



International Civil Aviation Organization

**SIXTEENTH MEETING OF THE
COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND
METEOROLOGY SUB-GROUP (CNS/MET SG/16) OF APANPIRG**

Bangkok, Thailand, 23 – 27 July 2012

Agenda Item 5: Review report of the Performance Based Navigation (PBN) Task Force/9 meeting

REPORT OF NINTH MEETING OF PBN TASK FORCE

(Presented by the Secretariat)

SUMMARY

This paper presents report of the Ninth Meeting of the Performance-Based Navigation Task Force (PBN/TF/9, Bangkok, Thailand, 27 to 29 March 2012) and the progress of Asia/Pacific PBN implementation.

This paper relates to –

Strategic Objectives:

A: Safety – *Enhance global civil aviation safety*

C: Environmental Protection and Sustainable Development of Air Transport – *Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment*

Global Plan Initiatives:

GPI-5 RNAV and RNP (Performance-based navigation)

GPI-11 RNP and RNAV SIDs and STARs

GPI-12 Functional integration of ground systems with airborne systems

GPI-21 Navigation systems

1. INTRODUCTION

1.1 The Ninth Meeting of the Performance-Based Navigation Task Force (PBN/TF/9) was held in Bangkok, Thailand from 27 to 29 March 2012.

1.2 The meeting was attended by 62 participants from Australia, Bangladesh, Cambodia, China, Hong Kong China, Fiji, India, Indonesia, Lao PDR, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, United States, Viet Nam, IATA, and aviation industry representatives.

Agenda Item 5 (1)

23/07/12

1.3 The meeting developed two (2) Draft Conclusions, and one (1) Draft Decision. The whole report of the meeting is provided at :

http://www.bangkok.icao.int/cns/meeting.do?method=MeetingDetail&meeting_id=123

1.4 Outcomes from PBN/TF/9 were presented to the Twenty-second Meeting of the APANPIRG Air traffic Management/Aeronautical Information Services/Search and Rescue Sub-Group (ATM/AIS/SAR/SG/22), Bangkok, Thailand, 25 -29 June 2012.

2. DISCUSSIONRelevant Meeting Outcomes

2.1 The PBN/TF/9 meeting was briefed on relevant Conclusions from the Twenty Second Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/22, Bangkok, 5 to 9 September 2011):

- a) *Conclusion 22/23- Participation in the Asia/Pacific Flight Procedure Programme;*
- b) *Conclusion 22/22 - GNSS minimum requirement for RNP Navigation Specification;*
- c) *Conclusion 22/24 – Regional RAIM Prediction System and Minimum Technical and Operational Requirement; and*
- d) *Conclusion 22/25 - Regional PBN Plan Amendment Conclusion 22/26 – Workshop on GNSS implementation.*

2.2 The meeting noted draft principles related to PBN that were presented to the First Meeting of the ICAO Asia/Pacific Seamless ATM Planning Group (APSAPG/1, Bangkok, 31 January to 3 February 2012):

- a) the continued transition from ground-based aids to satellite-based PBN procedures, while maintaining a necessary redundancy and contingency network;
- b) support for a Global Navigation Satellite System (GNSS)-based, integrated regional PBN approval standard;
- c) regional cooperation for Space-Based Augmentation System (SBAS) in terms of interoperability and increased service areas and a GNSS ionospheric monitoring network;
- d) support for PBN specifications that include GNSS ‘low end’ aircraft and better spacing for terminal airspace, based on empirical data;
- e) universal implementation of Continuous Descent Operations (CDO) and Continuous Climb Operations (CCO) unless restricted by factors such as terrain, SUA, and noise constraints;
- f) early implementation of Aeronautical Information Management (AIM), (including Systems Wide Information Management) for advanced States;
- g) cooperative development and use of aeronautical databases such as the European Aeronautical Database (EAD); and
- h) regulation of aeronautical data and its quality, to ensure interoperable operations.

