 (RNP 10)
B1	RNAV 5 all permitted sensors
B2	RNAV 5 GNSS
B3	RNAV 5 DME/DME
B4	RNAV 5 VOR/DME
B5	RNAV 5 INS or IRS
B6	RNAV 5 LORANC
C1	RNAV 2 all permitted sensors
C2	RNAV 2 GNSS
C3	RNAV 2 DME/DME
C4	RNAV 2 DME/DME/IRU
D1	RNAV 1 all permitted sensors
D2	RNAV 1 GNSS
D3	RNAV 1 DME/DME
D4	RNAV 1 DME/DME/IRU

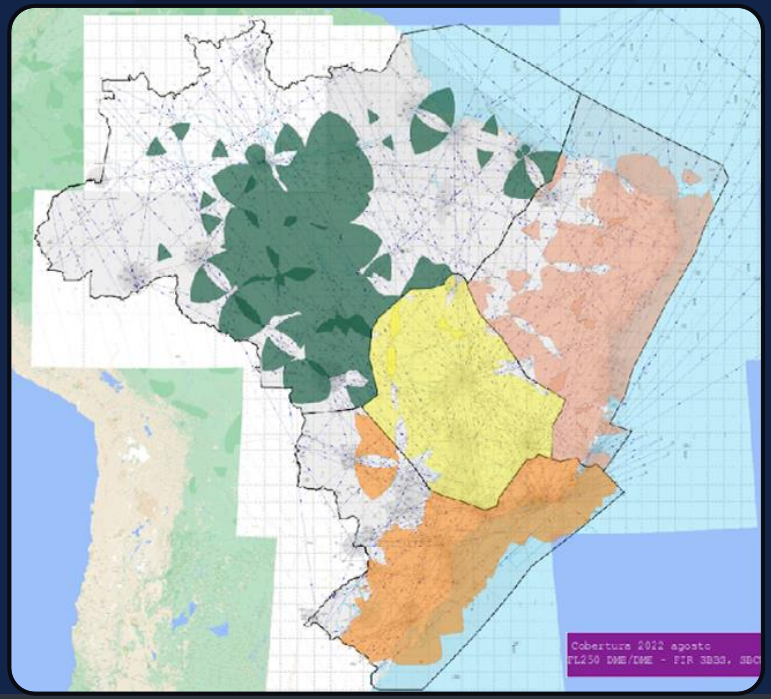
BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

DECEA's Plan – DME/DME/Inertial Project

Project: DME/DME Coverage Design in TMA

TMA
São Paulo
Rio de Janeiro
Brasília
Belo Horizonte
Curitiba
Recife
Porto Alegre
Salvador

Project: DME/DME Coverage – Above FL245



BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

MON Plan

- Establishes the structure, procedures, and responsibilities for the implementation of MON;
- Ensures the continuity and safety of air navigation operations in the event of GNSS failure, utilizing ground navigation infrastructures and conventional procedures such as DME/DME, DME/DME/IRU, VOR/DME, ILS, and SID OMNI; and
- Provides backup navigation that enables safe and precise operations, even in adverse situations. Systems such as DME/DME, VOR/DME, DME/DME/IRU and ILS are crucial for GNSS contingency.

SIRIUS BRASIL

PCA 100-5

MINIMUM OPERATING NETWORK (MON) IMPLEMENTATION PLAN IN RESPONSE TO GNSS FAILURE

2025

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

MON Plan – Conditions and Criteria

A MON may include:

- ❑ 1 IAC CONV ILS or VOR/DME;
- ❑ 1 SID CONV or OMNI or RNAV 1 (DME/DME/Inertial);
- ❑ 1 STAR CONV or RNAV 1 (DME/DME, DME/DME/Inertial); and
- ❑ Upper routes with higher traffic demand RNAV 5 (DME/DME, DME/DME/Inertial).

