INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE FOURTH MEETING OF THE PERFORMANCE BASED NAVIGATION TASK FORCE (PBN/TF/4)

OSAKA, JAPAN
4 – 6 MARCH 2009

The views expressed in this Report should be taken as those of the PBN/TF and not of the Organization.

Adopted by the PBN/TF
and published by the ICAO Asia/Pacific Office

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ATTACHMENTS

Attachment 1: A CD Rom which includes the following material has been provided to all participants (not included with this Report):

i) PBN/TF/4 Meeting Papers
ii) Report of the PBN/TF/1 Meeting
iii) Report of the PBN/TF/2 Meeting
iv) Report of the PBN/TF/3
v) Material from the ICAO PBN Website

vi) Participants List

vii) Supporting Documents i.e. Interim Edition of the APAC Regional PBN Implementation Plan; RASMAG Review of the Interim Edition of the APAC PBN Implementation Plan; CAR/SAM Roadmap and CAR/SAM Report; 3rd Edition of PBN Manual etc.

PART I - HISTORY OF THE MEETING

1. Introduction

1.1 The Fourth Meeting of the Performance Based Navigation Task Force (PBN/TF/4) was held in Osaka, Japan from 4 to 6 March 2009 at the ANA Gate Tower Hotel Osaka.

1.2 The PBN/TF/4 Meeting was preceded by the ICAO-JCAB Asia/Pacific PBN Implementation Seminar which was hosted by the Japan Civil Aviation Bureau (JCAB) at the Aeronautical Safety College, Osaka, Japan on 2 – 3 March 2009. Eighty four (84) participants representing Australia, Bangladesh, Cambodia, China, Hong Kong China, Fiji, Indonesia, Japan, Lao PDR, Malaysia, Maldives, New Zealand, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, United States, Viet Nam, IATA, IFALPA and Jepessen attended the Seminar. The two day event included presentations on ICAO PBN Concept Facilitation, Implementation Guidelines, and State Presentations by six of the Asia Pacific States on their Implementation Status, in addition to an Industry Presentation from IFALPA.

2. Attendance

2.1 The PBN/TF/4 Meeting was attended by sixty eight (68) participants from Australia, Bangladesh, Cambodia, China, Hong Kong China, Fiji, India, Indonesia, Japan, Lao PDR, Malaysia, Maldives, New Zealand, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, United States, Viet Nam, IATA and IFALPA. List of participants is at **Appendix A** to this Report.

3. Opening of the Meeting

3.1 Mr. Hiroshi Inoguchi, Director for International Policy Coordination, ATS Planning Division, JCAB welcomed the participants to Japan for participating in the Fourth Meeting of the PBN Task Force. Mr. Inoguchi wished the meeting all success.

3.2 On behalf of the Regional Director, ICAO Asia Pacific Office, the Secretary PBN Task Force welcomed the participants to the Fourth Meeting of the PBN Task Force. The Secretary expressed the gratitude of the ICAO Asia Pacific Office (APAC) and thanked the JCAB and the Ministry of Land, Infrastructure, Transport and Tourism, Government of Japan for agreeing to host the Fourth Meeting of the PBN Task Force concurrent with the ICAO-JCAB PBN Implementation Seminar. He lauded the facilities provided by JCAB for the Task Force Meeting.

3.3 The Secretary asserted that the ICAO PBN Global effort provides a common platform for all stakeholders in order to allow a more coordinated and harmonized approach in the implementation of Performance Based Navigation at the Regional level. He stressed that the implementation of PBN with related changes to airspaces, procedures and separation etc., would likely place new and challenging demands on States that require considerable assistance and guidance. PBN brings together a number of diverse RNAV and RNP applications. As such, the participation of all stakeholders in the development of a PBN Implementation Plan is essential. The Secretary stated that while the Regional PBN Implementation Plan is expected to be further refined during the Fourth Task Force Meeting, there is now a need to earnestly move into the 'implementation phase' and ensure that the State PBN Implementation Plans are in place by 2009. He reminded the participants of the targets /timelines set by the 36th Session of the ICAO Assembly for the implementation of PBN.

3.4 The Secretary drew the attention of the Meeting to two outstanding issues namely: the nomination of *State PBN Focal Points* and the submission of completed *Worksheets* with data on terminal instrument procedures and approaches. He highlighted that till date only 22 States have nominated *PBN Focal Points.* The Secretary also pointed out that it was agreed in the First Meeting of the PBN Task Force that the Focal Points in each State would provide the ICAO APAC Regional Office with the completed *Worksheet* on detailed status regarding the current and planned implementation of PBN terminal instrument procedures and approaches. The deadline for submission of data on runway ends at

international aerodromes was June 2008 and for the domestic airports was December 2008, however, till the commencement of the PBN/TF/4 Meeting only 8 completed *Worksheet* had been received. The Secretary requested States that were yet to nominate their *PBN Focal Points* to do so at the earliest as the role of the *State PBN Focal Point* was crucial to the implementation of the State PBN Plan. He also requested States to submit the runway data at the earliest so that accurate/good data could be used for effective Regional Planning purposes.

3.5 The Secretary informed the Meeting of the inability of Mr. Ian Mallett, Chairperson, PBN Task Force, to attend the Meeting on medical grounds. In addition, Mr. Henrik Neilsen, Rapporteur State PBN Implementation Plan Subgroup was also not present as he had left the services of the Civil Aviation Authority of Australia. The Secretary placed on record the excellent work done by Mr. Henrik Neilsen in support of the Regional PBN efforts. The Meeting was informed that in the absence of Mr. Ian Mallett, the Rapporteur for the Regional PBN Implementation Plan Subgroup, Mr. Noppadol Pringvanich would officiate as the Chairperson for the Fourth Meeting.

3.6 The Officiating Chairperson of the PBN Task Force, Mr. Noppadol Pringvanich, welcomed the delegates to Osaka for the Fourth Meeting of the PBN Task Force. He noted the high level of participation at the meeting and lauded the Task Force for the excellent efforts put in so far. Mr. Noppadol Pringvanich also complimented the Task Force for developing the APAC Regional PBN Implementation Plan and asserted that the focus should now shift to implementation so that all target dates set by the ICAO Assembly are met.

3.7 The Chairperson appreciated the efforts put in by JCAB in supporting the Meeting and also thanked the ICAO Asia Pacific Office for the preparatory work.

4. Officers and Regional Office

4.1 Mr. Noppadol Pringvanich, Engineering Manager, Aeronautical Radio of Thailand Ltd., (AEROTHAI), chaired the Meeting.

4.2 Mr. David VanNess, Implementation and Resource Development Coordinator, ICAO PBN Programme, ICAO Montreal provided technical guidance to the Meeting.

4.3 Mr. Fareed Ali Shah, Regional Officer Flight Safety, was the Secretary to the Task Force Meeting.

5. Documentation and Working Language

5.1 The working language of the Meeting as well as all documentation was in English.

5.2 Six (6) Working Papers and four (4) Information Papers were presented at the Meeting. A List of Papers is included at **Appendix B** to this Report.

PART II - REPORT ON AGENDA ITEMS

Agenda Item 1: Adoption of Agenda

1.1 The following Agenda was adopted for the meeting:

Agenda Item 1:	Adoption of Agenda
Agenda Item 2:	Global PBN Implementation
Agenda Item 3:	State / Industry Presentations
Agenda Item 4:	Task Lists Review
Agenda Item 5:	Review of Interim Edition of Regional PBN Plan
5.1	Review of RASMAG Proposals on Interim Edition of Regional PBN Plan
5.2	Interpretation of Summary Table and Implementation Targets
5.3	Others (Editorial Changes)
Agenda Item 6:	PBN Implementation in SAM Region
Agenda Item 7:	Appraisal of PBNTF Output against TORs
Agenda Item 8:	Update of Task Lists
Agenda Item 9:	Any Other Business
Agenda Item 10:	Date and Venue for Next Meeting

Agenda Item 2: Global PBN Implementation Plan

2.1 **Presentation of Working Paper /2 – Secretariat.** The Secretariat Working Paper /2, which provided the *Global PBN Update*, was presented by Capt. Dave VanNess, Implementation and Resource Coordinator, ICAO PBN Programme.

2.1.1 Global PBN Task Force (GPBN TF). Capt. VanNess informed the Meeting that in December 2008, at the invitation of ICAO and IATA, representatives of States, industry and international organizations came together for the first meeting of the Global PBN Task Force (GPBN TF). The objectives were to build upon the global and regional structures, which have already been put in place for PBN implementation, and to produce tools and enablers to facilitate and expedite the work. This first meeting resulted in agreement among the participants on the need for a global effort such as this, and divided the TF into Teams to work on specific plans and deliverables. The three separate teams, Promotion, Implementation Support and Implementation Management, are supported by a coordinating core team. The goal of the second meeting of the GPBNTF, 2-6 February 2009, was to develop the work programme, including a definition of the scope of activities and timelines, for the three PBN Task Force Teams. The report of the GPBN TF/2 meeting can be found on the ICAO PBN website: www.icao.int/pbn. To assist the GPBN TF the meeting was asked to review and provide suggestions to improve the proposed model action plan developed by the GPBN TF and to provide their views concerning areas on which the GPBN TF should concentrate its efforts.

2.1.2 Asia Pacific Flight Procedure Programme (FPP). Capt. VanNess also provided a short update on the progress in establishing the Asia Pacific Flight Procedure Programme office. He stated that at the APANPIRG/19, support was expressed for the continued development of the concept of establishing a flight procedure programme in the region for the purpose of assisting States to develop their capabilities in the instrument flight procedure domain. As requested by the APANPIRG/19 meeting, plans for the establishment of a Flight Procedure Programme office in the Asia-Pacific region are progressing. The decision to locate the FPP office in Beijing, China was announced. As the arrangements progress for establishment of the office a meeting will likely be scheduled, in order to inform States of the progress and to provide detailed information, so that they can plan for their future participation in the FPP and integrate this planning with their State PBN Implementation Plans. The task force was asked to provide feedback on how best the FPP could support their PBN implementation efforts.

2.2 Discussion.

Global PBN Task Force. The following comments were received:

2.2.1 New Zealand was of the view that the PBNSG continue to review and revise the PBN Manual to achieve a more hierarchical and easily used structure to minimise the number and complexity of the airworthiness approvals required for PBN operations. Newer aircraft will be supported in PBN airworthiness approvals by the aircraft OEM. The imperative for the simplified PBN Manual structure and global harmonisation and acceptance of guidance material is to support the State airworthiness approvals of legacy aircraft, particularly those that do not have current active OEM support.

2.2.2 The guidance material, in addition to specifying the airworthiness requirements for approval, need to draw attention to the human factors associated with installations and operations to ensure a high level of operational safety.

2.2.3 Global guidance material for operational approval procedures and training requirements are required to ensure common standards in all States to facilitate international operations.

2.2.4 The GPBNTF is considered to be an organisation well placed to advise ICAO Regions on harmonisation and the development of common standards.