2.3 PBN/TF/9 was apprised of the planning to measure the performance of Asia/Pacific administrations in implementing the various Aviation Systems Block Upgrade (ASBU) elements, which were a key part of the Seamless ATM planning. The PBN/TF Chairman suggested that other regions should be encouraged to use the measurement tools being developed by the Asia/Pacific.

Global PBN Update

2.4 The Secretariat presented global PBN development information. Significant matters affecting or potentially affecting the Asia/Pacific Regions were described as follows:

- a) a Go Team visit (intended to improve States relatively advanced in PBN matters that could serve as regional PBN champions) to New Delhi, India, 11 to 15 June 2012;
- b) a PBN Airspace design workshop was conducted during 2011 in New Delhi;
- c) the development of a PBN OPS approval handbook guidance for global application with ICAO COSCAP-SEA (Cooperative Development of Operational Safety and Continuing Airworthiness Programme – Southeast Asia) and the Australian Civil Aviation Safety Authority (CASA);
- d) new amendments to PANS-OPS (ICAO Doc 8168), Volume II and Annex 15 which were under review by the Air Navigation Commission (however Annex 15 amendments may be delayed);
- e) a navigation specification for SBAS and its inclusion in RNP APCH;
- f) an RNP 2 navigation specification for en-route application, including remote and continental use, including high and low continuity applications;
- g) the inclusion of Baro-VNAV into the PBN Manual (ICAO Doc 9613);
- h) application of Radius-to-Fix (RF) turn principles beyond terminal airspace as Fixed Radius Turns for all RNP applications;
- i) an Advanced RNP navigation hierarchical specification applicable for en-route (RNP1), arrival, departure and approach to avoid the need for separate approvals for the different phases of flight and which includes parallel offset capability;
- j) an RNP 0.3 navigation specification for helicopter operations but which can also be applied by low speed fixed wing ops; and
- k) the RNP AR APCH (Required Navigation Performance Authorization Required) navigation spec was expected to be extended to departures and for one engine inoperative situations.

2.5 The forthcoming ICAO PBN Symposium (Montreal, Canada from 16 to 19 October 2012) was highlighted (<http://www.icao.int/Meetings/PBN-Symposium/Pages/default.aspx>).

Asia/Pacific PBN Implementation

2.6 PBN/TF/9 The meeting recalled that State PBN Plans were ranked PBN Plans into three categories based on quality:

- Robust – when 8 to 10 basic plan elements (BPE) were satisfied;
- Marginal – when 5 to 7 BPE were satisfied; and
- Incomplete – when 4 or less BPE were satisfied.

Agenda Item 5 (1)

23/07/12

2.7 The PBN Plan Review Team had undertaken assessments of 12 plans in 2012, and as a result there has been a significant improvement in the number of administrations with a ‘Robust’ status plan, so one-third of administrations now had satisfactory PBN planning. States that had achieved this status in the past 12 months were: Hong Kong, China, Myanmar, Nepal, the Philippines and Sri Lanka. **Attachment A** provides a graphical representation of the status of Asia/Pacific PBN Plans. **Table 1** provides an overall summary of the status of Asia/Pacific PBN Plan changes.

Asia/Pacific PBN Plan Status	2011 (PBN/TF/8)	2012 (PBN/TF/9)
Robust	9 (21%)	14 (33%)
Marginal	4 (10%)	5 (12%)
Incomplete	8 (19%)	5 (12%)
Total Plans	21 (50%)	24 (57%)
Administrations with no plan	21	18

Table 1: Asia/Pacific PBN Plan Overall Status Changes

2.8 Notwithstanding the overall improvement, a large number of States remained as either ‘Marginal’ or ‘Incomplete’ status plans, or had no plan. States with significant aviation activity in this category were Malaysia (‘Marginal’), Pakistan (‘Marginal’) and Indonesia (‘Incomplete’). Pakistan noted that their plan would be updated in the near future. In Indonesia’s case a significant amount of PBN development was currently being undertaken, with 90 PBN approaches and 50 PBN arrival/ departure procedures being planned by 2016.

