



# ICAO

International Civil Aviation Organization  
North American, Central American and Caribbean Office  

---

WORKING PAPER

NACC/WG/11 — WP/32  
07/09/2026

**Eleventh Meeting of the North American, Central American and the Caribbean Working Group  
(NACC/WG/11)**

Guatemala City, Guatemala, September 21-25, 2026

---

**Agenda Item 5:           Modernization of Communication, Navigation and Surveillance/Air Traffic Management (CNS/ATM), Digital Transformation and Cybersecurity for Air Navigation Services (ANS)**

**INFORMATION AND REQUIREMENTS FROM ALL NAVIGATION-RELATED AREAS FOR THE  
DEVELOPMENT OF A MINIMUM OPERATIONAL NETWORK (MON) FOR GNSS RESILIENCE IN THE CAR  
REGION**

(Presented by the Secretariat)

**EXECUTIVE SUMMARY**

This Working Paper presents the information and coordination required from all navigation-related areas including Aerodromes and Ground Aids (AGA), Communications, Navigation and Surveillance (CNS), Air Traffic Management (ATM) and Aeronautical Information Management (AIM) — as well as aerodrome authorities, airport operators, Air Navigation Service Providers (ANSPs), States and other stakeholders, to support the development of a Minimum Operational Network (MON) for Global Navigation Satellite System (GNSS) resilience in the Caribbean (CAR) Region. The proposed CAR MON is intended to provide a regional contingency capability that would support the safe continuation and recovery of aircraft operations during GNSS interference or outages. Its development requires not only an assessment of conventional navigation aids (NAVAIDs) and the CNS infrastructure that supports them, but also the identification of airports that should remain operational during GNSS disruptions, their available instrument approach and landing capabilities, the ATM route and procedure implications, the AIM publication requirements, traffic characteristics, operational capacity, alternate-airport functions, aircraft equipage, infrastructure dependencies and contingency arrangements.

|                         |                                                                                                                                                                                                                                                      |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Action:</b>          | Under Section 5                                                                                                                                                                                                                                      |
| <b>Strategic Goals:</b> | <ul style="list-style-type: none"><li>• Every Flight is Safe and Secure</li><li>• Aviation is Environmentally Sustainable</li><li>• Aviation Delivers Seamless, Accessible, and Reliable Mobility for All</li><li>• No Country Left Behind</li></ul> |

## 1. Introduction

1.1 The CAR Region has progressively transitioned toward Performance-Based Navigation (PBN) operations, with an increasing dependency on GNSS as the primary source of positioning and navigation. While GNSS provides significant operational benefits, its signals remain vulnerable to Radio Frequency Interference (RFI), including intentional jamming and spoofing, unintentional interference and other events capable of degrading or interrupting GNSS-based navigation.

1.2 To strengthen regional navigation resilience, ICAO has proposed the development of a MON for GNSS Resilience in the CAR Region. The objective is to develop a technical proposal that will support safe and continuous aircraft navigation during GNSS interference or outages and strengthen the resilience of the regional CNS infrastructure.

1.3 The project is expected to assess regional GNSS dependency, establish an inventory of NAVAIDs, analyse GNSS interference risk scenarios, develop the conceptual design of a CAR Regional minimum operational network (MON), identify MON infrastructure requirements and establish a regional implementation roadmap.

1.4 A MON should not be understood as a replacement for GNSS or as an infrastructure intended to reproduce the full capacity available during normal GNSS operations. Rather, it is a recovery and contingency capability independent of GNSS, designed to maintain an appropriate level of safe operations during a disruption.

1.5 Although the MON has a significant CNS component, its development cannot be undertaken solely as a navigation infrastructure exercise. The design of the MON must consider airspace, aircraft equipage, navigation infrastructure, instrument flight procedures, airports and operational requirements. This requires close coordination among AGA, AIM, ATM, CNS, aircraft operators, procedure designers and other stakeholders. Airports have a key role because the regional MON must determine where aircraft can safely continue an approach and landing, recover or divert following a GNSS disruption.

1.6 Analysis about MON requirement for all ANS areas is under **Appendix** of this working paper.

## **2. Conclusions**

2.1 The CAR Regional MON requires coordinated participation from AGA, CNS, ATM, AIM, airport operators, ANSPs, procedure designers and aircraft operators. Combined airport, CNS, ATM and AIM information is essential to determine which aerodromes can support safe recovery, diversion and continued operations during GNSS outages and to identify regional infrastructure gaps.

