



International Civil Aviation Organization

**Eighth Meeting of the Performance Based Navigation Sub-Group
(PBN SG/8)**

(Doha, Qatar, 12 - 13 December 2023)

Agenda Item 3: ICAO Global and Regional developments

DOC 9849, GNSS Manual Update Summary

(Presented by the Secretariat)

SUMMARY

This working paper presents the latest updates on the DOC 9849, GNSS Manual.

Action by the meeting is at paragraph 3.

REFERENCE

- Annex 10, Volume I,
- GNSS Manual Doc 9849, 4th Ed 2023
- Performance based Navigation (PBN) Manual (Doc 9613)
- Manual of All-Weather Operations (AWO, Doc 9365)

1. INTRODUCTION

1.1 The meeting will recall that the SARPs have been recently updated to add requirements for DFMC SBAS, new core constellations and additional core constellation signal. In addition, the increasing challenges to GNSS interference and compatibility have raised a number of issues which require States' attention when implementing GNSS services.

1.2 The NSP established an ad hoc group to update the GNSS manual in support of the SARPS changes and to address significant issues in the manual.

1.3 The revised Manual was reviewed by the NSP/7 and released in 2023.

1.4 This working paper provides a summary of the updates introduced with the release of Doc 9849, 4th Ed 2023.

2. DISCUSSION

2.1 Based on the 4th Ed of the GNSS Manual, the following is a summary, of the updates introduced:

- Chapter 2 Performance Requirements – This Section was reviewed for potential changes with respect to the new DFMC SBAS standards. A review of the correctness and completeness of

the content on performance requirements was also performed. Guidance material on GNSS performance reporting for GNSS service providers was included in Section 2.3.

- Chapter 3 Existing Core Satellite Constellations – This section was updated to reflect inclusion of new operational core constellations and new signal for existing constellations.
- Chapter 4 Augmentation Systems – This section was updated to address DFMC SBAS SARPS changes and to identify new SBASs included in the SBAS SARPS amendment. Additional information that could support the implementation of SBAS based operations was included, existing information was reviewed and needed updates were also addressed.
- Chapter 5 GNSS Vulnerability – This section was reorganized to better separate interference and environmental effects such as ionosphere and troposphere errors. Significant material was added to address recent developments and thinking with respect to jamming and spoofing. The group added new sections in 5.1.3 on characterization of jamming and spoofing consistent with past NSP papers. Clarification are included for the ionosphere material, and some preliminary text has been proposed to address troposphere errors and effects.
- Chapter 6 GNSS Evolutions – Section 6.5 text was updated to reflect operational state of GALILEO and BDS while providing information on their planned future evolutions. The GPS paragraph was updated to reflect current planned dates for new services. Section 6.6, Planned New Core Constellations, is now left intentionally blank and marked reserved as GALILEO and BDS information was moved to existing core satellite constellation section.
- Chapter 7 GNSS Implementation – Additions made for interference monitoring, interference anomaly reporting, and space weather advisory. DFMC related implementation issues addressed. In section 7.8.3 GNSS performance assessment, the basic set of core constellation performance parameters have been updated in line with new SARPs material; in particular new integrity parameters have been added. SBAS-based approach procedure material added as guidance pending DO-259 MOPS publication. Sections 7.8.2, 7.8.3, and 7.8.5 have been updated to include guidance material intended for States and organisations that provide GNSS services regarding regular performance assessment.
- Appendix A references (including references relevant to the new core constellations and signals) and table of avionics standard documents have been updated.
- Appendix C figures illustrating core constellation frequencies were updated to reflect relevant Annex 10 updates.
- Appendix D Navigation Roadmap, Appendix E PBN Roadmap and related roadmap material – The Secretariat reviewed the existing roadmap material and determined this material is adequately covered in other ICAO documents. The material in these appendices were removed and the appendices reserved in accordance with ICAO practice. Other manual material on the roadmaps were updated to reflect the current, relevant ICAO reference.
- Appendix F GNSS RFI Mitigation Plans – Proposed changes addressed current, significant issues with jamming and spoofing concerns. Changes were limited to those deemed essential guidance needed for states to be aware of threats posed by jamming and spoofing and essential tools and recommend practices for mitigation.

2.2 It should also be noted that, the Manual updates addressed changes required to support the recent SARPs changes and significant, outdated material within the current GNSS Manual. Another revision of the Manual would address lower priority issues.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) take note of the summary of the updates introduced in the Ed4 of the GNSS Manual; and
- b) discuss any related matters.

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