2.2.5 IATA felt that the aircraft manufacturers should be invited to attend both the GPBN TF and the APAC PBN TF so that they can support PBN implementation. IATA also reiterated the desirability of having a statement in the Aircraft Flight Manual indicating aircraft compliance or qualification for applicable navigation specifications.

2.2.6 The meeting considered that the GPBN TF initiative for GO Team visits will be a valuable opportunity for States to gain knowledge and understanding of PBN implementation and developed the following Conclusion 4/01 encouraging States to consider applying for a GO Team visit.

Asia Pacific Flight Procedure Programme. The following comments were received:

2.2.7 Japan: Recognized the importance of the Asia Pacific FPP and would like to contribute in the implementation of RNAV/RNP in Asia-Pacific region as a part of the FPP in Japan.

2.2.8 Maldives: Noted that quality data is critical to the procedure design and may be the most difficult task facing the States and the FPP in developing PBN instrument flight procedures (IFPs).

2.2.9 Australia: Considers the FPP an opportunity for regional consistency in IFPs. Additionally the FPP will be a source for independent quality assurance and validation of procedures and can be used to level the procedure design work load in a State.

2.2.10 Hong Kong China: There should be an FPP web site for online documentation, collaboration and assistance.

2.2.11 India: Will provide full support and assistance to the FPP and indicated that they have a section devoted to PBN on their Airports Authority of India (AAI) web site.

2.2.12 IATA: Asked if the FPP was considering recruiting new procedure designers and training them. (The FPP is not considering this, but will focus on developing the capabilities of the procedure designers from the States)

2.3 Conclusions.

In light of the discussions above, the meeting adopted the following conclusions:

Conclusion 4/01: The APAC PBN TF encourages States to consider the GO Team visit (related to APAC PBN TOR 3).

Conclusion 4/02: The APAC PBN TF requests the Global PBN Task Force to consider providing assistance to States which currently are at the early stage of PBN implementation (related to APAC TOR 3).

Conclusion 4/03: The APAC PBN TF agrees to provide progress report of PBN implementation in the Asia-Pacific to the Global PBN Task Force (related to APAC TOR 3).

Agenda Item 3: State / Industry Presentations

3.1 **Presentations from States**

3.1.1 **Australia.** The delegate provided an update on PBN deployment in Australia. He informed the meeting that:

a. RNP-10/RNAV10 - RNP-10 (RNAV-10) routes were introduced in both Oceanic and Remote Terrestrial areas of the Australian FIRs in the mid 1990s.

b. RNP-4 - RNP-4 routes were introduced in both the Oceanic and remote Terrestrial areas of the Australian FIRs in 2006.

c. RNAV(GNSS) NPA - In excessive of 420 RNAV(GNSS) NPA procedures are in use in Australia.

d. RNP-AR (Special) - RNP-AR (Operator/Aircraft specific) Departure (RNP-0.3), Approach (RNP-0.3 to RNP-0.1), Missed Approach (RNP-0.3) have been introduced at 14 airports and are in use by two operators with two aircraft types.

e. APV - A study has been completed on technology and cost benefit to support APV. APV Baro-VNav will be introduced at airports serviced by Baro-VNav capable aircraft.

f. SIDs & STARs - RNAV SIDS and STARs are currently in use at major airports; these will be converted to PBN RNP-1 Procedures.

g. Planning - A PBN Implementation Team (PIT) comprising airlines, airports, ANSP and government agencies has been formed and will plan and co-ordinate the continuing deployment of PBN in Australia. Anticipated order of deployment is Approach (including APV), Terminal Area followed by en route.

3.1.2 **Bangladesh.** The delegate from Bangladesh provided the following status on PBN implementation:

a. State Focal Point of contact has been nominated and notified.

b. A committee has been formed for phase wise implementation planning of PBN within the state. However this committee has to be reorganised in line with the PBN manual to ensure the participation of all concerned.

c. As regard to WGS-84, some critical position of the runway and Nav Aids of ZIA were surveyed and published in the AIP. Survey of other essential points in connection with PBN implementation will be carried out after completion of the PBN implementation planning.

d. For harmonization, en-route PBN plan will be finalised in coordination with neighbouring states.

e. Bangladesh hopes to submit the PBN plan before the PBN/TF/5 meeting.

3.1.3 **Cambodia.** The current status of the PBN Implementation Plan was provided by the delegate from Cambodia. He informed the meeting that:

a. As of the present, Cambodia has no plan for PBN and is still in the process of studying to establish the CNS/ATM Master Plan. The survey of WGS-84 coordinates is completed for almost 80% of the area and it is expected to finish in May 2009.

b. PBN will be part of the CNS/ATM Master Plan; this plan is being provided under the support of the Japanese Government. The JICA Project is for the Indochina Countries i.e. Cambodia, Laos, and Viet Nam. The Project started on 4 March 2009 in Phnom Penh, Cambodia.

c. PBN Technology has been introduced to many in the aviation industry, however, Cambodia has not introduced the PBN concept to either its staff or at the management level.

d. Cambodia now, has a clear picture of the PBN concept after having attended the 2 day seminar in Osaka, Japan (2-3 March 2009). This is considered the appropriate time for Cambodia to introduce such concepts to its management and staff as part of the PBN implementation plan.

e. Cambodia hopes that it will be able to cope with the PBN Regional Plan as it has participated in ICAO regional projects before such as Y2K, Reroute structure etc.

f. ICAO flight procedure design programme is an important training programme for States like Cambodia to foster the PBN implementation project faster.

3.1.4 **China.** The delegate from China informed the meeting that the Civil Aviation Administration of China (CAAC) issued the official order to implement PBN in Sep.2008. In this order, CAAC recognized PBN as one of the important reforms for the new aviation transportation system. It will follow the ICAO's guidance, harmonize with the international standards and enhance the cooperation with related organizations, manufactures and authorities. This program will be led by the CAAC, supported by the Airlines, ATC, Airports and Academy. The transition strategy is to move smoothly from the traditional navigation to PBN in defined phases.

3.1.4.1 The Meeting was also informed that CAAC is drafting the PBN roadmap with support from Boeing and will ask all the related stakeholders for comments. The Roadmap is expected to be

published in August this year. The regulation system will be refined to accommodate the PBN operation. CAAC also plans to support the RNP airborne equipage retrofit and establish the PBN flight procedure office. Several RNAV and RNP projects were carried out and have shown huge benefits. CAAC will finish the WGS-84 transition by November 2010. The Meeting was advised to note that China BeiDou (Compass) is planned to have the initial operation capability around 2012.

3.1.5 **Hong Kong China.** The Meeting was informed that to facilitate the development of the PBN implementation plan in Hong Kong and to ensure the harmonization of the PBN implementation between various aviation stakeholders, Hong Kong has established the PBN Planning and Implementation Team (PBN PIT) in November 2007. The PBN PIT comprised of various aviation stakeholders including procedure designer, airspace planner, engineer, flight standard and airworthiness personnel, local operators and IATA, etc. The PBN PIT has held four meetings between 2008 and 2009 and adopted the Hong Kong PBN Implementation Plan (HK PBN Plan) in February 2009. Basically, the HK PBN Plan is in line with the ICAO Regional PBN Implementation Plan. Short Term (2009-2012), Medium Term (2013-2016) and Long Term (beyond 2016) targets are formulated and all members of the PBN PIT agreed to the HK PBN Plan.

3.1.5.1 For approach airspace, Hong Kong aims at achieving 100% implementation of RNAV approach with Baro-VNAV procedures by 2012. Within 2013, Hong Kong plans to issue mandate for RNP 0.3 capability and to achieve 100% RNP 0.3 application for aircraft operate within approach airspace by 2016 or beyond.

3.1.5.2 For terminal airspace, Hong Kong aims at implementing RNAV 1 STARs by 2012. Within 2010, Hong Kong plans to issue mandate for RNAV 1 capability and to achieve 100% RNAV 1 application within the terminal airspace by 2013.

3.1.5.3 For en-route airspace, Hong Kong aims at conducting trial operations for RNP4 on L642 and M771 by 2012. Within 2010, Hong Kong plans to issue mandate for RNP 4 capability and to achieve 100% RNP 4 application within en-route airspace.

3.1.5.4 Currently, Hong Kong is conducting operational trial on RNAV approach with Baro-VNAV procedures. Due to airspace limitation, RNP 0.3 and RF leg are required in the missed approach segment. Thus, the procedures are RNP AR APCH procedure. The trial commenced on 1 Feb 2009. At this stage, the trial results are satisfactory. Comments received from pilots are positive and the majority commented that the tracking keeping accuracy, vertical and lateral profiles are very good.

3.1.5.5 Hong Kong will continue to develop PBN procedures in accordance with the HK PBN Plan, strengthen the PBN training and enhance the CNS infrastructure to support the PBN Implementation.

3.1.6 **Fiji.** The delegate provided the following update on Fiji's PBN Programme:

a. Fiji is attending the PBN Taskforce for the first time so its presence here is to update itself on the status of PBN in the region and gather as much information as possible to assist it in developing its program;

b. Information gathered from the 2 day seminar and subsequent Task Force meeting will be used to update its National CNS/ATM Plan;

c. A recommendation will be made to the Executives/Board to immediately establish a Fiji PBN Planning and Implementation Team comprising of all relevant stakeholders;

d. An update on Fiji's PBN Planning and Implementation program will be provided at the 5th PBN Task Force meeting in Bangkok later this year;

e. Fiji will try its best to provide its State Plan before the next APANPIRG meeting;

f. Fiji will seek assistance from States who have progressed with their PBN Programs such as USA, Australia, Thailand, Japan, Korea, and New Zealand.

3.1.7 **India**. The delegate from India provided the following update and requested the Meeting to take note of the PBN implementation in India.

3.1.7.1 PBN RNAV-1 arrival and departure procedures were implemented in India in August 2008 at Mumbai, Delhi and Ahmedabad terminal area. Subsequently, it is now planned to implement PBN RNAV-1 arrival and departure procedure in Chennai Terminal area.

3.1.7.2 In Chennai, the process of development of PBN procedures commenced with the identification of the objectives and the benefits that will accrue to the operators and ATS. To ensure participation and contribution of stakeholders, Working Group (WG) was constituted which comprised of representatives from regulator, airlines, ATM & CNS etc. WG meetings were held during various phases of procedure development to obtain suggestion and feedback from stakeholders. The draft PBN procedures for Chennai have been developed and sent to airlines for comments and suggestions before procedure finalization. The procedures are likely to be promulgated in May 2009.

3.1.7.3 It has also been planned to implement PBN arrival and departure procedures for Hyderabad International airport, Bangalore International airport and Kolkata airport in the next phase.

3.1.7.4 En-route PBN implementation (RNAV 5) is also being planned between Delhi-Mumbai-Delhi. Baro-VNAV approach procedure is also being planned for all the runways at Mumbai and Delhi airport.

