

International Civil Aviation Organization



**FOURTEENTH MEETING OF THE
COMMUNICATIONS/NAVIGATION/SURVEILLANCE
AND METEOROLOGY SUB-GROUP OF
APANPIRG (CNS/MET SG/14)**



Jakarta, Indonesia, 19 – 22 July 2010

Agenda Item 5: Navigation

3) Discuss issues related to implementation of GNSS and review developments that have taken place in the Region

GLOBAL NAVIGATION SATELLITE SYSTEM MANUAL (DOC 9849) – REVISION

SUMMARY

First Edition of GNSS Manual (Doc 9849) was published in 2005 to provide guidance on the implementation of GNSS. There has been a significant change in the global GNSS environment and hence the need has been felt to update the Manual should to reflect those changes. It has also been decided to provide guidance on the hurdles identified by the States in the implementation process. This paper presents a list of hurdles already identified and invites comments. Paper also invites information on additional hurdles faced by the States to supplement the list so that guidance on those also can be included in the Manual.

This paper relates to:

Strategic Objective:

- A. Safety – Enhance global civil aviation safety
- D. Efficiency – Enhance the efficiency of aviation operations

Global Plan Initiative:

- GPI – 5 RNAV and RNP (Performance Based Navigation)
- GPI – 21 Navigation

1. Introduction

1.1 The Standards and Recommended Practices (SARPs) for Global Navigation Satellite Systems (GNSS) were developed by the Global Navigation Satellite Systems Panel (GNSSP) and were introduced as part of Amendment 76 to Annex 10 to the *Convention on International Civil Aviation – Aeronautical Telecommunications, Volume I (Radio Navigation Aids)* in 2001. Guidance on the technical aspects and the applications of GNSS SARPs are provided in Attachment D to Annex 10, Volume I.

1.2 Subsequently a guidance manual was developed by the GNSSP to provide information on the implementation aspects of GNSS in order to assist the States in the introduction of GNSS operations. First Edition of *Global Navigation Satellite System (GNSS) Manual (Doc 9849, AN/457)* was published in 2005. The document is generally aimed at air navigation service providers (ANSPs) responsible for fielding and operating GNSS elements, and at regulatory agencies responsible for approving the use of GNSS for flight operations. It also provides GNSS information to the aircraft operators and manufacturers.

1.3 With the rapidly changing GNSS operating environment, it was found necessary to review the contents of Doc 9849 and amend them in line with the changes that have taken place. Working Group 2 (WG2) of Navigation Systems Panel (NSP), in its meeting held in November 2009 agreed to draft text for specific sections of the GNSS Manual and Secretariat agreed to coordinate a full review of the manual with the intent of presenting the final draft at the November 2010 NSP meeting.

1.4 Secretariat now requires information from States on the current hurdles to the implementation of GNSS due to the lack or inadequacy of guidance or due to any other factors.

2. Discussions

2.1 Navigation Systems Panel Secretariat, through a Working Paper presented at the NSP Working Group of the Whole meeting held from 17 to 28 May 2010 in Montreal, informed the Meeting that information on hurdles to the implementation of GNSS operations will be solicited from the ICAO Regional Offices and from specific States to support the action of reviewing and updating *Global Navigation Satellite System* (GNSS) Manual (ICAO Doc 9849). Secretariat also invited members and Advisors of the Navigation Systems Panel to provide information, based on their experience and knowledge on hurdles to GNSS implementation by 30 June 2010. A draft version of GNSS Manual proposing changes was also presented by the Secretariat for review by the meeting.

2.2 Subsequent to the publication of GNSS Manual in 2005, implementation activities of Performance Based Navigation (PBN) started globally and Third significantly revised Edition of the Performance Based Navigation (PBN) Manual (Doc 9613, AN/937) had been published in 2008. It was agreed that implementation of PBN, to a large extent is dependent on GNSS. A need therefore has been felt to provide a linkage between GNSS and PBN implementation in the GNSS Manual and avoid duplication of information in the two documents. Also information provided in the manuals needs to be updated to take into account the introduction of new constellations like Galileo etc.

2.3 While updating the manual in line with the observations made above, it has been suggested to incorporate guidance on the issues and hurdles which have been faced by the States while implementing GNSS in their administrations.

2.4 A list of the hurdles, compiled based on the information already available is attached for reference. The meeting is invited to review the list and comment. The meeting is also invited to bring out additional issues, which have been faced during implementation.