## **3. Recommendation**

3.1 The NACC/WG, through its AGA, AIM, ATM and CNS, areas, should support a standardized regional data-collection process covering airport infrastructure, instrument approaches, GNSS dependency, conventional NAVAIDs and the CNS infrastructure supporting them, ATM route and procedure implications, AIM publication requirements, traffic, aircraft equipage, contingency capability and future infrastructure plans. States should also identify airports that could serve as primary or alternate MON airports.

## **4. Suggested Action**

4.1 The Meeting is invited to support the CAR MON initiative, and it proposes the following conclusion:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                     |                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DRAFT CONCLUSION</b><br><b>NACC/WG/11/XX</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                     | <b>DRAFT CONCLUSION NACC/WG/AGA/TF/4/XX — PROVISION OF NAVIGATION-RELATED INFORMATION (AGA, CNS, ATM, AIM) FOR DEVELOPMENT OF THE CAR REGIONAL MINIMUM OPERATIONAL NETWORK (MON)</b>                                                                                         |
| <b>What:</b><br><br>That, in order to support the development of a harmonized CAR Regional Minimum Operational Network (MON) for GNSS resilience, CAR States and Territories, in coordination with airport operators, ANSPs and their CNS, ATM and AIM units:<br><br>a) provide ICAO with the required information on airport infrastructure, instrument approach and landing capabilities, GNSS dependency, conventional NAVAIDs and their supporting CNS infrastructure, ATM route and procedure implications, AIM publication requirements, traffic, operational capacity, alternate-airport capability, contingency arrangements and future infrastructure plans;<br>b) identify airports where approach and landing operations should be maintained during GNSS outages and identify the GNSS-independent infrastructure and procedures supporting those operations;<br>c) identify airports whose instrument operations are substantially dependent on GNSS and the corresponding contingency gaps;<br>d) validate the information in coordination with AGA, CNS, ATM, AIM, PBN procedure-design and aircraft-operator stakeholders; and<br>e) support ICAO NACC in consolidating this information for the technical assessment, conceptual design and implementation roadmap of the CAR Regional MON. |                                                                                                                     | <b>Expected impact:</b><br><br><input type="checkbox"/> Political / Global<br><input checked="" type="checkbox"/> Inter-regional<br><input type="checkbox"/> Economic<br><input type="checkbox"/> Environmental<br><input checked="" type="checkbox"/> Operational/Technical |
| <b>Why:</b><br><br>To provide the operational and aerodrome information necessary to determine which airports and navigation infrastructure should form part of the CAR Regional MON and ensure safe recovery, diversion and continuation of aircraft operations during GNSS interference or outages.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                     |                                                                                                                                                                                                                                                                              |
| <b>When:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 30 November, 2026                                                                                                   | <b>Status:</b> <input type="checkbox"/> Valid / <input type="checkbox"/> Superseded / <input type="checkbox"/> Completed                                                                                                                                                     |
| <b>Who:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <input checked="" type="checkbox"/> States <input checked="" type="checkbox"/> ICAO <input type="checkbox"/> Other: | All CAR States and Territories                                                                                                                                                                                                                                               |

— — — — —

## APPENDIX

### INFORMATION AND REQUIREMENTS FROM ALL NAVIGATION-RELATED AREAS FOR THE DEVELOPMENT OF A MINIMUM OPERATIONAL NETWORK (MON) FOR GNSS RESILIENCE IN THE CAR REGION

#### 1. Analysis

##### 1.1 *Role of AGA, AIM, ATM, and CNS in the CAR Regional MON*

1.1.1 A regional MON must provide more than en-route navigation continuity. It must ultimately allow aircraft affected by a GNSS disruption to continue safely, leave the affected area, divert when necessary and land at an appropriate aerodrome.

1.1.2 MON planning should encompass both en-route and approach operations, ensuring that conventional NAVAIDs can support the required services during GNSS outages. Consequently, one of the key outputs of the CAR MON study should be the identification of a network of aerodromes that could support safe aircraft recovery during regional or localized GNSS disruptions. Delivering this network depends equally on CNS (the conventional NAVAID infrastructure itself), ATM (route and procedure design that make the recovered capability usable), and AIM (timely publication of contingency information) the MON is therefore a multi-disciplinary outcome and not an AGA product alone.