3.1.8 **Indonesia.** The delegate from Indonesia provided an update on the PBN Implementation Plan Report.

3.1.8.1 Indonesian ATM has contributed in safe and efficient operation of aircraft by the application of Reduced Vertical Separation (RVSM) and Area Navigation (RNAV) over the last several years for certain specified airways and routes.

3.1.8.2 The expansion of RNAV airway/routes for entire Indonesia will be completed by 2015.

3.1.8.3 Implementation of the Instrument Approach Procedures (IAP) using RNAV, including GNSS, is already completed in a small number of airports in Indonesia. At the beginning the GNSS approach procedures were overlayed with the VOR/DME approach procedures in order to familiarize both ATC and Pilot. Number of airports where RNAV-RNP can be efficiently used for an instrument approach will be increased both for busy major airports as well as remote airports/airfield where air navigation facility is not sufficiently provided. RNAV procedures will be added or upgraded with RNP procedures also by 2015, following the ICAO guidance manual.

3.1.8.4 As far as practicable, application of instrument precision approach category-I should be extended to all 46 significant airports by 2015 where scheduled jet flights are expected. This would also apply to airports where poor weather conditions are frequent or where approach is difficult due to geographical constraints.

3.1.9 **Japan.** The Meeting was informed that Japan started the trial of RNAV in 1992 and introduced the RNAV that met the global standards, first in Asia, in 2007. Japan established the RNAV road map based on ICAO PBN manual in 2007, and amended the RNAV road map last year in order to accelerate the implementation of RNAV. According to the RNAV road map, Japan will complete the RNAV implementation for almost all major domestic city-pairs by 2011.

3.1.9.1 So far, Japan has introduced 89 RNAV 5 routes for en-route, RNAV 1 routes for terminal area in 13 airports, and RNAV (GNSS) approach in 15 airports, including RNP approach in 4 airports. Furthermore, Japan plans to introduce RNAV AR approach in the near future.

3.1.10 **Lao PDR.** A Summary of the State PBN Implementation Plan progress report was provided by the delegate from Lao PDR.

3.1.10.1 The Department of Civil Aviation of Lao PDR has set up the working team for studying on PBN Implementation as well as Focal Point Person to ensure the State Implementation Plan in accordance with ICAO PBN Regional Implementation Plan and to identify the ICAO navigation specification for further implementation.

3.1.10.2 The phases of implementation will focus on the basic RNAV and RNP as a primary to be considered for en-route, subsequently TMA and approach areas will be indicated in the PBN Implementation roadmap.

3.1.11 **Malaysia.** The delegate from Malaysia stated that the twenty three (23) Malaysian instrument aerodromes are mostly equipped with conventional Instrument Approach Procedures, SIDs and STARs with combination of ILS, VOR/DME and NDB. Pre-PBN Navigation Specification for En-route and Terminal has been implemented. RNP10 routes in the South China Sea and Bay of Bengal. RNAV STAR had been implemented at some major airports. RNAV Approach procedures based on VOR/DME and GNSS have also been published for KLIA and at some major airports which have undergone upgrading. The NPA procedures are supplemental to the precision approach procedures available. WGS84 had been fully implemented in 2005. On moving towards PBN, a National PBN Working Group consists of representatives from various relevant units and agencies have been formed. Drafts of State PBN Implementation Plan and road map have been produced in accordance with the APAC Regional PBN Implementation Plan.

3.1.12 **Maldives**. The delegate from Maldives stated that in line with the deliberations of the recently concluded Indian Ocean Action Co-ordination Group Meeting held last month in Male' three of the ATS routes traversing through Male' FIR will be changed to RNAV routes before the end of the year. Additionally one RNAV route will be established between Hanimadhoo to the north of Maldives and Trivandrum in the south of India. To implement PBN, for the en-route phase within Male' FIR, it is planned to declare all airspace, encompassing the FIR, above FL285 as RNP 10 with 50 NM lateral and longitudinal separation. To support this conclusion we have collected enough data on fleet COM/NAV/SUR capability on all major airlines calling at airports within Maldives and those transitting through our FIR. Up until now results of these data indicate 99.9% of aircraft as RNP capable, justifying the proposal for RNP 10. Like I said, it will be futile for us to go this path alone and I urge all our neighbours, excluding Australia and Mauritius to keep abreast with what is happening around us and to try and meet the needs of the users of the ATS system.

3.1.12.1 RNP 1, PBN based SIDs and STARs for use within the Male' TMA has been designed and ground checked. Emirates Airlines, one of our major customers has been gracious enough, in offering us the opportunity to run a real time simulation of these procedures, including the associated RNP Baro-VNAV approaches in their simulators in Dubai. Once these are completed and following the subsequent flight validations it is anticipated to implement these well before the target dates.

3.1.12.2 Maldives is a country where GPS approaches have been in place since the early 90s and all these have now been converted to RNP Baro-VNAV approaches which are pending implementation after flight validations.

3.1.13 **New Zealand.** In his presentation the delegate stated that New Zealand has been progressively implementing RNAV operations for a number of years. There are now established RNAV-10 and RNP-4 routes for oceanic areas with RNAV terminal procedures now being implemented. There are now 86 procedures at 54 aerodromes and heliports with Baro-VNAV procedures at the major international aerodromes. In addition to these procedures, development is continuing on the Queenstown RNP AR procedures; Air NZ are currently operating the A320 and B737-300 to RNP-0.3 minima.

3.1.13.1 The development of terminal procedures has continued, particularly at Auckland. RNAV STAR procedures were first introduced at Auckland in 1997 but have been refined over the years since. In 2000 – 2001 continuous descent approaches were trialled but their success was limited by having to intervene to sequence traffic.

3.1.13.2 In 2008 there was an Optimised Arrival Trial that utilised ETA and RTA for sequencing with other traffic. The arrival path was an RNAV STAR rather than an optimised arrival path. The trial established that fuel savings of 100 to 250 kg could be saved per approach on the trial 747, 777 and A320 aircraft.

3.1.13.3 In the current phase of PBN implementation, the arrival and departure routes at the major airports will be optimised to provide lateral separation of SIDs and STARs until vertical separation is achieved; jet aircraft will have unrestricted climb; turboprop aircraft departures will be the shortest possible route and all arrivals will be continuous descent.

3.1.13.4 The next phases will be the introduction of parallel RNAV routes on the main trunk routes to be followed by the introduction of RNAV SIDs and STARs at regional airports. There are already GPS approaches at the regional airports.

3.1.13.5 In late 2008 and early 2009, the Asia and South Pacific Initiative to Reduce Emissions (ASPIRE) trial took place. This was a collaborative trial to establish the baseline for air traffic management performance and carbon emissions between Air NZ, Qantas, United, Airways Corporation, Air Services Australia and the FAA. There were three flights: an Air NZ 777 flying from Auckland to San Francisco, a United 747-400 flying from Sydney to San Francisco and a Qantas A380 flying from Los Angeles to Melbourne. For the 777 flight, the fuel saving was 4700 kg compared to the standard trip fuel.

3.1.13.6 In recent months, the CAA has become aware of a number of human factors issues that affect RNAV operations. These include aircraft installations, flight operations (particularly when associated with RNAV system failures and the missed approach), training effectiveness and issues specific to general aviation aircraft. These human factors need to be noted and addressed with the implementation of PBN.

3.1.14 **Philippines**. The delegate from the Philippines provided an update on the status of PBN implementation in the Philippines.

3.1.14.1 In the Philippines the CAAP National Working Group consists of representatives from CAAP, airline operators and pilot association. It has already had a series of coordination meetings with 5 major airlines operators. CAAP is still in the planning process for the full implementation of PBN in the Philippines.

3.1.14.2 PBN Implementation – Enroute. The Philippines have already implemented uni-directional ATS RNAV Routes, namely: L625, N892, M767 and N884 using the RNP 10 requirements.

3.1.14.3 PBN Implementation – Terminal. Through the effort of FedEx Express, Philippines was able to implement the RNAV (GPS) Approach and Departure Procedures in one (1) of the major international airports, the Subic Bay International Airport. The procedure was developed by FedEx company, ground and flight validated by the Federal Aviation Administration experts and also approved by CAAP authorities. The company had extended their resources such as providing trainings for air traffic controllers and the use of their flight simulators needed for the trainings. Further, FedEx has also

provided Philippines with the RNAV (GPS) approach procedures for three (3) major international airports. These procedures have already been disseminated to 5 local airline operators for their study and review on whether their company has the operational capability, particularly focusing on whether their fleet of aircraft and pilots has meet the required navigational performance.

3.1.14.4 The Philippines acknowledged and recognized the importance of PBN in civil aviation. As it is still in the planning process for CNS/ATM program, the State's short term target is to be able to at least implement the RNAV procedures at major international airports. The recently conducted seminar has been a big help and Philippines will strive hard to be able to accomplish what the ICAO requires from the State.

3.1.15 **Republic of Korea.** The delegate from the Republic of Korea provided a Summary of the PBN implementation interim plan.

3.1.15.1 In order to establish PBN implementation plan, KCASA has established national PBN TF in 2008.

3.1.15.2 As a result of PBN TF activities, PBN implementation interim plan was prepared as follows:

a. Short term (2009-2012)

En route : Current RNAV routes are to be changed to RNAV 5, however RNAV 2 routes are to be introduced in high density area to facilitate traffic flow.

Terminal : Current RNAV STARs/SIDs are to be changed to RNAV 1.

Approach : APV Baro-VNAV are to be introduced in major airports.

b. Medium term (2013-2016)

En route : New RNAV routes are to be based on RNAV2 or RNP2.

Terminal : RNAV 1 or RNP 1 STARs/SIDs will be expanded.

Approach : APV with Baro-VNAV will be introduced in all airports, and approach procedures using GBAS will be introduced at major airports.

c. Long term (2017-)

En route : Existing RNAV 5 routes will be changed to RNAV 2 or RNP 2.

Terminal : RNAV 1(or RNP 1) STARs/SIDs are to be mandated in high density TMAs.

Approach : GLS will be expanded to other airports.

This PBN implementation interim plan will be finalized through a few more national PBN TF meetings.

3.1.15.3 Thereafter, formal PBN implementation plan will be submitted after approval of the Government. ROK expects that it could submit its PBN implementation plan to the ICAO Asia/Pacific office by Asia/Pacific PBN/TF/5 meeting.

3.1.16 **Singapore.** The delegate from Singapore provided a comprehensive account of the efforts made by Singapore to implement PBN.

3.1.16.1 Enroute. RNAV enroute operations based on RNP10 requirements for aircraft approval was in place in the South China Sea region since November 2001 for six major parallel trunk routes that connect Singapore and the airports in Northeast Asia including Japan. States involved in that implementation then agreed on a 60NM lateral and 80NM longitudinal separation based on Mach Number Technique as the standard for the RNP10 routes. In total, these account for about >30% of international routes in Singapore FIR.