2.9 Of significant interest to the Task Force was the proportion of Pacific Island administrations (14 of 18) that had not provided a PBN Plan to the Asia/Pacific Office:

- Cook Islands;
- French Polynesia and New Caledonia (France);
- Kiribati;
- Marshall Islands;
- Federated States of Micronesia;
- Nauru;
- Palau;
- Papua New Guinea;
- Samoa;
- Solomon Islands;
- Tonga;
- Vanuatu; and
- American Samoa, Guam, Johnston, Kingman, Midway, Mariana, Palmyra, Wake Islands (USA).

2.10 A PBN plan was provided by Tonga at the ATM/AIS/SAR/SG/22 meeting.

2.11 The meeting updated the Status of PBN Implementation Plan Table (**Attachment B**). Recalling that the ICAO Assembly Resolution A37-11 required, *inter alia*, States to implement approach procedures that have vertical guidance on 30% of runway ends by 31 December 2010¹, the vast majority of administrations that had advised the Regional Office of progress indicated achievement of the 30% implementation target.

2.12 Regarding Standard Instrument Departure and Standard Terminal Arrival Procedures (SID and STAR), only seven administrations had submitted data indicating compliance with the short-term Regional PBN Plan target (RNAV1 SIDs/STARs for 50% of international airports by 2010): Australia, Hong Kong, China, India, Japan, Maldives, New Zealand and the Republic of Korea.

2.13 Only six administrations (Hong Kong, China, India, Indonesia, Myanmar, the Republic of Korea and Sri Lanka) had provided any detail of PBN en-route procedure development, despite the implementation target of re-defining routes into PBN navigation specification by 2012 and implementing additional RNAV/RNP routes.

PBN Assistance

2.14 On 30 November 2011, a Special Implementation Project (SIP) was approved for a PBN implementation Workshop that was intended to be held in the South Pacific in the third or fourth quarter of 2012 to assist small Pacific Island States to develop a PBN Plan. The PBN Workshop that would utilize the services of experts from the Asia/Pacific Region.

2.15 The PBN/TF discussed the establishment of a ‘buddy’ system for administrations that did not have a robust status plan. It was recognised that a simple training session was probably insufficient to develop a robust PBN response; hence the need to have a longer term relationship with States that were more advanced in PBN development. There were various means of assistance that could be used, such as ICAO Workshops, Flight Procedures Programme (FPP) training, ‘champion’ States that had undergone Go-team visits or who were sufficiently mature to provide advice; and assistance from International Organizations such as IATA.

2.16 A total of 30 administrations did not have a robust status PBN Plan. **Table 2** illustrates the status of these plans and possible means of individual tailored assistance:

Administration	PBN Plan Status	Possible Assistance Plan
Afghanistan	No Plan Received	ICAO HQ, Donor Nations
Bangladesh	Marginal	COSCAP SA/FPP
Bhutan	No Plan Received	COSCAP SA
Brunei Darussalam	No Plan Received	COSCAP SEA
Cambodia	Incomplete	COSCAP SA/FPP
Cook Islands	No Plan Received	PBN Workshop, NZ
Fiji	Marginal	PBN Workshop
French Polynesia	No Plan Received	PBN Workshop, France
Indonesia	Incomplete	Australia
Kiribati	No Plan Received	PBN Workshop, NZ
Korea, DPR	Marginal	COSCAP NA/FPP
Lao PDR	Incomplete	COSCAP SEA/FPP

¹ Except where there is no local altimeter setting available and there are no aircraft suitably equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more, implementation of straight-in LNAV only procedures are acceptable.

