



International Civil Aviation Organization

**Communication Navigation and Surveillance
Sub-Group (CNS SG)**

Fifth Meeting
(Cairo, Egypt, 11 - 13 December 2012)

Agenda Item 5: Performance Framework for CNS implementation in the MID Region

PROGRESS IN GNSS AND PBN IN THE MID REGION

(Presented by the Secretariat)

SUMMARY

This paper presents the progress in Global Navigation Satellite System (GNSS) and the Performance Based Navigation (PBN) it also highlight the rationalization of NAVAID in accordance with the recommendations of Twelfth Air Navigation Conference (AN-Conf/12).

Action by the meeting is at paragraph 3.

REFERENCE

- AN-Conf/12 Draft Report
- MIDANPIRG/13 Report

1. INTRODUCTION

1.1 MIDANPIRG/13 was held in Abu Dhabi, UAE, 22-26 April 2012. The meeting developed 59 Conclusions and 12 Decisions and PBN Symposium held in Montréal from 16 to 19 October 2012.

1.2 The Twelfth Air Navigation Conference (AN-Conf/12) held in Montreal from 19 to 30 November 2012, gained consensus, commitments and formulated recommendations to achieve a harmonized global air navigation system for international civil aviation, in order to optimize the opportunities in technology and maturing work programmes toward common global objectives. The AN-Conf/12 considered Aviation System Block Upgrades (ASBUs) and the Communications, Navigation, Surveillance (CNS), Aeronautical Information Management (AIM) and avionics roadmaps for inclusion in the Global Air Navigation Plan.

2. DISCUSSION

2.1 The meeting may wish to recall that the frequency Interference-free operation of Global Navigation Satellite System (GNSS) is essential. The meeting further recalled that the frequency band 1 559 - 1 610 MHz, is used for elements of GNSS, and the International Telecommunication Union (ITU) process, allows under footnotes No. 5.362B and 5.362C the operation of fixed service in some States on a secondary basis until 1 January 2015. The continued

use by the fixed service constitutes a severe constraint on the safe and effective use of GNSS in some areas of the world, as distances of up to 400 km between the stations of the fixed service and the aircraft is required to ensure safe operation of GNSS. Ten States have removed their names from footnotes 5.362B and 5.362C during WRC-12. This was a significant step forward towards achieving better worldwide protection of GNSS.

2.2 Based on the above MIDANPIRG/13 noted that the following MID States (*Iraq, Jordan, Qatar, Saudi Arabia, Sudan, Syria and Yemen*) have their States names under footnotes 5.362B and/or 5.362C. Accordingly, the MIDANPIRG/13 meeting urged these States to remove their names from the footnote and agreed to the following Conclusion:

CONCLUSION 13/44: PROTECTION OF GNSS SIGNAL

That, States that are listed in the footnotes 5.362B and 5.362C be urged to take necessary measures to remove their names from these footnotes as soon as possible.

2.3 As a follow-up to the above ICAO MID Regional office issued State letter AN 6/28-12/217 dated 18 July 2012, requesting Civil Aviation Authorities to coordinate with the Telecommunication Regulatory Authority in their State, to remove their State name from the footnotes No. 5.362B and 5.362C. However, reviewing ICAO HQ SL E 3/5-12/62 dated 28 November 2012 and the attached WRC position the same States Names appear.

2.4 MIDANPIRG/13 meeting reviewed and updated the Strategy for the implementation of GNSS in the MID Region to be in line with ICAO General Assembly Resolution A37-11, and agreed to the following Conclusion:

CONCLUSION 13/45: STRATEGY FOR THE IMPLEMENTATION OF GNSS IN THE MID REGION

*That, the Strategy for implementation of GNSS in the MID Region be updated as at **Appendix 4.5R (Appendix A to this WP)** to the Report on Agenda Item 4.*

2.5 MIDANPIRG/13 meeting encouraged MID States to conduct GNSS studies, workshops and seminars, since GNSS is the only sensor that supports all PBN navigation specifications, and agreed that the questionnaire at **Appendix B** to this working paper, be used by the ICAO MID Regional Office to conduct a survey on the implementation of GNSS in the MID Region, and agreed to the following Conclusion:

CONCLUSION 13/46: GNSS SURVEY

*That, States complete the GNSS questionnaire at **Appendix 4.5S** to the Report on Agenda Item 4.5 and send it to the ICAO MID Regional Office before 1 September 2012.*