3.1.16.1.1 In July 2008, reduced horizontal separation down to 50NM lateral / 50NM longitudinal based on RNAV10 operation was implemented on two routes, M771 and L642, to cater for the high air traffic between Singapore and Hong Kong as well as airports in China. Plans include to convert the remaining international routes to RNAV10 spec and heavily utilised routes to RNP4 from near to medium term.

3.1.16.2 Departures/Arrivals. Changi's current set of SIDs and STARs were predicated on Eurocontrol's P-RNAV standard, implemented in May 2006. Reason for the new RNAV SIDs and STARs was to facilitate better air traffic management by introducing some form of segregation between departure and arrival tracks, both in the lateral and the vertical dimensions. Plan is to transition these into RNAV1 nav specs in accordance with PBN Manual. This should be accomplished in the near term by 2012.

3.1.16.3 Approach. There are 2 parallel runways at Changi Airport. Arrivals typically come into Changi on ILS approach procedures, available on all four runway ends as the predominant precision approach procedures for use into Changi Airport. VOR non-precision approach procedures serve as the backup for Changi Runway 2. In April 2005, Baro-VNAV approaches were introduced as backup procedures for two Changi Runway 1 (two ends – Changi 20R and 02L) to provide vertical guidance as a safety enhancement over traditional non-precision approaches. Plan is to extend this RNP APCH with Vertical Guidance (Baro-VNAV) to the other Changi runway by 2012.

3.1.17 **Sri Lanka.** The delegate from Sri Lanka provided the following update:

a. Present CNS-ATM Structure includes:
- 2 Radar Systems (Primary Radar and SSR)
- ADS-C with CPDLC (covering whole of FIR)
- ILS and VOR (DME)

b. Moving towards PBN

- Enroute: Almost all the ATS routes are RNP 10 now, expect to implement RNP 4 by 2011 (with the help of the available infrastructure). ADS-B to be introduced by 2014.

- Terminal: Conventional SIDS (VOR/DME) using now, to be moved to RNAV 1 SIDS/STARS (GNSS as primary means) by 2012.

- Approach: RNAV (GNSS) approach worth with Baro V NAV by 2014, as backup to ILS.

3.1.18 **Thailand**. A presentation was made by Thailand summarizing the current progress on the State's PBN implementation. Since May 2007, the National Working Group on PBN and GNSS was formed to provide a forum of all aviation stakeholders for GNSS and PBN implementation. The Working Group is now finalizing a roadmap for PBN and GNSS implementation for Thailand and expects its completion by June 2009. Regarding, actual PBN implementation, Thailand has authorized full operations of RNAV(GNSS) approaches at Phuket International Airport since February 12th, 2009. These approaches will later be revised to include Baro-VNAV profiles. Additionally, RNAV 1 SIDs/STARs and RNP approaches are now being developed for Samui, Hat yai, Suvarnabhumi, Don Mueang, Chiang Mai and

Krabi. Regarding PBN en-route, Thailand is now considering implementing PBN routes for major city-pairs both within domestic airspace and in coordination with neighboring States. RNAV 10, RNAV 5 and RNP 4 are now being considered for this en-route implementation.

3.1.19 **United States.** The meeting was provided with the US PBN Implementation Status Summary by the delegate from the United States.

3.1.19.1 The US published the "Roadmap for Performance-Based Navigation" in 2003 and updated it in 2006 to reflect progress with international harmonization activities and to align national PBN strategies with the Next Generation Air Transportation System (NextGen) goals. In 2008, essential elements of the Roadmap were integrated within the NextGen Implementation Plan. Current PBN implementations by the US include: RNP 10 and RNP 4 routes in oceanic areas; RNAV-2 for "Q" and "T" routes; RNAV 1 for SIDs and STARs; RNAV (GPS) approaches with vertical guidance; and RNP AR approaches. Since 2005, 118 Q/T routes, 250 RNAV SIDs/STARs, 1548 RNAV approaches with baro-VNAV, and 138 RNP AR approaches have been implemented. Except for 13 of the RNP AR (special) approaches, all of these procedures were developed with standard (public) criteria for use by all approved operators.

3.1.19.2 The US will soon (within the next year or so) have the capability to implement RNP 2 routes, RNP 1 SIDS and STARs, and RNP APCH with baro-VNAV, based on guidance in FAA Order 8260.54A and AC 90-105. Some of the ongoing US development work with PBN include: demonstrating RNAV STARs with optimized profile descent (OPD); establishing track-to-track spacing standards for RNAV 2/RNP 2 routes; conducting specific projects to decouple adjacent airport operations with curved path (RNP AR) approaches; including RNP AR approaches in current standards for parallel ILS, dependent and simultaneous independent operations; and conducting research on PBN applications to closely spaced parallel runways.

3.1.20 **Viet Nam.** The delegate from Viet Nam provided the following update on the progress made on the implementation of PBN:

a. Year 2001:
   - Implemented RNAV routes and 4 parallel RNP10 routes

b. Year 2008:
   - Reduced separation to 50x50 NM to 2 RNP10 routes
   - Started RNP4 studying implementation for 2 RNP10 routes
   - Established national PBN and GNSS implementation working group; Leader of this working group is PBN focal point

c. Year 2009:
   - Started to conduct draft national PBN implementation plan harmonizing with Regional PBN implementation plan.

3.2 Presentations from Industry

3.2.1 **IFALPA**. A summary of the presentation on PBN Procedures from the Pilot's Perspective was provided by IFALPA**.**

3.2.1.1 The delegate stated that regardless whether we knew or not, all pilots were flying according to PBN procedures but the knowledge of PBN issues were not clearly understood by pilots. For example, the difference between RNAV and RNP is not very clear as well as the definition of APV: Baro-VNAV etc. There are two types of RNAV (GNSS) approaches in Japan. One has the required RNP indicated and in the other the required RNP is not indicated. He thought that the unification of such indication is very important to avoid confusion in pilots.

3.2.1.2 The delegate concluded that the recurrent training or refresher of knowledge of PBN (RNAV, RNP and APV) is very necessary and important. Baro-VNAV is spreading in Japan, but there are not so many occasions for doing Baro-VNAV approach for one pilot. Thus doing Baro-VNAV approach in a simulator at least once a year is very important. The delegate was confident that recurrent training will contribute towards maintaining the level of required flight safety.

Agenda Item 4: Task Lists Review

4.1 The Meeting reviewed the Regional PBN Implementation Plan Subgroup Task List and the State PBN Implementation Plan Task List from the PBN /TF/3 Meeting.

4.2 In the Regional PBN Implementation Plan Subgroup Task List there were 22 Performance Objectives listed. Of these, 13 were closed at the last PBN/TF/3 Meeting. After due deliberations, one Performance Objective listed at S. No. 1-14 (PBN Certification Process) was considered closed. The Status on the remaining 5 Performance Objectives was considered OPEN / On-going and would be reviewed at the next Meeting (PBN/TF/5).

4.2.1 The updated Regional Implementation Plan Subgroup Task List is placed at **Appendix C.**

4.3 In the State PBN Implementation Plan Subgroup Task List there were 9 Performance Objectives listed. Of these, 8 Performance Objectives were closed at the last PBN/TF/3 Meeting. The Performance Objective listed at S.No. 3 (PBN Training Material) continues to remain OPEN as the Meeting recognized that the issue of Training was very important for the successful implementation of PBN. It was agreed that more effort was required towards imparting appropriate training/education at all levels. The Meeting noted that the Global PBN Task Force was also tasked with developing, planning and scheduling training and workshops to support PBN implementation

4.3.1 The updated State PBN Implementation Plan Subgroup Task List is placed at **Appendix D.**

Agenda Item 5: Review of Interim Edition of Regional PBN Plan

5.1 Review of RASMAG Proposals on Interim Edition of Regional PBN Plan

5.1.1 **Presentation of Working Paper / 3 – Secretariat.** The Secretariat presented Working Paper/3 on the RASMAG Review of the Regional PBN Implementation Plan (Interim Edition – September 2008)

5.1.2 The Meeting was informed that APANPIRG/19 recognized that as the PBN/TF/3 meeting had been held in July 2008, after RASMAG/9 in May 2008 and ATM/AIS/SAR/SG/18 in June 2008, these two Subgroups had not had the opportunity to review the proposed Regional PBN Plan. Consequently, APANPIRG/19 considered it more appropriate to adopt the plan as an 'interim' edition, pending review by RASMAG and ATM/AIS/SAR/SG. APANPIRG/19 adopted the Interim Edition (which will henceforth be referred to as Version '0') under Conclusion 19/25 and urged States to review the interim plan, provide feedback to ICAO Regional Office and use the interim plan as a basis for developing national PBN Implementation Plans.

5.1.3 The RASMAG/10 Meeting (December 2008) reviewed the Interim Edition (V '0') of the Regional PBN Implementation Plan and proposed additional text for Section 9 - *Safety Assessment & Monitoring Requirements* to clarify that the responsibility for safety assessment and on going monitoring lay with the implementing States and not with RASMAG. States are encouraged to coordinate with RASMAG regarding the en-route safety assessment and monitoring requirements and methodologies. The

RASMAG meeting also proposed a number of editorial updates to the Interim Edition. The version incorporating the RASMAG proposals is V '0.1'.

5.1.4 The Meeting reviewed at length the RASMAG proposals (V '0.1') and by and large accepted the proposed editorial changes and additions to the text in Section 9 (Safety Assessment and Monitoring Requirements).

5.2 Interpretation of Summary Table and Implementation Targets

5.2.1 **Presentation of Working Paper / 4 – Secretariat.** The Secretariat presented Working Paper/ 4 on the Interpretation of Summary Table and Implementation Targets.

5.2.2 The Secretariat highlighted the need to correctly interpret the Summary Table and Implementation Targets for Short Term (2008 – 2012) and Medium Term (2013 – 2016) as developed by the PBN Task Force and approved by the APANPIRG/19. The Meeting was informed that some discussions have taken place on the interpretation of the Summary Table and Implementation Targets. To obviate the possibility of any misunderstanding, the Secretariat proposed that a *Note* be included in the two tables for better understanding/appreciation of the target timelines.

5.2.3 The Meeting agreed to amend the Regional PBN Implementation Plan and approved the text of the two *Notes* proposed by the Secretariat.

5.3 Others

5.3.1 **Presentation of Working Paper / 5 – Secretariat.** The Secretariat presented Working Paper/ 5 on the Asia/Pacific Area Traffic Forecasting Group (APA TFG).

5.3.1.1 The Secretariat informed the Meeting that the Global Air Navigation Plan (Doc 9750) requires that planning be carried out on the basis of well-developed traffic density forecasts. Asia/Pacific Area Traffic Forecasting Group (APA TFG) periodically develops such traffic forecasts for the region. The Secretariat highlighted some of the forecasts developed by the Fourteenth Meeting of APA TFG held in Bangkok from 22 to 29 September 2008 and recommended that the figures provided in this forecast be used as the basis for the PBN implementation plan in the region.