3. Action required by the Meeting

3.1 The meeting is invited to:

- (a) review the list placed at **Attachment** identifying the hurdles in the implementation of GNSS and provide comments; and
- (b) identify additional hurdles based on their knowledge and experience in implementing GNSS in their administrations.

**Review of GNSS Manual (ICAO Doc 9849)
Current hurdles to the implementation of GNSS operations**

1. The Secretary of the Navigation Systems Panel (NSP) is coordinating a revision of the GNSS Manual (Doc 9849). To ensure that the revised manual meets the goal of supporting GNSS implementation at the national level, the Secretary requires information from Regional Offices and States on current hurdles to the implementation of GNSS due to the lack or inadequacy of available ICAO guidance, or to any other factors.
2. At the NSP Working Group of the Whole Meeting in Montreal 17-28 May 2010, participants developed a partial list of hurdles (below), but it is expected that Regional Offices are in the best position to identify other hurdles and to validate the list.
3. The Secretary has asked Mr. Ross Bowie, who retired from NAV CANADA in 2009 and who chaired the NSP working group that developed the current GNSS Manual, to coordinate this work. It would be appreciated if you would provide your comments and suggestions to the NSP Secretary (ACapretti@icao.int) and to Mr. Bowie (ross.bowie@sympatico.ca) via e-mail at your earliest convenience.
4. Preliminary list of hurdles:
 - There is uncertainty about NOTAM requirements. The meeting agreed that it was feasible to provide NOTAMs about potential service outages for Basic GNSS Receivers (GPS RAIM) and for SBAS and GBAS to be used as a tool by operators to make operational decisions. The meeting also agreed that the wide variety of avionics implementations that support RNP dictated that aircraft operators should use aircraft-specific tools to predict service outages for their fleets. To do this, operators need basic information about GNSS component planned and actual outages. The meeting went on to discuss ways to address this hurdle in the manual revision. The manual needs to demonstrate the link between NOTAM provision and safety.
 - The meeting noted that the GNSS Manual was developed before PBN Manual development started, and that having these two manuals creates confusion. This can be resolved by ensuring compatibility between the two manuals.
 - Documentation does not support the requirement of some States to develop a safety assessment. The meeting recommended that the manual describe safety assessments that were used by States to support current operations and to encourage the acceptance of these assessments by other States, while noting any geographical or traffic-related issues that could dictate a differences analysis.
 - Some States feel that there is an institutional problem because the current core satellite constellations are operated by the military. The manual needs to stress the commitments to civil aviation by Russia and the United States of America.

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Attachment

- Some States are worried about vulnerability. The current manual addresses this issue and includes mitigation techniques, but this material needs to be emphasized. The manual needs to stress that availability is the issue, spoofing is not an issue for aviation.
- The meeting noted that States do not always use the GNSS Manual as a reference to support implementation.
- States require a business case analysis to support implementation, and the manual does not provide enough information to support identification and quantification of benefits. The meeting agreed that examples would be useful and might obviate the necessity for States to complete their own business cases for simple applications like Basic GNSS non-precision approach operations.
- The implementation of GNSS-based terminal area operations in some States faces the requirement for an environmental assessment including extensive public consultation, all at great cost. This is a difficult institutional issue that has no easy solution.
- Some States do not know how to address aircraft certification, in part because there are currently different standards applied globally.
- Some States perceive there is a barrier to APV implementation because of the lack of currency and consistency among ICAO publications. The meeting agreed that the manual should clearly show that APV is possible despite these issues, perhaps including a documentation map and that the NSP should work within ICAO to resolve inconsistencies.
- The meeting noted that there is a lack of GNSS knowledge within some regulatory agencies, and that this is exacerbated by inconsistencies in ICAO documentation. The meeting agreed that the manual should be revised to support the education of regulators. Once the manual is revised there should be a program to provide material and support to regional offices to allow them to provide pertinent information to States.
- Some States have difficulties meeting survey requirements because responsibilities are split between ANS providers and airport operators.
- A major hurdle to full implementation in most States is avionics equipage. Aircraft operators face major costs to equip their fleets, and to equip a large fleet can take five years or more. At the same time, different mandates, different airspace requirements and different mandate deadlines in different areas make it difficult to decide when to equip. As an example, in Europe there is a mandate for ADS-B that can be supported by C129 avionics, and a mandate for APV that requires more advanced avionics. There is a requirement for a vision developed among ANSPs and aircraft operators.