1.1.3 International experience demonstrates the importance of this airport component. For example, the United States MON concept is intended, among other objectives, to allow aircraft to recover safely to designated MON airports during GNSS outages. The French example goes further by considering not only airports forming part of an ILS MON, but also additional aerodromes that may be required to accommodate diverted traffic if parking capacity at primary MON airports becomes saturated.

1.1.4 This consideration is particularly relevant to the CAR Region because of its geography. Island States and Territories, limited airport alternatives, significant oceanic areas and differences in airport infrastructure mean that the suitability of an airport as part of a regional MON cannot be assessed exclusively on the presence of a VOR, DME or ILS. A broader airport operational assessment is required.

#### 2. Information required from AGA AIM, ATM and CNS and States

2.1 To support development of the CAR Regional MON, the Secretariat considers that States, airport operators, ANSPs and their CNS, ATM and AIM units should provide a standardized dataset for each international airport and for other aerodromes that could potentially perform a contingency or alternate function, together with the associated NAVAID, procedure and publication information from CNS, ATM and AIM. Appendix A sets out the information needed from each of these navigation-related areas.

## **2.2                    *Instrument approach and landing capability***

2.2.1                Particular attention should be given to airports where all or most instrument approaches depend on GNSS. Airports where approaches are based on GNSS may experience serious operational impacts during a GNSS outage. It also recognizes the continuing resilience role of ILS, particularly for low-visibility operations.

2.2.2                States should therefore identify, for each relevant airport:

- which runways have GNSS-dependent approaches;
- which runways have GNSS-independent approaches;
- whether ILS remains operational and its category;
- whether VOR/DME or other conventional procedures remain available;
- which procedures would become unavailable immediately following a GNSS outage;
- whether missed-approach procedures have GNSS dependencies; and
- what minimum approach capability should be retained to support contingency operations.

2.2.3                This analysis is essential because the presence of an ILS alone does not necessarily establish complete GNSS-independent recovery capability. The entire procedure, including the missed approach and supporting navigation infrastructure, must be considered.

## **2.3                    *Identification of potential CAR MON airports***

2.3.1                Based on the information collected, the CAR MON study should classify airports according to their potential role during GNSS contingency operations. A possible classification for further analysis could include:

- Category A – Primary MON Airports
- Aerodromes considered essential for continued regional operations and capable of providing GNSS-independent approach and landing capability
- Category B – MON Recovery/Alternate Airports
- Aerodromes capable of receiving diverted aircraft and providing appropriate recovery capability during GNSS disruptions
- Category C – GNSS-Dependent Airports
- Aerodromes where instrument operations are substantially dependent on GNSS and where alternative contingency arrangements would therefore be required
- Category D – Supporting Aerodromes
- Aerodromes that may provide additional regional contingency capability based on geographical location, available infrastructure or operational requirements.

## **2.4            *Traffic and aircraft equipage***

2.4.1            MON planning should consider the type and volume of traffic and the navigation capabilities of aircraft operating at each airport. This information is necessary to determine whether DME/DME, VOR/DME or other conventional navigation capabilities can effectively support contingency operations during GNSS outages.

## **2.5            *Airport capacity during a GNSS disruption***

2.5.1            Potential MON airports should be assessed not only for navigation capability but also for their capacity to receive diverted traffic. Runway capacity, aprons and parking availability, fuel, ground handling and other operational limitations should be considered, particularly during large-scale GNSS disruptions.

## **2.6            *Cross-border and regional considerations***

2.6.1            The CAR MON should be developed as a regional network. States should consider the use of NAVAIDs and airports in neighboring States where this improves contingency coverage, operational continuity and cost efficiency, supported where necessary by bilateral or regional agreements.

## **2.7            *Protection of critical NAVAIDs and airport infrastructure***

2.7.1            States should identify NAVAIDs and airport infrastructure that are essential to maintaining operations during GNSS outages. Any planned replacement, modernization or decommissioning should consider MON requirements and the possible impact on routes, procedures and airport accessibility.

