



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

5) other radio navigation issues

**OUTCOME OF NSP WORKING GROUP OF THE WHOLE MEETING
NOVEMBER 2009**

(Presented by the Secretariat)

SUMMARY

ICAO NSP and other NSP Working Groups and Sub-Groups met from 10 to 20 November 2009. This paper reports the outcome of the meeting and discusses issues which were taken up in the meeting.

This paper relates to:

Strategic Objectives:

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

Global Plan Initiatives:

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

1. Introduction

1.1 Navigation Systems Panel (NSP) and other NSP Working Groups and Sub-Groups met in Montreal, Canada from 10 to 20 November 2009. 73 participants from 20 States and international professional bodies participated in the meetings.

1.2 Secretariat briefed the meeting about the organizational changes in ICAO and informed that ICAO had signed cooperation agreements with three standards organizations, RTCA, EUROCAE and SAE, for the exchange of information between the respective secretariats. As per the agreement, ICAO will get access to the documents from these organizations and ICAO in turn will make available its documents to these organizations.

2. Discussion

2.1 Agenda Item 2: SARPs for GNSS elements and signals (ABAS, SBAS and core constellations)

2.1.1 The meeting was informed that data collected to validate accuracy performance of GLONASS constellation indicated that the root mean square range error over all satellites did not exceed 6 meters and therefore concluded that the system complied with the updated SARPs. Meeting was also informed about the satellite in orbit status and future programmes for GLONASS. Information on GAGARIN, a joint EU-Russia initiative to investigate technical aspects of combined Galileo-GLONASS aviation receivers and antennas was also presented to the meeting.

2.1.2 Galileo Open Service Signal in Space ICD was presented and related issues like performance etc. were discussed. Issues related to obsolescence, new monitoring stations, replacement of geostationary satellites were discussed through a presentation and the meeting was informed that the system will inhibit service beyond European airspace in the initial version. EC member confirmed that the Message Type 0 (MT 0 for “Do not Use”) was likely to be removed in June 2010. Initially, only En-route through NPA service is available at this date with a few months of in-service observations to follow before APV operations can be published based on EGNOS. The EGNOS commercial service is intended to support other communities in addition to the civil aviation community.

2.1.3 A map reflecting worldwide service availability for various Horizontal Alert Limit (HAL) to provide conservative estimates of Required Navigation Performance (RNP) service availability, was presented and issues connected with this were discussed including the usage of this information to steer the content of the PBN manual with respect to the need for prediction and possible implementation of aspects for such prediction.

2.1.4 System for Differential Correction and Monitoring (SDCM), the Russian plan to develop a space based augmentation system for GPS and GLONASS over Russian territory was presented. The current prototype system with 11 ground stations in Russia (with a plan to extend it up to 23 stations) has demonstrated a good system performance. The plan includes three GEO payloads to be launched in 2010, 2011 and 2013 respectively. No GEO ranging service is envisaged since the expected benefits is seen as marginal.

2.1.5 Limitation of existing SBAS Standards providing for monitoring of maximum 51 satellites was discussed and an ad-hoc group was appointed to study this issue. Meeting discussed issues related to GPS in Annex 10 and assigned the task of resolving these issues. Draft Galileo SARPs Part A – Reduced Version was presented to the meeting and it was informed that the draft is in line with the latest published version of Galileo OS SIS – ICD. Proposal to revise the minimum signal power levels for future geostationary satellites upwards to cope with the increasingly challenging RNSS interference environment (because of growing inter system interference due to high number of new satellites from multiple constellations) and redefining signal power level at the receiving end were discussed and were accepted for consideration.

2.2 Agenda Item 3: SARPs for GNSS elements and signals (GBAS)

2.2.1 A concept paper developed by the CAT II/III sub group of Navigation System Panel proposed technical concept for new GBAS Annex 10 requirements to support CAT III operations. Current standards for GBAS signal-in-space defined in Annex 10 (Amendment 77) are defined in terms of performance that can be expected at the output of an airborne, fault-free GBAS receiver. For example the ground subsystem requirements for integrity and continuity defined in Annex 10 are defined at the output of the airborne receiver. This strategy was adopted by the Sub-Group to define a high-level performance standard rather than a detailed design standard; simplify approval process for aircraft equipment and to complete the ground and air allocation of requirements for navigation

system error etc. But defining the signal-in-space performance in this manner, it was subsequently realized places a burden on the augmentation system to account for the performance of all possible users that comply with airborne specifications given any combination of satellites that they might be using.

2.2.2 Information regarding the two phased process for the development and validation of the SARP amendments for GBAS Approach Service Type D (GAST D) were also discussed. Phase I includes the draft and technical validation of SARPs material and Phase 2 includes the validation of this material by the States involved in early implementation projects and update of the SARPs based on the validation results. It may be mentioned that to evolve from CAT I (GAST C) to GAST D an additional method for mitigating potential errors due to ionospheric anomalies must be implemented in the aircraft.

2.3 Agenda Item 4: SARPs for conventional radio navigation aids

2.3.1 Critical and Sensitive Area (CSA) as studied by different agencies was discussed and it was agreed that the subject should be studied further and a proposal for amendment to the SARPs should be developed to optimize the CSA requirements.

2.4 Agenda Item 5: Updates to Doc 8071

2.4.1 The meeting was informed about the plan to thoroughly review and update Doc 8071. It was agreed that the material provided in Doc 8071 should be better organized, for example by eliminating the overlap between PBN Manual and Doc 8071. It was proposed that the material related to validation of flight procedures should probably be handed over to Instrument Flight Procedures Panel (IFPP).