Agenda Item 5 (1)

23/07/12

Macao, China	No Plan Received	FPP, Hong Kong China
Malaysia	Marginal	COSCAP SEA/FPP
Maldives	Incomplete	COSCAP SA/FPP
Marshall Islands	No Plan Received	PBN Workshop, USA
Micronesia, FS	No Plan Received	PBN Workshop, USA
Nauru	No Plan Received	PBN Workshop, NZ
Niue (NZ)	No Plan Received	PBN Workshop, NZ
New Caledonia	No Plan Received	PBN Workshop, France
Pakistan	Marginal	COSCAP SA/FPP
Palau	No Plan Received	PBN Workshop, USA
Papua New Guinea	No Plan Received	PBN Workshop, Australia
Samoa	No Plan Received	PBN Workshop, NZ
Solomon Islands	No Plan Received	PBN Workshop, Australia
Timor-Leste	No Plan Received	PBN Workshop, COSCAP SEA/FPP
Tonga	Draft Received	PBN Workshop, NZ
Vanuatu	No Plan Received	PBN Workshop, Australia
Vietnam	Incomplete	COSCAP SEA
American Samoa, Guam, Johnston, Kingman, Midway, Mariana, Palmyra, Wake Islands	No Plan Received	PBN Workshop, USA

Table 2: Administrations without Robust Status PBN PlansAsia/Pacific Flight Procedure Programme

2.17 The meeting noted that the FPP Steering Committee had approved the extension of the FPP into Phase 2, from 2013 to 2017, although the office location was still to be advised. By the end of 2011, 23 Asia-Pacific Administrations had become Member States of the FPP; 11 of which as Active Participating Administrations and 12 as User Participating Administrations. From 2011 to March 2012, the FPP had conducted 19 training courses with more than 700 training participants from 24 States.

2.18 The meeting discussed the legal framework in which the FPP operated. The FPP Manager noted that the FPP was not currently subject to any external certification or auditing, however it was mainly a training or advisory body that had been endorsed by APANPIRG.

GNSS Landing System

2.19 Australia provided a presentation on PBN and GNSS global developments. The presentation included information on the Australian installation of GNSS Landing System (GLS) at Sydney. One GLS installation could deliver the equivalent of Instrument Landing System (ILS) performance to all six runways at Sydney, although only newer aircraft were equipped to fly this form of approach. IATA supported the GLS technology but would prefer an aggressive timeline and implementation plan for airline requirements.

2.20 The meeting suggested that a GLS seminar could be held in the Asia/Pacific, noting that all 'new generation' Boeing, Airbus and Bombardier aircraft already had GLS equipage. Moreover, the meeting noted that the GBAS design material in Doc 8168 was reserved. It was suggested that GLS as part of a GNSS section could be included within State PBN Plans. Moreover, information on expected GLS regional planning could form part of the Asia/Pacific Seamless ATM plan. The meeting agreed to the following Draft Conclusion for consideration by the CNS-MET Sub-group:

Draft Conclusion PBN/TF/9/1: Asia/Pacific GLS Seminar

That, ICAO plan an Asia/Pacific GNSS Landing System (GLS) Seminar to provide information on emerging GLS technology, airport and airline GLS planning, and the development of applicable standards.

PBN Overlay Procedures

2.21 The meeting was apprised of the dialogue that had been on-going in Australia regarding the requirements for a conventional instrument flight procedures flown using GNSS/RNP aircraft. IATA stated that this was a complex area with possible legal implications for ATC. The meeting noted the lack of guidance on this matter and suggested that ICAO might consider developing such material, which should include guidance for ATC. The meeting agreed to the following Draft Conclusion for consideration by the CNS-MET Sub-group:

Draft Conclusion PBN/TF/9/2: Global PBN Standards for GNSS/RNP aircraft Flying Conventional Instrument Flight Procedures

That, ICAO HQ review and further develop operational and guidance material for conventional instrument flight procedures flown using GNSS/RNP aircraft.