## **2.8            *Provision of navigation-related information (AGA, CNS, ATM, AIM) for development of the car regional minimum operational network (MON)***

2.1            The following information provides the proposed framework for collecting and validating the navigation-related information required to support the development of the CAR Regional Minimum Operational Network (MON) for GNSS resilience, covering all relevant areas — AGA, CNS, ATM and AIM — and not only aerodrome data. It is intended to guide CAR States and Territories, in coordination with airport operators, ANSPs and their CNS, ATM and AIM stakeholders, in identifying airports capable of supporting continued approach, landing, recovery and diversion operations during GNSS disruptions. The information collected should cover airport infrastructure, instrument procedures, conventional navigation capabilities and the CNS infrastructure supporting them, ATM route and procedure considerations, AIM publication arrangements, traffic characteristics, aircraft equipage, operational capacity, contingency arrangements and identified infrastructure or operational gaps. Once validated, this information will be submitted to ICAO for incorporation into the regional technical analysis and the development of the proposed CAR MON.

| Area                              | Information required                                                                                                                                                                |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Airport identification         | State/Territory; airport name; ICAO location indicator; coordinates/elevation; airport operator; ANSP; hours of operation                                                           |
| 2. Runway infrastructure          | Runway designations; runway dimensions; declared distances; operational restrictions; runway availability; relevant limitations for aircraft expected during contingency operations |
| 3. Instrument approach capability | Available ILS CAT I/II/III, LOC, VOR/DME, VOR, RNP APCH, RNP AR, GBAS/GLS and other instrument approach procedures                                                                  |
| 4. GNSS dependency                | Identification of approaches, arrivals, departures and other airport operations that depend primarily or exclusively on GNSS                                                        |
| 5. GNSS-independent approaches    | Identification of runways having an instrument approach/landing capability that can remain available following loss of GNSS                                                         |
| 6. Conventional NAVAIDs           | VOR, DME, VOR/DME, ILS/DME, NDB or other relevant facilities supporting the airport; location; ownership; coverage; operational status                                              |
| 7. NAVAID reliability             | Availability, serviceability, redundancy, maintenance arrangements, flight inspection status and known limitations                                                                  |
| 8. Traffic information            | Annual movements; peak-hour traffic; IFR movements; principal aircraft categories/types; scheduled commercial operations; cargo and GA activity                                     |
| 9. Aircraft equipage              | To the extent available, information regarding typical aircraft capabilities such as DME/DME, VOR/DME, INS/IRS and relevant PBN capabilities                                        |
| 10. Airport capacity              | Capacity to receive diverted aircraft; apron/parking limitations; terminal constraints; fuel availability; ground-handling considerations                                           |
| 11. Alternate airport role        | Current designated alternate functions and potential capability to serve as a MON recovery/diversion airport                                                                        |
| 12. Contingency procedures        | Existing airport/ANSP procedures for GNSS degradation or loss, including approach, landing, diversion and recovery arrangements                                                     |
| 13. GNSS interference history     | Known GNSS RFI, jamming or spoofing events affecting airport operations and any operational consequences                                                                            |



| Area                                       | Information required                                                                                                                                                                                                                                                                             |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14. Future infrastructure plans            | Planned installation, replacement, modernization or decommissioning of ILS, VOR, DME, NDB, GBAS or other navigation infrastructure                                                                                                                                                               |
| 15. Dependencies                           | Identification of airport procedures dependent upon specific NAVAIDs, including facilities located outside the airport or in another State                                                                                                                                                       |
| 16. Criticality                            | State/airport assessment of whether the airport should maintain operations during a localized or regional GNSS outage and the minimum operational level required                                                                                                                                 |
| 17. CNS infrastructure                     | Inventory of the CNS network supporting the airport and the wider en-route/terminal area (VOR, DME, NDB, GBAS/GLS ground stations, ILS transmitters); ownership, siting, power supply resilience, monitoring and maintenance arrangements; planned CNS network changes relevant to MON coverage. |
| 18. ATM route and procedure considerations | Conventional (non-GNSS) routes, holding patterns and instrument flight procedures available to support contingency operations; ATC sector and airspace implications of reverting to conventional navigation; coordination requirements with adjacent FIRs.                                       |
| 19. AIM publication arrangements           | Availability of AIP, NOTAM and charting products for GNSS-independent procedures and MON airports; arrangements for timely publication and dissemination of contingency information during a GNSS disruption.                                                                                    |