5.3.1.2 The Meeting reviewed the forecast developed by the Fourteenth Meeting of APA TFG and agreed to amend the Regional PBN Implementation Plan and make reference to the latest forecast of the APA TFG in Section 6 of the APAC Regional PBN Implementation Plan.

5.3.2 **Editorial Changes**

5.3.2.1 The Meeting reviewed at length the RASMAG proposals (V '0.1') and accepted the proposed editorial - changes along with making necessary editorial adjustments to the Plan.

5.3.2.2 In addition, the Meeting also considered it necessary and appropriate to introduce further changes to some of the existing text so as bring in more clarity to the document.

5.3.2.3 The revised version of the document as finalized by the PBN/TF/4 Meeting (V '0.2) is placed at **Appendix E** to the Report.

5.4 Conclusion.

In view of the deliberations under Working Papers WP/3, WP/4 and WP/5 the Meeting amended the APAC Regional PBN Implementation Plan (V '0.1') and adopted the following conclusion:

Conclusion 4/04 **The APAC PBN Task Force requested that the Interim Edition (V '0.2') of the Regional PBN Implementation Plan be presented at the ATM/AIS/SAR/SG/19 Meeting (June 22-26, 2009) for review as required by APANPIRG/19.**

Agenda Item 6: PBN Implementation in SAM Region

6.1 **Presentation of Working Paper / 6 – Secretariat.** The Secretariat presented Working Paper/ 6 on the Implementation of PBN in the SAM Region and the Results of the Work Done by Project RLA/06/901.

6.1.1 Highlighting the PBN work done by Project RLA/06/901, including the PBN Implementation Project for En-route Operations, the Model Implementation Project for TMA and Approach Operations, and the results of the tasks that should be completed in the SAM Region, the Secretariat invited the Meeting to review and consider the information in SAM/IG/2 WP/04 while undertaking development of the action plans in support of the Asia /Pacific PBN Implementation Plan.

Agenda Item 7: Appraisal of PBNTF Output against TORs

7.1 The Meeting reviewed the APAC PBN Task Force Terms of Reference (TOR) and developed the following cross reference between the TOR and the Meeting Agenda:

- PBN Implementation Seminar → TOR 2, 4, 6, 8
- Agenda Item 2 Global PBN Implementation → TOR 3, 9
- Agenda Item 3 State/Industry Presentation → TOR 1
- Agenda Item 5 Review of the Interim Edition of Regional PBN Implementation Plan → TOR 1
- Agenda Item 6 PBN Implementation in SAM Region → TOR 9

7.2 The Meeting also made an in depth appraisal of the PBN TF Outputs against the PBN TF Terms of Reference and adopted the following Conclusions and Actions:

Conclusion 4/05 **The APAC PBN TF agrees to continue an annual review of the Asia-Pacific Regional PBN Implementation Plan (TOR 1).**

Action 4/06 **Develop an up-to-date archive of all relevant guidance materials for each PBN implementation step as outlined in the PBN manual (TOR 2, 4, 5, 6).**

Action 4/07 **Arrange future annual PBN implementation seminars to serve as a forum for exchanging expertise and implementation experiences and invite interested States who would like to host future seminar to make a formal proposal at the next PBN TF meeting and to invite industry representatives to attend the seminar (TOR 2, 4, 6, 8).**

Conclusion 4/08 **In respect to the request by COSCAPs regarding the development of guidance material for APV, the APAC PBN TF recognized the work currently being conducted by the Global PBN TF to develop and review materials on the issues of APV and Non-Precision Approach as related to PBN (TOR 5).**

Conclusion 4/09 **The ICAO APAC PBN TF recommends that the PBNSG continue to review and revise the PBN Manual to achieve a more hierarchical and easily used structure to minimize the number and complexity of the airworthiness approvals required for PBN operations. The GPBNTF is considered to be an organization well placed to advise ICAO Regions on harmonization and the development of common standards (TOR 3, 8).**

Conclusion 4/10 **The APAC PBN TF agrees to continue coordination with other regional PBN task forces and the Global PBN Task Force to ensure harmonization of PBN implementation (TOR 9).**

Action 4/11 **States are requested to provide progress report regarding PBN implementation at each Task Force meeting (TOR 1, 2, 4, 5, 10).**

Action 4/12 **Mandate States to present their PBN Implementation Plan and to provide progress reports on the development of the State Plan at the next PBN TF meeting (TOR 1, 2, 4, 10).**

Action 4/13 **Request the Task Force Chairperson and Rapporteurs to develop a common template for State PBN Implementation Progress Report to be reviewed by the next PBN TF meeting (TOR 1, 2, 4, 10).**

Conclusion 4/14 **The APAC PBN TF agreed to develop a regional PBN progress report to be reported annually to CNS/MET and APANPIRG and to be posted on ICAO APAC and ICAO Global PBN web site (TOR 1, 2, 4, 10).**

Action 4/15 **Request ICAO Headquarter to provide a presentation on the requirement for safety assessment for PBN implementation and overview of how to conduct proper safety assessment at future PBN TF meetings (TOR 7, 10).**

Conclusion 4/16 **The APAC PBN Task Force considers itself a suitable forum to facilitate and harmonize terminal and en-route PBN implementation in the Asia Pacific Region. Therefore, the Task Force requests APANPIRG to consider adding the following task into the Task Force's TOR.**

"Facilitate and coordinate the harmonized implementation of PBN for terminal and en-route applications in the Asia Pacific Region."

Action 4/17 **Recognizing that the PBN planning activities for the Asia-Pacific are nearing completion and acknowledging the Task Force's willingness to support actual PBN implementation, the APAC PBN Task Force request working papers regarding revision of the Task Force's work structure to be submitted for consideration at PBN TF/5. Members of the PBN TF are encouraged to coordinate intersessionally to prepare the working papers. (TOR 10).**

Agenda Item 8: Update of Task Lists

8.1 In view of the appraisal carried out of the PBN TF Outputs against the PBN TF Terms of Reference the Meeting developed a detailed Implementation Task List of work that still needed to be carried out to ensure effective and smooth implementation of PBN in the Asia Pacific Region.

Implementation Task List

- **General**
  - Fleet readiness statistics for different navigation specification
  - General guidance on aircraft types and their configurations that have capability for different PBN navigation specifications
  - Prepare performance measuring methodology to assess success of PBN implementation
- **En-route**
  - Identify appropriate navigation specification for existing pre-PBN RNAV routes.
  - Identify and prioritize suitable city-pairs which can benefit from PBN implementation
  - Develop a status report on areas of en-route harmonization gaps.
  - Identify regional route structures for application of RNAV 10 and RNP 4 separation standards.
- **Terminal Area & Approach**
  - Create a status report of WGS-84 implementation within the APAC
  - Create a status report of compliance with the Annex 15 Electronic Terrain and Obstacle Data (ETOD) requirements
  - Identify proper strategies for PBN applications for helicopter in the Asia-Pacific
  - Identify and prioritize suitable airports and terminal areas which can benefit from PBN implementation

Agenda Item 9: Any Other Business

9.1 In order to enable the PBN Task Force and the APAC Regional States to keep abreast with the developments taking place in the realm of PBN and other safety areas, the PBN TF felt that regular flow and exchange of information was necessary and must be ensured. The PBN Task Force adopted the following Action item:

Action 4/18 Request ICAO to provide status report of the work by PBNSG, SASP and IFPP.

9.2 Hong Kong China offered to host the next PBN Implementation Seminar in 2010. The formal proposal on the Seminar would be provided by Hong Kong China at the next PBN/TF/5 meeting. It was generally agreed that a PBN Implementation Seminar should be held on an annual basis to educate all stake holders on issues related to PBN and the developments taking place globally.

Agenda Item 10: Date and Venue for Next Meeting

10.1 The PBN Task Force agreed to hold its Fifth Meeting prior to the CNS/MET/SG/13 meeting.

10.2 The ICAO Asia Pacific Office offered to host the Fifth Meeting at the APAC Regional Office during the period 15 – 17 July 2009.

10.3 The APAC PBN Task Force agreed to hold the Fifth Meeting of the PBN Task Force at the ICAO Asia Pacific Office, Bangkok from 15 – 17 July 2009. The PBN/TF/5 meeting will commence at 0900 hours on the first day.

10.4 The Meeting agreed to meet twice a year around January and July.

11. **Closing of the Meeting**

11.1 **Review of Draft Report.** The Task Force reviewed the Draft Report of the PBN/TF/4 meeting and gave its concurrence after incorporating minor changes.

11.2 The Acting Chairperson summarized the proceedings of the meeting. He noted with satisfaction that the PBN/TF/4 meeting had accomplished the tasks set for it. He thanked all participants for their active involvement and emphasized that without their cooperation and willingness to share information it would not have been possible for the APAC PBN Task Force to meet its objectives. He highlighted that developing the APAC Regional PBN Implementation Plan in less than a year was a significant achievement and complimented the Task Force on a job well done.

11.2.1 The Acting Chairperson stressed on the need to move ahead from the planning to the 'implementation phase' so that the timelines established by the ICAO Assembly are met. He requested the Task Force members to continue to work together, in the spirit of cooperation, so that the numerous benefits of PBN can be accrued by all States / Administrations in the Asia/Pacific region.

11.2.2 The Acting Chairperson thanked JCAB, the ICAO Secretariat and Capt. Dave VanNess for the support provided to the Task Force Meeting.

11.3 The Secretary, PBN Task Force thanked the Acting Chairperson, Capt. Dave VanNess and all participants for the support and cooperation extended throughout the Meeting. The Secretary also thanked the JCAB for providing the venue and facilities for the conduct of the PBN/TF/4 Meeting.

11.3.1 The Secretary reiterated his earlier request that States that were yet to nominate their PBN Focal Points to do so at the earliest as the role of the State PBN Focal Point was crucial to the implementation of the State PBN Plan. He also requested States to submit the runway data at the earliest.

11.4 Mr. Makoto Eguchi thanked ICAO for providing an opportunity to JCAB to host the APAC PBN Task Force Meeting in Japan.