2.6 As follow-up to above ICAO MID Regional Office Issued State Letter AN 6/28-12/216 dated 18 July 2012 and the following States replied (Bahrain, Jordan, Kuwait, Oman, and Qatar). The PBN/GNSS TF/5 is planned to be held in Cairo 7-9 May 2013 will consolidate the replies and provide the analysis. It is worth mention that AN-Conf/12 many paper related to GNSS were discussed and recommendations were agreed; among which are the following recommendations:

Recommendation 6/5 – ICAO work programme to support global navigation satellite system evolution

That ICAO undertake a work programme to address:

- a) interoperability of existing and future global navigation satellite system constellations and augmentation systems, with particular regard to the technical and operational issues associated with the use of multiple constellations;*
- b) identification of operational benefits to enable air navigation service providers and aircraft operators to quantify these benefits for their specific operational environment; and*
- c) continued development of Standards and Recommended Practices and guidance material for existing and future global navigation satellite system elements and encouraging the development of industry standards for avionics.*

Recommendation 6/6 – Use of multiple constellations

That States, when defining their air navigation strategic plans and introducing new operations:

- a) take advantage of the improved robustness and availability made possible by the existence of multiple global navigation satellite system constellations and associated augmentation systems;*
- b) publish information specifying the global navigation satellite system elements that are approved for use in their airspace;*
- c) adopt a performance-based approach with regard to the use of global navigation satellite system (GNSS), and avoid prohibiting aircraft use of GNSS elements that are compliant with applicable ICAO Standards and Recommended Practices;*
- d) carefully consider and assess if mandates for equipage or use of any particular global navigation satellite system core constellation or augmentation system are necessary or appropriate;*

That aircraft operators:

- e) consider equipage with GNSS receivers able to process more than one constellation in order to gain the benefits associated with the support of more demanding operations.*

2.7 The meeting may wish to note that MIDANPIRG/13 was apprised of the outcome of the PBN/GNSS TF/3 meeting (Cairo, 30 November – 02 December 2010) and PBN/GNSS TF/4 meeting (Cairo, 02-04 October 2011). Accordingly, MIDANPIRG/13 meeting reviewed the MID Regional PBN Implementation Strategy and plan that include the new requirement as per ICAO General Assembly Resolution A37-11, and agreed to the following Conclusion:

CONCLUSION 13/47: MID REGIONAL PBN IMPLEMENTATION STRATEGY AND PLAN

That, the MID Regional PBN Implementation Strategy and Plan be updated as at Appendix 4.5T to the Report on Agenda Item 4.5.

2.8 MIDANPIRG/13 meeting was of the view that prompt action by the Region and States is required to accelerate PBN planning, development and implementation to a pace of at least achieving closer to the ICAO Resolution implementation targets.

2.9 Based on the above, the meeting agreed that a comprehensive Regional Support Strategy is required and should include the following objectives;

- Promotion of PBN to decision makers within States to create the political will to invest and devote the necessary resources for PBN implementation;
- Establishing a regional working-level team or forum to identify implementation needs and to direct and/or organize the appropriate resources that will deliver PBN solutions to States;
- Formulation of cooperative arrangements to assist States in PBN implementation; and
- Development of additional support mechanisms that create skills and capabilities within States to implement and to sustain PBN operations

2.10 MIDANPIRG13 meeting agreed to establish MID PBN Support Team (MPST), under Decision 13/48 also agreed on three areas of work for the MPST: 1) promote PBN and convince Stakeholders to support PBN; 2) Gap Analysis and States PBN Implementation Plan update/improvement; and 3) Implementation of PBN.

2.11 The meeting may wish to note that the Global PBN Go-Team recommended that each ICAO Region develop the PBN Go-Team capabilities within the Region in order to assist MID States in the Implementation of PBN. Accordingly, MIDANPIRG/13 meeting agreed to the following Conclusion:

CONCLUSION 13/49: MID PBN SUPPORT TEAM (MPST)

That,

- a) ICAO MID Regional Office provide the leadership for MPST;*
- b) UAE be the champion for the MPST;*
- c) IATA fully commit and support the MPST; and*
- d) MID States assign members to MPST and allocate necessary resources.*

2.12 MIDANPIRG/13 The meeting reviewed and updated the status of the MID Region State PBN implementation plan and PBN implementation focal points and agreed that progress reports to be sent in June and December in order to monitor the progress of implementation of PBN in the Region.