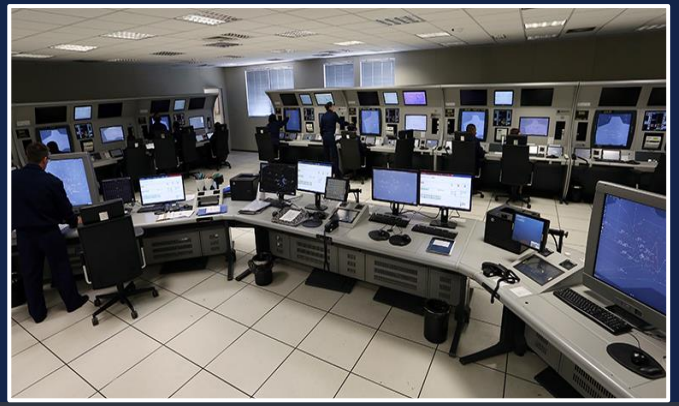
The aerodromes of interest:

- ❑ located in the capitals of the Brazilian states or considered to provide support to the capitals, and that have regular air transport operations;
- ❑ included in the ranking of the 40 busiest airports in Brazil, according to the DECEA Air Traffic Statistical Yearbook for 2024/2025, and that have regular air transport operations;
- ❑ at military air bases; and
- ❑ at locations where there is strategic interest defined by DECEA.

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

MON Plan – Contingency Plan – GNSS Failure

- Upper Airways: Navigation must be maintained using DME/DME/Inertial with RNAV5 specification, where coverage is available;
- SID/STAR operations: as long as they are within the DME/DME infrastructure coverage, complemented by the aircraft's inertial systems, they may continue to be treated as RNAV 1 procedures, with support for ILS-based approaches and conventional procedures, such as VOR/DME, at the designated airports;
- For aircraft unable to maintain these procedures, radar vectoring control will be required; and
- The plan also considers a reduction in airspace capacity and efficiency, especially in areas where DME/DME coverage is limited.



BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

MON Plan – More Details

- Strategic positioning of ground-based aids to cover critical traffic flows and major aerodromes;
- Review of contingency plans by Area Control Centers (ACC), Approach Control (APP), and the Air Navigation Management Center (CGNA);
- Development and publication of MON procedures by the Aeronautical Cartography Institute (ICA);
- Monitoring and operational readiness of the DME/VOR/ILS infrastructure; and
- Training programs and simulation exercises.

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATING NETWORK (MON) IN RESPONSE TO GNSS DISRUPTION

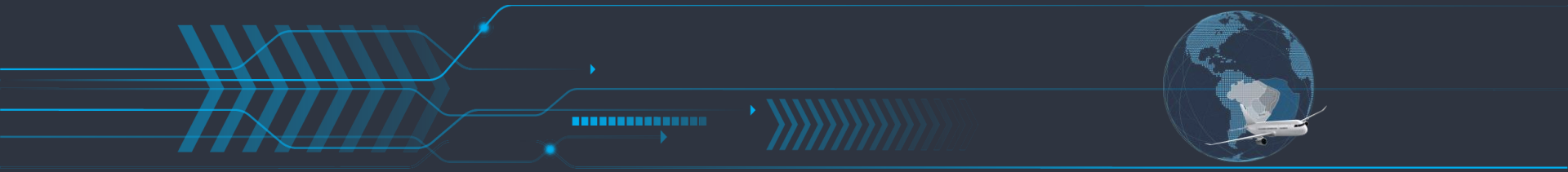
MON Plan – Current Situation and Challenges

- Current Situation: 5 Regional Centers are in the process of analyzing their areas, considering the conditions and criteria established in the Plan; GEIV conducting DME/DME/IRU flights in TMAs;
- Continental scale;
- Technical and logistical challenges in remote areas, such as in the northern region of the country; and
- Continuous maintenance and periodic review of MON assets.

Thank you

Departamento
de Controle do Espaço Aéreo
Department of Airspace Control

FORÇA AÉREA BRASILEIRA
Asas que protegem o País



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