Instrument Flight Procedure Design Approval

2.22 The meeting noted that of the approach classifications (Non-Precision, Approach with Vertical Guidance [APV, SBAS-LPV, Baro-VNAV and RNP-AR] and Precision), there was no associated lighting and runway standards for APV. Apparently the Approach Classification Task Force (ACTF) was reviewing the APV definition. Australia was approving RNP-AR (Authorisation Required) procedures based on individual safety cases, including assessment of approach aids.

2.23 The meeting discussed the responsibilities of a third party design organization for an Instrument Flight Procedure (IFP), especially RNP-AR approaches. Australia advised that a design organization under the Australian Part 173 certification rule was responsible for IFP maintenance, and if they were not maintaining the design, this would precipitate a withdrawal of the IFP. IATA stated the use of IFP designed by third parties had led to a more complex legal relationship with airlines, which sometimes required legal agreements.

2.24 Australia noted that flight inspection and flight validation used to be within one manual, and that it required a highly equipped aircraft to do both. As flight validation was a much simpler process of design verification, this component had been moved to ICAO Doc 9906 Volume 5 and 6, which have only recently been made available on ICAO-NET. The meeting reviewed the relevant passages from Doc 9906 Volume 5, noting that it referred to the use of simulator or flight validation when appropriate, but that flight validation was required where runway or landing location infrastructure had not been previously assessed for instrument operations or when determined by the State Authority.

PBN Operational Environment

2.25 IATA noted that there was a distinct difference between the number of PBN procedures that had been designed and the number that were actually flown, apparently due to factors such as ATC preference for vectoring and pilots not requesting the IFP.

Agenda Item 5 (1)

23/07/12

2.26 The meeting emphasised that consultation was necessary with agencies that could affect IFP development including Air Traffic Control (ATC) and airline operators at the earliest IFP design stage. It was noted that some States required dialogue with aerodrome operators for matters such as noise abatement and local authority requirements, navigation aid providers, airspace planners and ATC to ensure the design could be integrated into the operating environment.

Document Consistency

2.27 Nepal asked about apparent inconsistency of references in ICAO documents for PBN implementation. The first issue related to Annex 11, Section 7.3.1, regarding the need for active monitoring by ATC units of radio navigation aids, when this was not entirely applicable for GNSS even though GNSS was classified as a radio navigation aid in Annex 10. Australia noted that Receiver Autonomous Integrity Monitoring (RAIM) was a form of monitoring, which could be partly tactical as advisories can be issued rapidly by NOTAM. However it was recognized that this was not the same as traditional monitoring of navigation aids by ATC units.

2.28 The other issue related to the use of the current altimeter setting (reference PANS ATM paragraph 11.4.3.2.2), requiring altimetry data to be ‘extracted’ from an appropriate meteorological office source, when this was not always the case if ATC provided this information. The Secretariat would discuss these matters with ICAO HQ with a view to updating the material to reflect the specific operating environment of space-based navigation systems, and modern operating practices.

2.29 It was further noted that the US had cancelled TSO C129A. This was intended for the development of new receivers and did not invalidate their continued use.

Baro V-NAV

2.30 Australia noted some issues with the current ICAO PANS-OPS (Doc 8168) design standard for Baro-VNAV that could be taken up by the Task Force:

- the current APV design required runway alignment unlike RNAV (GNSS), which allowed an offset course by up to 15°;
- the Baro-VNAV missed approach point must be at the runway threshold; and
- the design technically required the use of ‘W surfaces’, even though these were intended for SBAS LNAV/VNAV designs.

2.31 The Chairman reminded the meeting that ICAO had already enacted policy that the reversion from an unserviceable ILS was a Baro V-NAV procedure, so this form of IFP should be planned wherever there was an ILS.

RNAV Visual Arrival Procedures

2.32 IATA commented that when weather conditions permit, RNAV visuals procedures were useful and asked for more ICAO guidance. The Chairman suggested that participants should research this area to see if a future recommendation was required.