2.13 The meeting may wish to note that a PBN Symposium held in Montréal from 16 to 19 October 2012. The event shared the latest developments relating to PBN applications. Furthermore, AN-Conf/12 discussed PBN implementation and the opportunities for the rationalization of terrestrial Navigation Aids (NAVAID), arising with the implementation of PBN enabled by GNSS capability in the aircraft.

2.14 The AN-Conf/12 considered it an approach that aimed at maximizing the greatest economic benefits of rationalization, namely those that come from avoiding the replacement of navigation aids at the end of their lifecycle. The approach was based on an analysis aimed at identifying rationalization opportunities, evaluating the necessary route changes and determining

whether a limited PBN implementation on the affected routes would be more cost effective than the replacement of the aids.

2.15 The AN-Conf/12 noted that one constraint on the rationalization process is that a minimum network of terrestrial aids should be maintained to cope with temporary loss of GNSS service. In general, the fundamental requirement to be met by such a network is to fully maintain safety following the loss of GNSS service, and maintain an acceptable level of efficiency and continuity to the extent possible. And on the basis of the discussions, the following recommendation was accepted by the Committee:

Recommendation 6/10 –Rationalization of terrestrial navigation aids

That, in planning for the implementation of performance-based navigation, States should:

- a) assess the opportunity for realizing economic benefits by reducing the number of navigation aids through the implementation of performance-based navigation;*
- b) ensure that an adequate terrestrial navigation and air traffic management infrastructure remains available to mitigate the potential loss of global navigation satellite system service in their airspace; and*
- c) align performance-based navigation implementation plans with navigation aid replacement cycles, where feasible, to maximize cost savings by avoiding unnecessary infrastructure investment.*

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) urge States to delete their name from footnote as per ICAO Position; encourage States to undertake GNSS studies and share information;
- b) support PBN/GNSS TF for the GNSS and PBN implementation; and
- c) consider rationalization of NAVAID with the PBN Implementation.

APPENDIX A

REVISED STRATEGY FOR THE IMPLEMENTATION OF GNSS IN THE MID REGION

The following is the Strategy for the implementation of GNSS aligned with PBN in the MID Region:

Considering that:

- a) Safety is the highest priority.
- b) Elements of Global Air Navigation Plan on GNSS and requirements for the GNSS implementation will be incorporated into the CNS part of FASID.
- c) GNSS Standards and Recommended Practices (SARPs), PANS and guidance material for GNSS implementation are available.
- d) Human, environmental and economic factors will affect the implementation.
- e) The availability of avionics, their capabilities and the level of user equipage.
- f) The development of GNSS systems including satellite constellations, augmentation systems and improvement in system performance.
- g) The airworthiness and operational approvals allowing the current GNSS applied for en-route and non-precision approach phases of flight without the need for augmentation services external to the aircraft.
- h) The effects of ionosphere on GNSS and availability of mitigation techniques;
- i) The PBN concept and the availability of PBN guidance material
- j) The monitoring of the GNSS signal according to ICAO Document 9849 (GNSS Manual) and other related ICAO documents
- k) States pay fair cost for GNSS to service providers (according to ICAO provisional policy guidance on GNSS cost allocation)

The general strategy for the implementation of GNSS in the MID Region is detailed below:

- 1) Introduction of GNSS Navigation Capability should be consistent with the Global Air Navigation Plan.
- 2) Implementation of GNSS and Augmentations should be in full compliance with ICAO Standards and Recommended Practices and PANS.
- 3) Assessment of the extent to which the GNSS system accessible in the Region can meet the navigational requirements of ATM service providers and aircraft operators in the Region.
- 4) Introduce the use of GNSS with appropriate augmentation systems, as required, for en-route navigation and Implementation of approach procedures with vertical guidance (Baro-VNAV and/or augmented GNSS), including LNAV only minima, for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014 as per 37th ICAO General Assembly resolutions 37-11 and according to Regional PBN Implementation Plan.
- 5) States, in their planning and introduction of GNSS services, take full advantage of future benefits accrued from using independent core satellite constellations, other GNSS elements and their combinations, and avoid limitations on the use of specific system elements.