2.5 Agenda Item 6: Spectrum

2.5.1 One of the topics discussed in the meeting was the planning criteria for VDL 4 in the VHF NAV band and it was noted that this will raise a number of technical issues. The Working Group of the Whole discouraged the approval of this planning criteria by ICAO ACP, as VOR and ILS monitors may have to be modified at a high cost to accommodate this requirement. It was assured that the matter will be given due attention both in ACP as well as in NSP. Following the changes in the ITU Radio Regulations to provide a more flexible use of VHF NAV and COM bands, it was agreed that NSP should address the work needed to support a potential extension of GBAS into the VHF COM band, instead of merely focusing on concerns regarding the potential extension of COM systems into the VHF NAV bands.

2.5.2 Brief report on the implementation of pseudolites was presented and issues raised in the presentation were discussed.

2.5.3 After discussing issues related to changing the SARPs related to antenna gain, it was agreed that the standard should not be changed for the time being.

2.6 Agenda Item 7: Guidance on operational implementation issues

2.6.1 Review and amendment of ICAO Doc 9849 (GNSS Manual) to identify areas that need a substantive update as well as areas that were not previously addressed in the manual was briefed to the meeting. Moving GNSS guidance material from Annex 10 to the GNSS Manual was considered as one of the options. It was expressed that some States consider the green pages in the Annex as having the same status as the white pages and this will influence the effectiveness of these when shifted to the guidance material. Following were considered as the area of interest in the manual.

- 1) CAT II/III
- 2) LPV and LPV200
- 3) RAIM Prediction
- 4) NOTAMs
- 5) GNSS Monitoring
- 6) Safety Case Analysis
- 7) Receiver Design
- 8) Human Factors
- 9) Flight Planning
- 10) PBN Publications
- 11) GNSS Regulation Template; and
- 12) Implementation Template

2.6.2 The meeting also discussed harmonizing the contents of GNSS Manual (Doc 9849) and PBN Manual (Doc 9613). Various issues, which are common to both these documents were discussed. It was felt that the manual needs to reflect both the operational requirements like the GNSS monitoring and prediction services as well as the expectations of users as to who should be the provider of this service. It was generally agreed that ANSPs could be expected to provide the GNSS status and basic RAIM prediction service where a service is provided that does not always meets the defined minimum service availability. The output from these predictions need not be published as a NOTAM but could be available through web-based planning services.

2.6.3 Tasks were assigned to ensure that all GNSS requirements for PBN are taken into account in the planned review of Doc 9849 and to review and update as required the GNSS status reporting and prediction material in Doc 9849 and the “Notes on GNSS monitoring” in light of the need for real-time monitoring service to support accident investigation. While discussing the requirement of reviewing Doc 9849, it was noted that the reference to the use of “primary means” operations have led to confusion and that “standalone” is a less ambiguous term when referring to GNSS approach. Challenges in computing en-route RAIM from TSO C 129 and C145/146 receivers were also identified. Meeting noted the requirement to be explicit about what was meant when referring to the use of GNSS in terms of certified receivers and felt the need to reinforce the institutional acceptance of GNSS by States in the manual. *RNAV Human Factor*, originally presented to APANPIRG/20 was also reviewed by the meeting. The meeting agreed that the operational considerations recommended in the report should be included in the body of the Manual or added as an Appendix to the document.

2.6.4 The meeting was informed about the performance experiences of an integrated inertial-satellite navigation system and its usage as an inexpensive means of maintaining RNP containment in the event of loss of GNSS signal (RNP 1.0 for 18 minutes and RNP 4 for 60 minutes).

2.6.5 Phased reduction of ground based navigation systems, a predicted outcome of implementation of GNSS and optimization of navigation services has now started becoming a reality. UK has proposed to reduce their current number of DVORs from 46 to 19 (through rationalization) and withdraw remaining 10 en-route NDB facilities. Germany is expecting to reduce the number of VOR/DVORs by 43% and NDBs by 81%.

2.7 Agenda Item 8: Status of GNSS elements and signals

2.7.1 Airbus Industries announce a new concept called SLS (Satellite Landing System) and informed that this new system had been installed on Airbus A350 XWB to support LPV – 200 operations. The system initially will be based on SBAS and then evolve to other GNSS systems like Galileo, modernized GPS and multi-constellation GNSS in the mid/long term. SLS and LPV 200 will support an RNP approach capability without requiring navigation ground infrastructure in the vicinity of the airport, while providing a geometric vertical guidance, free of temperature errors and no more depending on barometric settings manual inputs.

2.7.2 China is working on the development of a long-term strategy for its Future ATM and CNS infrastructure and has launched several GBAS and RNAV/RNP projects. It was informed that there is no proposal to include the COMPASS SARPs in Annex 10 immediately, since this item can be included in the work-programme only after the concerned State formally expresses its commitment to support the system for use by civil aviation.

2.8 Agenda Item 9: Recommendation by WGW of SARPs changes for submission to the Air Navigation Commission

2.8.1 The meeting proposed amendment to SARPs and Guidance Material concerning GBAS Cat I based on the experiences gained from project implementation and from issues raised in the development of GAST D material.

2.9 Next meeting of NSP was held in Montreal from 17 to 28 May 2010 and the subsequent meeting will be held also in Montreal from 8 to 19 November, this year.

3. Action required by the Meeting

3.1 The meeting is invited to note the outcome of NSP November 2009 meeting.