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PBN/TF/4 - List of Participants
(Osaka, Japan, 4-6 March 2009)

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	57	Mr. Robert Carty *(Speaker)*	FAA Flight Standards Service		
	58	Mr. Daniel Hanlon	Air Traffic Organization Representative FAA Asia Pacific US Embassy Singapore	Tel +65-6543-1466	Dan.hanlon@faa.gov

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LIST OF PAPERS

WORKING PAPERS

Number	Agenda	Title	Presented by
WP/1	1	Adoption of Agenda	Secretariat
WP/2	2	Global PBN Update	Secretariat
WP/3	5	RASMAG Review of Regional PBN Implementation Plan	Secretariat on behalf of RASMAG
WP/4	5	Interpretation of Summary Table and Implementation Targets	Secretariat
WP/5	5	Asia/Pacific Area Traffic Forecasting Group (APA TFG)	Secretariat
WP/6	5	Implementation of PBN in the SAM Region Results of the Work on PBN Done by Project RLA/06/901	Secretariat

INFORMATION PAPERS

Number	Agenda	Title	Presented by
IP/1	-	List of Working Papers (WPs) and Information Papers (IPs)	Secretariat
IP/2	3	Creation of the Bay of Bengal Reduced Horizontal Separation Implementation Task Force	Secretariat
IP/3	3	Review of the Fourth Meeting of South-East Asia RNP Implementation Task Force	Secretariat
IP/4	9	PBN Implementation in the Enroute Phase	IATA

FLIMSY PAPERS

Number	Agenda	Title	Presented by
		Task Lists: PBN/TF/1, PBN/TF/2, PBN/TF/3	Secretariat
		TOR (Revised)	Secretariat

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TASK LIST - Regional PBN Implementation Plan Subgroup

No.	PERFORMANCE OBJECTIVE	ICAO Strategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	Status
1-1	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **Introduction** Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Mr. Noppadol Pringvanich (AEROTHAI)	– Mr. Doug Michael (IATA)	Closed
1-2	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **PBN Operational requirements & Implementation Strategy** Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Mr. Noppadol Pringvanich (AEROTHAI)	– Mr. Doug Michael (IATA), – Mr. Tan Yean Guan (CAA Singapore), – Mr. Raymond Kwok-chu LI (CAD Hong Kong), – Mr. WXS Croos (Airport&Aviation Sri Lanka), – Capt Korn Mansumitchai (IFALPA), – Mr. Liu Song (CAAC)	Closed
1-3	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **Current Status & Forecast: APAC traffic forecast** Section for Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Mr. Doug Michael (IATA)	– Mr. Noppadol Pringvanich (AEROTHAI)	Closed

No.	PERFORMANCE OBJECTIVE	ICAO Strategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	Status
1-4	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **Current Status & Forecast: Aircraft fleet readiness status** Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Mr. Doug Michael (IATA)	– Mr. Noppadol Pringvanich (AEROTHAI)	Closed
1-5	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **Current Status & Forecast: CNS Infrastructure** Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Mr. Noppadol Pringvanich (AEROTHAI)	– All RPSG members	Closed
1-6	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **Safety Assessments and Monitors** Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Mr. Hajime Yoshimura (JCAB)	– Mr. Tan Yean Guan (CAA Singapore), – Capt. Alex Passerini (Qantas-Australia)	Closed
1-7	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **Appendix A - Reference documentation for developing operational and airworthiness approvals** Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Capt. Alex Passerini (Qantas-Australia)	– Mr. Doug Michael (IATA), – Mr. Noppadol Pringvanich (AEROTHAI)	Closed
1-8	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **Appendix B – Practical Example of tangible benefits** Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Capt. Alex Passerini (Qantas-Australia)	– Mr. Edsall Williams (Airservices-Australia), – Mr. Noppadol Pringvanich (AEROTHAI)	On-going

No.	PERFORMANCE OBJECTIVE	ICAO Strategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	Status
1-9	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Draft **Appendix C – Procedure to modify the regional plan** Section for PBN Regional Plan	To facilitate the development of the Regional Plan	Draft document	17 March 2008	Mr. Li Peng (ICAO APAC)	– Mr. Noppadol Pringvanich (AEROTHAI)	Closed
1-10	PBN Coordination & Implementation	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Identify the short falls preventing the implementation of PBN	To identify preventive measures and to support PBN implementation	Working Papers	1 April 2008	All RPSG members		On-going
1-11	PBN Coordination & Implementation	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Identify training requirements	To assist States in their planning and implementations	Working Papers	1 April 2008	All RPSG members		On-going
1-12	PBN Coordination & Implementation	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Assess possibilities of future PBN seminar	To assist States in their planning and implementations	Working Papers, Information Papers	1 April 2008	All RPSG members		Closed
1-13	PBN Coordination & Implementation	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Identify ways and means to share resources	To assist States in their planning and implementations	Working Papers	1 April 2008	All RPSG members		Ongoing
1-14	PBN Certification Process	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Develop standard template for application & approval package	To harmonize PBN approval process within the region	Working Papers, Draft template	1 April 2008	Capt. Alex Passerini (Qantas-Australia)	– Mr. Doug Michael (IATA), – Capt. Aric Oh (IATA)	Closed

No.	PERFORMANCE OBJECTIVE	ICAO Strategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	Status
1-15	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	ICAO, via a State letter, to request States to update information on CNS infrastructure in the FASID table	To obtain information necessary for regional planning	State letters, Updated FASID table	1 April 2008	ICAO Bangkok Office		Closed
2-1	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Each State, which has not submit the updated FASID table to ICAO, to update the content of the FASID table and submit the updated table to ICAO Regional Office.	To obtain information necessary for regional planning	Updated FASID table	July 2008	All RPSG members		Ongoing
2-2	PBN Coordination & Implementation	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	To draft a program for the proposed PBN seminar and circulate the drafted program to RPSG members for review and comments.	To facilitate PBN training	Draft program for future PBN seminar	July 2008	Mr. Hajime Yoshimura (JCAB) and Mr. Noppadol Pringvanich (AEROTHAI)	All RPSG members	Closed
2-3	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	To review the current agreed draft Regional Plan and to study other draft materials.	To facilitate the development of the Regional Plan	-	July 2008	All RPSG members		Closed
2-4	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	ICAO Regional Office to coordinate with ATM/AIS/SAR Subgroup of APANPIRG to ensure consistency of planning and usages of terminology.	To facilitate the development of the Regional Plan	Coordination with ATM/AIS/SAR	Next APANPIRG meeting	ICAO Regional Office		Closed

No.	PERFORMANCE OBJECTIVE	ICAO Strategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	Status
2-5	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Dave VanNess to prepare a presentation on ICAO definitions of Non-Precision Approach, Approach with Vertical Guidance, and Precision Approach	Clarification on the terminology	Presentation	July 2008	Dav VanNess		Closed
3-1	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	IATA to submit the result from the fleet readiness survey to be integrated as part of the Regional Plan	To facilitate the development of the Regional Plan	Reviewed Regional Plan	July 2008	Mr. Doug Michael (IATA)	– Mr. Noppadol Pringvanich (AEROTHAI)	Closed
3-2	PBN Planning	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Review the current agreed draft Regional Plan and to provide appropriate comments.	To facilitate the development of the Regional Plan	Survey Result	July 2008	All RPSG members		Closed

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TASK LIST – State PBN Implementation Plan Subgroup

No.	PERFORMANCE OBJECTIVE	ICAO Strategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	Status
1	Current Levels of State Operations and Initial Intent	Establish current Regional position		Invited to provide Brief to present to Working Group	Understand the starting point for implementation of PBN	Brief presented to Working Group	Next Meeting (1 – 3 Apr 08)	Mr Henrik Nielsen (CASA, Australia)		CLOSED Jul 2008 States should now be working on their actual implementation plans
2	List of Issues	Establish list of Local and General Issues which should be addressed during implementation of PBN		Establish source list of issues	Establish checklist of issues to be addressed	List of Issues	APANPIRG/ 19	Mr Henrik Nielsen (CASA, Australia)		CLOSED Moved to Item No 7, to include Milestone Items
3	PBN Training Material	Provide Training Framework and individual training packages for pilots, controllers, regulators etc		Training framework and material	Provide training material to Regional States plus States of other Regions	Training packages	Framework by next Meeting (1 – 3 Apr 08)	Mr Henrik Nielsen (CASA, Australia)		ON-GOING March 2009 IFALPA, QANTAS, Pakistan and China to provide refined lists of training objectives for PBN operations
4	On-The-Job Training specifically with regard to PBN Procedure Design	Establish ability and intent of States to offer participation		Provide education for States, specifically relating to PBN Procedure Design	Greater spread of knowledge with regards to PBN Procedure Design	Training	Next Meeting (1 – 3 Apr 08)	Mr Henrik Nielsen (CASA, Australia)		CLOSED Function to be achieved through proposed Flight Procedures Office (FPO)

No.	PERFORMANCE OBJECTIVE	ICAO Strategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	Status
5	Provision of Model Operational and Air Worthiness Approval Documentation	Model Approval Documentation		Assist States with approval documentation	Greater understanding of approval process	Operational and Air Worthiness Approval Documentation	Next Meeting (1 – 3 Apr 08)	Mr Honghai Yang (China)		CLOSED Implementation document made available to member States as Attachment to Meeting Report No 2.
6	Updates to List of Issues and Milestones Issues for 'Road map' towards PBN	List of Issues and Milestone		Assist States developing	Understand 'Road' towards PBN	List of Issues		Mr Henrik Nielsen (CASA, Australia)		CLOSED July 2008 Sample contents list and implementation plans were identified at ATT 1 and at the PBN web site
7	New Zealand to provide consolidated PBN NAV Specifications matrix	PBN Matrix Development			Assisting Certification efforts	PBN Matrix	16 Jun 08	Mr Ron Doggett (New Zealand CAA)		CLOSED July 2008 The PBN Task Force should request that the SASP panel develop appropriate separation standards aligned with PBN

No.	PERFORMANCE OBJECTIVE	ICAO Strategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	Status
9	Provide proposed format and agenda items for proposed PBN Seminar to be held in Sukuoka, Japan during November 2008	Future PBN Seminar		Provide feedback to	Provide greater training opportunity	Provide feedback	Next Meeting (16 – 18 Jul 08)	Mr Henrik Nielsen (CASA, Australia)		CLOSED July 2008 List of topics noted. Additional topics: Training issues, and RNP-AR Specials approvals process (NZ / AU)
10	Provide feedback to State Letter on FPO concept	Implementing a Flight Procedure Office in the Asia Pacific Region			Provide assistance with procedure design	Reply to State Letter	Date specified in State Letter (nominally 16 Jun 08)	Mr David van Ness (ICAO, Montreal)		CLOSED July 2008 This item to be discussed at the Task Force Group level

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC REGIONAL PERFORMANCE-BASED NAVIGATION IMPLEMENTATION PLAN

Interim Edition

VERSION 0.2

PBN TF/4 March 2009

RECORD OF AMENDMENT

Version	Activity	Date
0	Adopted by APANPIRG/19 as Interim Edition	September 2008
0.1	RASMAG Proposal	December 2008
0.2	Amended/Finalized by PBN/TF/4	March 2009

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ASIA/PACIFIC REGIONAL PERFORMANCE-BASED NAVIGATION IMPLEMENTATION PLAN

1. Executive Summary

1.1 This Asia/Pacific Regional PBN Implementation Plan has been produced in line with Resolution A 36/23 adopted by ICAO Assembly in its 36th Session held in September 2007 and Conclusion 18/52 adopted by APANPIRG/18. The Regional PBN Plan addresses the strategic objectives for PBN implementation based on clearly established operational requirements, avoiding equipage of multiple on-board or ground based equipment, avoidance of multiple airworthiness and operational approvals and explains in detail contents relating to potential navigation applications. The Plan envisages the conduct of pre- and post-implementation safety assessments and continued availability of conventional air navigation procedures during transition. The Plan also discusses issues related to implementation which include traffic forecasts, aircraft fleet readiness, adequacy of ground-based CNS infrastructure etc. Implementation targets for various categories of airspace for the short term (2008 – 2012) and for the medium term (2013 – 2016) have been projected in tabular forms to facilitate easy reference. For the long term (2016 and beyond) it has been envisaged that GNSS will be the primary navigation infrastructure. It is also expected that precision approach capability using GNSS and its augmentation system will become available in the long term.