PBN Implementation Process

2.33 Thailand stated that it was important to note the benefits of PBN so this information can be utilized in later studies. IATA appreciated the effort by Thailand in being a regional PBN leader, and agreed that the description of benefits was important as it had been one of the weak points in past plans submitted by Asia/Pacific States.

2.34 Nepal asked about the ATC training process for RNP implementation. Thailand used the PBN Manual material and added information from the development feedback process. This training was conducted prior to every implementation, which was further checked by the regulator.

2.35 The meeting emphasised the need to harmonise navigation specifications across national borders.

2.36 There was also discussion about the use of ‘Continental’ and ‘Oceanic’ terms, which had not been helpful for Hong Kong, China in formulating plans. It was recognised that the emphasis should be on the operating characteristics of communications and ATS surveillance facilities in the area, not the geographical features in the new PBN environment. The meeting agreed that these prescriptive terms should not be used. The Regional PBN Plan would need updating to reflect recent changes, which could occur at the next PBN/TF meeting.

Task Force Terms of Reference

2.37 IATA, Australia, Fiji and Thailand developed a draft amendment of the TORs to include monitoring, feedback, encouraging State PBN implementations, and coordination with the ICAO FPP and COSCAP. The meeting agreed to the following Draft Decision for the CNS-MET Sub-Group’s endorsement and APANPIRG’s approval, in order to reflect expected current PBN/TF activities:

Draft Decision 9/3: Revised PBN/TF Terms of Reference

That, the following amendments are made to the PBN/TF Terms of Reference:

3) Identify other issues/action items arising from the work of ICAO or for consideration by ICAO in order to facilitate regional and global harmonization of existing as well as future applications, and where appropriate, provide responses and support to the ICAO ~~RNPSOR~~ PBNSG.

4) Assist States in the preparation and review of their PBN implementation documentation and provide feedback to ensure regional harmonization and for possible inclusion in ICAO-developed model documentation.

5) Monitor the progress of State PBN implementation, identify constraints to implementation and capture information on the effectiveness (tangible benefits) of State PBN applications.

7) Address other regional PBN implementation issues, including the development of staff resources and skills, as needed by safety management. Coordinate and consult with ICAO FPP, COSCAP, industry partners and volunteering administrations who are providing support to State PBN implementation.

Agenda Item 5 (1)

23/07/12

PBN FMS database limitation

2.38 Hong Kong, China described difficulties in establishing a new RNP AR approach for Runway 25 as most FMS only accepted six name characters (Doc 8168 Vol. II Part 1 Section 4 Chapter 9 refers). A new procedure required seven characters (such as RNVy25R). Only a few aircraft could accept seven characters such as the B777 and B748, limiting the number of users. The Doc 8168 'RNV' portion could be truncated, but this was driven by ARINC coding. The Secretariat and Chairman discussed the possibility of a coding solution with other concerned bodies².

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this paper;
- b) endorse the draft tailored assistance plan in Table 2 (paragraph 2.16);
- c) discuss and agree to, the following:
 - Draft Conclusion PBN/TF/9/1: Asia/Pacific GLS Seminar;
 - Draft Conclusion PBN/TF/9/2: Global PBN Standards for GNSS/RNP aircraft Flying Conventional Instrument Flight Procedures;
 - Draft Decision 9/3: Revised PBN/TF Terms of Reference; and
- d) discuss any other relevant matters as appropriate.

² The USA confirmed after the meeting that the actual characters used in the ARINC-424 title were an approach code, the runway number and letter, and the suffix. The actual title of the approach 'RNAV' was only listed in the record as 'R', but showed on the FMS display as 'RNV', so it did not use three characters, only one. Almost all FMS had the capability to display the six characters based on a procedure title with a suffix. Those that did not would only have one of each type of procedure to the runway.