- 6) Facilitate the use of GNSS; as enabler for PBN for en-route, terminal, approach and departure navigation. States should coordinate to ensure that harmonized separation standards and procedures are developed and introduced concurrently in adjacent flight information regions along major traffic flows to allow for a seamless transition to GNSS based navigation.
- 7) States should to the extent possible work co-operatively on a multinational basis under ICAO MID Office guidance to implement GNSS in order to facilitate seamless and inter-operable systems and undertake coordinated R&D programmes on GNSS implementation and operation.
- 8) States consider segregating traffic according to navigation capability and granting preferred routes to aircraft that are appropriately equipped for PBN to realize the benefits of such equipage taking due consideration of the need of State aircraft.
- 9) ICAO and States should undertake education and training programs to provide necessary knowledge in AIM, PBN, GNSS, Augmentation systems and operational application.
- 10) States establish multidisciplinary GNSS implementation teams, using section 5.2.2 and Appendix C of ICAO Document 9849, GNSS Manual.
- 11) States, in their planning for implementation of GNSS services, provide effective spectrum management and protection of GNSS frequencies to reduce the possibility of unintentional interference.
- 12) During transition to GNSS, sufficient ground infrastructure for current navigation systems must remain available. Before existing ground infrastructure is considered for removal, users should be given reasonable transition time to allow them to equip accordingly.
- 13) States should approach removal of existing ground infrastructure with caution to ensure that safety is not compromised, such as by performance of safety assessment, consultation with users through regional air navigation planning and plan for complete decommissioning of NDBs by 2012.
- 14) Implement GNSS with augmentation as required for APV where operationally required in accordance with the MID Regional and National PBN Implementation plans.
- 15) States continue their efforts to implement GNSS applications for en-route, APV and TMA operations. Attention should be accorded to meeting all GNSS implementation requirements, including establishment of GNSS legislation, regulatory framework, and approval procedure.

Notes:

GNSS (and ABAS using RAIM in particular) is available on a worldwide basis, not much needs to be done in terms of infrastructure assessment. Nonetheless, the responsibility for providing services based on GNSS within the airspace of a particular State remains within that State.

A decision on whether or not to develop a status monitoring and NOTAM system for ABAS operations should be made by taking into account the nature of PBN approvals. In many cases ABAS operations are predicated on having a full complement of traditional NAVAIDs available for back-up when ABAS cannot support service.

APPENDIX B

GNSS ASSESSMENT SURVEY

The following GNSS survey has been developed by ICAO to assess the Regional (Global) level of GNSS implementation and to determine the role that States would like ICAO to assume

Please return the completed survey to icaomid@cairo.icao.int before 1 September 2012

State Name:

Contact Name:

Contact email:

- 1) Has your State developed a plan to implement GNSS -- Yes No
- 2) Was the GNSS Manual (Doc 9849) used as a reference when considering the implementation of GNSS Yes No
- 3) Has the basic GNSS regulation been promulgated in your State -- Yes No
- 4) a-Has your administration received requests from domestic aircraft operators to provide GNSS-based services -- Yes No

b-Has your administration received requests from international aircraft operators to provide GNSS-based services -- Yes No
- 5) What is the level of WGS – 84 survey completion in your State
 - a. For Waypoints -- _____%
 - b. For Airports -- _____%
- 6) What percentage of aircraft are equipped with GNSS avionics _____%
- 7) a- What is the number of runways in your State that meet instrument standards but do not have an instrument approach _____

b- What is the number of runways in your State that are only served by a circling procedure
- 8) In your State, how many PBN approach procedures are promulgated based on
 - a. GNSS -- _____
 - b. Conventional navigation-aids _____
- 9) How many ILS systems are equipped with marker beacons only (no DME) for aircraft to perform altitude/distance cross checks? _____

10) Do you allow the use of FMS GPS based computed distance checks? -- Yes No

11) Does your State plan to implement ADS-B -- Yes When _____ No

12) Does your State plan to implement Multilateration -- Yes When _____ No

13) What is the Status of the following systems in your State

a. ADS-C -- Equipped Yes No Operational Yes No

b. CPDLC -- Equipped Yes No Operational Yes No

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14) Does your State have any plans to implement augmentation systems

a. SBAS -- Yes When _____ No

b. GBAS -- Yes When _____ No

15) What role would your State like ICAO to assume in your GNSS Programme

16) Any comments