2. Explanation of Terms

2.1 The drafting and explanation of this document is based on the understanding of some particular terms and expressions that are described below:

2.1.1 **Asia/Pacific Regional PBN Implementation Plan.** A document adopted by APANPIRG, often referred to as the "Regional PBN Plan", offering appropriate guidance for air navigation service providers, airspace operators and users, regulating agencies, and international organizations on the evolution of navigation capabilities as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short, medium and long term in the APAC Region.

2.1.2 **Performance Based Navigation** Performance based navigation specifies RNAV and RNP system performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in an airspace.

2.1.3 **Performance requirements.** Performance requirements are defined in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. Performance requirements are identified in navigation specifications which also identify which navigation sensors and equipment may be used to meet the performance requirement.

3. Acronyms

3.1 The acronyms used in this document along with their expansions are given in the following list

ABAS	Aircraft-Based Augmentation System
AIS	Aeronautical Information Services
APAC	Asia and Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APV	Approach Procedures with Vertical Guidance
ATC	Air Traffic Control
Baro VNAV	Barometric Vertical Navigation
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management

CPDLC	Controller Pilot Data Link Communications
DME	Distance Measuring Equipment
EMA	En-route Monitoring Agency
FASID	Facilities and Services Implementation Document
FIR	Flight Information Region
FMS	Flight Management System
GBAS	Ground-Based Augmentation System
GNSS	Global Navigation Satellite System
GRAS	Ground-based Regional Augmentation System
IATA	International Air Transport Association
IFALPA	International Federation of Air Line Pilots' Associations
INS	Inertial Navigation System
IRU	Inertial Reference Unit
PANS	Procedures for Air Navigation Services
PBN	Performance Based Navigation
PIRG	Planning and Implementation Regional Group
RASMAG	Regional Airspace Safety Monitoring Advisory Group
RCP	Required Communication Performance
RNAV	Area Navigation
RNP	Required Navigation Performance
SARP	Standards and Recommended Practices
SBAS	Satellite-Based Augmentation System
SID	Standard Instrument Departure
STAR	Standard Instrument Arrival
TMA	Terminal Control Area
VOR	VHF Omni-directional Radio-range
WGS	World Geodetic System

4. Introduction

Need for the regional PBN Implementation Plan

4.1 The Thirty-sixth Session of the ICAO Assembly held in Montreal in September 2007 adopted a Resolution to resolve that States and PIRGs complete a regional PBN implementation plan by 2009.

4.2 Recognizing that the PBN concept is now established, States should ensure that all RNAV and RNP operations and procedures are in accordance with the PBN concept as detailed in State letter AN 11/45-07/22 and the ICAO Doc 9613: PBN Manual for ensuring a globally harmonized and coordinated transition of PBN.

4.3 In view of the need for detailed navigation planning, it is advisable to develop a Regional PBN Plan to provide proper guidance to air navigation service providers, airspace operators and users, regulating agencies, and international organizations, on the evolution of navigation capabilities as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short and medium term in the APAC Region.

4.4 Furthermore, the Asia/Pacific Regional PBN Implementation Plan will contain the basic material serving as guidance for regional projects for the implementation of air navigation infrastructure, such as ABAS, SBAS, GBAS, GRAS, etc., as well as for the development of national implementation plans.

Roles of Navigation in supporting ATM operations

4.5 An "airspace concept" may be viewed as a general vision or master plan for a particular airspace. Based on particular principles, an airspace concept is geared towards specific objectives. Strategic objectives drive the general vision of the airspace concept. These objectives are usually identified by

airspace users, air traffic management (ATM), airports as well as environmental and government policy. It is the function of the airspace concept and the concept of operations to respond to these requirements. The strategic objectives which most commonly drive airspace concept are safety, capacity, efficiency, access, and the environment.

4.6 Navigation is one of several enablers of an airspace concept. Communications, ATS Surveillance and ATM are also essential elements of an airspace concept.

4.7 The PBN–concept specifies RNAV and RNP system performance requirements in terms of accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of a particular Airspace Concept, when supported by the appropriate navigation infrastructure. In that context, the PBN concept represents a shift from sensor-based to performance-based navigation. Performance requirements are identified in navigation specifications which also identify the choice of navigation sensors and equipment that may be used to meet the performance requirements. These navigation specifications are defined at a sufficient level of detail to facilitate global harmonization by providing specific implementation guidance for States and operators.

4.8 Under the PBN concept, the generic navigation requirements are defined based on operational requirements. Thus, users may evaluate the available options. To ensure synchronization of investment and interoperability of the airborne and ground systems, the selection of the solution should be in consultation with aviation stakeholders, including international and domestic airline operators, air navigation service providers, and regulators. The solution selected should also be the most cost-effective one.

4.9 The development of the PBN concept recognized that advanced aircraft RNAV systems are achieving an enhanced and predictable level of navigation performance accuracy which, together with an appropriate level of functionality, allows a more efficient use of available airspace to be realized. It also takes account of the fact that RNAV systems have developed over a 40-year period and as a result there were a large variety of differing implementations globally. Identifying navigation requirements rather than on the means of meeting the requirements will allow use of all RNAV systems meeting these requirements irrespective of the means by which these are met.

Benefits of Performance-Based Navigation

4.10 The main benefits derived from the implementation of PBN are:

a) Increased airspace safety through the implementation of continuous and stabilized descent procedures using vertical guidance;
b) Reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel, noise reduction, and enhanced environmental protection;
c) Use of the RNAV and/or RNP capabilities that already exist in a significant percentage of the aircraft fleet flying in APAC airspace;
d) Improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimized RNAV or RNP paths;
e) Implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows;
f) Reduced delays in high-density airspaces and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas;
g) Reduction of lateral and longitudinal separation between aircraft to accommodate more traffic;
h) Decrease ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the needs for ATC-Pilot communications and radar vectoring;
i) Increase of predictability of the flight path.

Goals & Objectives of PBN Implementation

4.11 APANPIRG, in its Eighteenth meeting (September 2007), discussed various issues related to an early implementation of PBN in the region. To facilitate coordination between States, a PBN Task Force was formed under Conclusion 18/52 and tasked to develop a harmonized regional PBN implementation plan.

4.12 The Asia/Pacific Regional PBN Implementation Plan has the following strategic objectives:

a) To ensure that the implementation of the navigation item of the CNS/ATM system is based on clearly established operational requirements.
b) To avoid undue equipage of multiple on board equipment and/or ground-based systems.
c) To avoid the need for multiple airworthiness and operational approvals for intra- and inter-regional operations.
d) To explain in detail the contents of the Regional Air Navigation Plan, relating to potential navigation applications.

4.13 Furthermore, the Asia/Pacific Regional PBN Implementation Plan will provide a high-level strategy for the evolution of the navigation applications to be implemented in the APAC Region in the short term (2008-2012) and medium term (2013-2016). This strategy is based on the concepts of Area Navigation (RNAV) and Required Navigation Performance (RNP) in accordance with ICAO Doc. 9613: *Performance Based Navigation Manual*, and will be applied to aircraft operations involving instrument approaches, standard departure (SID) routes, standard arrival (STAR) routes, and ATS routes in oceanic and continental areas.

4.14 The Regional PBN Plan was developed by the APAC States together with the international organizations concerned (including IATA and IFALPA)~~,~~ and is intended to assist the main stakeholders of the aviation community plan a gradual transition to the RNAV and RNP concepts. The main stakeholders of the aviation community that benefit from this Regional Plan are:

- Airspace operators and users.
- Air navigation service providers.
- Regulating agencies.
- International organizations.

4.15 The Regional PBN Plan is intended to assist the main stakeholders of the aviation community plan the future transition and their investment strategies. For example, airlines and operators can use this Plan to derive future equipage and additional navigation capability investments; air navigation service providers can plan a gradual transition for the evolving ground infrastructure. Regulating agencies will be able to anticipate and plan for the criteria that will be needed in the future.

4.16 Recognizing the safety benefits of PBN, the thirty-sixth session of the ICAO Assembly held in Montreal, September 2007 adopted a Resolution to resolve that States and PIRGs prepare ~~a~~ PBN implementation plans by 2009 to achieve:

a) Implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones; and
b) Implementation of APV (Baro-VNAV and/or augmented GNSS) 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.

The ICAO Assembly also urges that States include in their PBN implementation plan provisions for implementation of APV to all runway ends serving aircraft with a maximum certificated take-off mass of 5700 kg or more, according to established timelines and intermediate milestones.

Planning Principles

4.17 Planning for the implementation of PBN in the APAC Region shall be based on the following principles:

a) Pre- and post-implementation safety assessments will be conducted in accordance with ICAO provisions to ensure the application and maintenance of the established target levels of safety.
b) Continued application of conventional air navigation procedures during the transition period, to guarantee the operations by users that are not RNAV and/or RNP equipped.
c) The first regional PBN implementation plan should address the short term (2008-2012) and medium term (2013-2016) and take into account long term global planning issues.
d) Target date for preparation of the first regional PBN implementation plan is APANPIRG/19 (September 2007).

5. PBN Operational Requirements & Implementation Strategy

5.1 Introduction of PBN should be consistent with the Global Air Navigation Plan. Moreover, PBN implementation shall be in full compliance with ICAO SARPs and PANS and support relevant ICAO Global Plan Initiatives.

5.2 The ICAO Council accepted the second amendment to the Global Air Navigation Plan for the CNS/ATM System in November 2006. The approved plan has been renamed as Global Air Navigation Plan (Doc 9750). The relevant Global Plan Initiatives including implementation of performance based navigation (PBN) and navigation system have been included in the Global Plan. The introduction of PBN must be supported by an appropriate navigation infrastructure consisting of an appropriate combination of Global Navigation Satellite System (GNSS), self-contained navigation system (inertial navigation system) and conventional ground-based navigation aids.

5.3 The *Strategy for the Provision of Precision Approach, Landing & Departure Guidance Systems* and the *Strategy for Implementation of GNSS Navigation Capability* were reviewed and updated by the Eleventh meeting of CNS/MET Sub Group of APANPIRG in July 2007. The updated strategies were reviewed and adopted by APANPIRG as *Strategies for the Provision of Navigation Services* in its Eighteenth meeting held in September, 2007 under Conclusion 18/30.

Route Operations

5.4 As the routes structure and en-route operation are extensive and complicated in APAC – region, it is difficult to restructure and include the whole airspace in a single implementation plan for en-route operations.

5.5 Considering the traffic characteristics and CNS/ATM capability, en-route operations can be classified as Oceanic, Remote continental, and Continental en-route.

5.6 In principle, each classification of en-route operation (paragraph 5.5 above) should adopt, but not be limited to, a single RNAV or RNP navigation specification. This implementation strategy should be applied by implementing States in coordination with airspace users.

5.7 APANPIRG established the PBN Task Force to develop a PBN implementation plan for the Asia/Pacific Region and to address related regional PBN implementation issues. Accordingly, States are encouraged to work cooperatively bilaterally, multilaterally and with the PBN Task Force to ensure regional and sub-regional harmonization of en-route PBN implementation.

5.8 In areas where operational benefits can be achieved and appropriate CNS/ATM capability exists or can be provided for a more accurate navigation specification than that specified in this plan, States are

encouraged to introduce the more accurate navigation specification on the basis of coordination with stakeholders and affected States.

5.9 Similarly, in circumstances where affected States are agreeable to completing an implementation in advance of the timelines specified in this plan, early implementation is encouraged on the basis of coordination between affected States and airspace users.

TMA Operations

5.10 TMA operations have their own characteristics, taking into account the applicable separation minima between aircraft and between aircraft and obstacles. TMA operations also involve the diversity of aircraft, including low-performance aircraft flying in the lower airspace and conducting arrival and departure procedures on the same path or close to the paths of high-performance aircraft.

5.11 In this sense and as called for under APANPIRG Conclusion 18/53, States shall develop their own national plans for the implementation of PBN in sovereign TMAs. Such national plans should be based on the Asia/Pacific Regional PBN Implementation Plan, seek the harmonization of the application of PBN and avoid the need for multiple operational approvals for intra- and inter-regional operations. Applicable aircraft separation criteria should also be considered.

Instrument Approaches

5.12 States are encouraged to introduce PBN approaches that provide Vertical Guidance to enhance safety. Conventional approach procedures and conventional navigation aids should be maintained to support non-equipped aircraft during the transitional period.

5.13 During early implementation of PBN, IFR Approaches based on PBN should be designed to accommodate a mixed-equipage (PBN and non-PBN) environment. ATC workload should be taken into account while developing approach procedures. One possible way to accomplish this is to co-locate the Initial Approach Waypoint for both PBN and conventional approaches

6. Current Status & Forecast

APAC traffic forecast

6.1 Traffic forecasts have a special role to play in the planning and implementation processes; they represent the demand for future ATM. Global Air Navigation Plan (Doc 9750) requires that the Planning and Implementation Regional Groups (PIRGs) base their work on well developed traffic density forecasts. Guidance on the preparation of traffic forecasts is provided in *Manual on Air Traffic Forecasting* (Doc 8991). At the Asia/Pacific regional level, the traffic forecasting activities were started with the formation of ICAO Pacific Area Traffic Forecasting Group formed in 1991. The scope of the group was subsequently broadened to include Intra-Asia/Pacific traffic also and the group was renamed as Asia/Pacific Area Traffic Forecasting Group (APA TFG).

6.2 Report of the Fourteenth meeting of Asia/Pacific Area Traffic Forecasting Group (APA TFG/14) has been published as Doc 9915. Report includes medium term forecasts of air traffic in the Transpacific area and for selected Transpacific and Asia/Pacific city pair markets through 2012. Report also contains a long term forecast with a horizon to the year 2015 and the short term forecast for the period 2008 – 2010 and intermediate forecasts for each of the years 2015 and 2020.

6.3 The February 2008 forecast prepared by IATA for APAC traffic in respect of passenger, cargo, aircraft movements and new aircraft deliveries in the Regions is also provided in the Appendix B to this plan as reference.

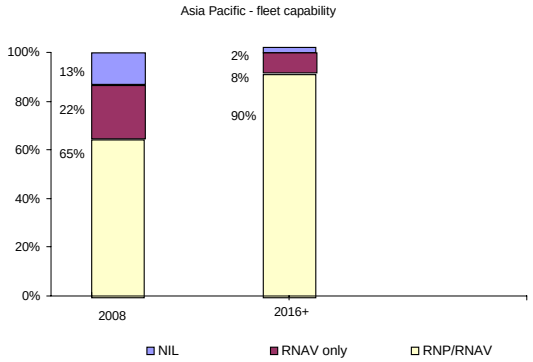
Aircraft fleet readiness status

6.4 2007 was a record year for Asia/Pacific airlines with 418 new aircraft deliveries and more than 1,000 new orders. The overall number of deliveries to Asia/Pacific based airlines in 2008 is expected to total 430 aircraft.

6.5 All major commercial aircraft manufacturers since the 1980's have included RNAV capabilities. The commercial aircraft currently produced incorporate an RNP capability.

6.6 One significant issue for PBN implementation today is directly related to the multitude of FMS installations and varying degrees of capabilities associated with the current fleet of RNAV aircraft. Specifically, there are numerous FMS systems installed in today's fleets, all with varying capabilities.

6.7 The diagram below displays a high level analysis based on fleet numbers from Ascend Online Fleets database March 2008 and RNAV/RNP classification by IATA.



CNS Infrastructure

Navigation infrastructure

Global Navigation Satellite System (GNSS)

6.8 Global Navigation Satellite System (GNSS) is a satellite-based navigation system utilizing satellite signals, such as Global Positioning System (GPS), for providing accurate and reliable position, navigation, and time services to airspace users. In 1996, the International Civil Aviation Organization (ICAO) endorsed the development and use of GNSS as a primary source of future navigation for civil aviation. ICAO noted the increased flight safety, route flexibility and operational efficiencies that could be realized from the move to space-based navigation.

6.9 GNSS supports both RNAV and RNP operations. Through the use of appropriate GNSS augmentations, GNSS navigation provides sufficient accuracy, integrity, availability and continuity to support en-route, terminal area, and approach operations. Approval of RNP operations with appropriate certified avionics provides on-board performance monitoring and alerting capability enhancing the integrity of aircraft navigation.

6.10 GNSS augmentations include Aircraft-Based Augmentation System (ABAS), Satellite-Based Augmentation System (SBAS), Ground-Based Augmentation System (GBAS), and Ground-based Regional Augmentation System (GRAS).

Other PBN navigation infrastructure

6.11 Other navigation infrastructure includes INS, VOR/DME, DME/DME, and DME/DME/IRU. These navigation infrastructures may satisfy the requirements of RNAV navigation specifications, but not those of RNP.

6.12 INS may be used to support PBN en-route operations with RNAV 10 and RNAV 5 navigation specifications.

6.13 VOR/DME may be used to support PBN en-route and STAR operations based on the RNAV 5 navigation specification.

6.14 Uses of DME/DME and DME/DME/IRU may support PBN en-route and terminal area operations based on RNAV 5, RNAV 2 or RNAV 1 navigation specifications. Validation of DME/DME coverage area and appropriate DME/DME geometry should be conducted to identify possible DME/DME gaps, including identification of critical DMEs, and to ensure proper DME/DME service coverage.

Surveillance infrastructure

6.15 For RNAV operations, States should ensure that sufficient surveillance coverage is provided to assure the safety of the operations. For RNP operations, surveillance coverage may not be required. Details on the surveillance requirements for PBN implementation can be found in the ICAO PBN Manual and ICAO PANS-ATM (Doc 4444), and information on the current existing surveillance infrastructure in APAC can be found in ICAO FASID tables.

Communication infrastructure

6.16 Implementation of RNAV/RNP routes includes communication requirements. Details on the communication requirements for PBN implementation can be found in ICAO PANS-ATM (Doc 4444), ICAO RCP Manual (Doc 9869), and ICAO Annex 10. Information on the current existing communication infrastructure in APAC can also be found in ICAO FASID tables.

7. Implementation Plan for Performance Based Navigation

ATM Operational Requirements

7.1 The Global ATM Operational Concept (Doc 9854) makes it necessary to adopt an airspace concept able to provide an operational scenario that includes route networks, minimum separation standards, assessment of obstacle clearance, and a CNS infrastructure that satisfies specific strategic objectives, including safety, access, capacity, efficiency, and environment.

7.2 In this regard, the following programmes will be developed:

a) traffic and cost benefit analyses
b) necessary updates on automation
c) operational simulations in different scenarios
d) ATC personnel training
e) Flight plan processing
f) Flight procedure design training to include PBN concepts and ARINC-424 coding standard
g) Enhanced electronic data and processes to ensure appropriate level of AIS data accuracy, integrity and timeliness
h) WGS-84 implementation in accordance with ICAO Annex 15
i) iuniform classification of adjacent and regional airspaces, where practicable
j) RNAV/RNP applications for SIDs and STARs

k) Coordinated RNAV/RNP routes implementation
l) RNP approach with vertical guidance

Short Term Implementation Plan

Route Operations

7.3 During the planning phase of any implementation of PBN routes, States should gather inputs from all aviation stakeholders to obtain operational needs and requirements. These needs and requirements should then be used to derive airspace concepts and to select appropriate PBN navigation specification.

7.4 In this phase, the application of RNAV 10 and RNP 4 navigation specifications is expected for Oceanic and Remote continental routes. Prior to implementation of RNP 4, States should consider air traffic demands, ATC workload, surveillance and communication capabilities and fleet readiness statistics, and consult all stakeholders.

7.5 For Continental routes, the application of RNAV 5 and RNAV 2 navigation specifications is expected. In the continental en-route areas of operation, States may choose to implement RNAV 2 routes to enhance efficiency of airspace usage and support closer route spacing, noting that appropriate communication and surveillance coverage must be provided. The RNAV 2 navigation specification can also be used in airspace~~,~~ where sufficient CNS capability is provided and there are operational benefits.

TMA Operations

7.6 In selected TMAs, the application of RNAV 1 in a radar environment can be supported though the use of GNSS or ground navigation infrastructure, such as DME/DME and DME/DME/IRU. In this phase, mixed operations (equipped and non-equipped) will be permitted.

7.7 In a non-radar environment and/or in an environment without adequate ground navigation infrastructure, the SID/STAR application of Basic-RNP1 is expected in selected TMAs with exclusive application of GNSS. In this phase, mixed operations (equipped and non-equipped) will be permitted.

Instrument Approaches

7.8 The application of RNP APCH with Baro-VNAV procedures is expected to be implemented in the maximum possible number of airports, commencing primarily with international airports. To facilitate transitional period, conventional approach procedures and conventional navigation aids should be maintained for non-equipped aircraft.

7.9 States should promote the use of APV operations (Baro-VNAV or augmented GNSS) to enhance safety and accessibility of RNP approaches.

7.10 The application of RNP AR APCH procedures should be considered in selected airports, where obvious operational benefits can be obtained due to the existence of significant obstacles.

Summary table & Implementation targets

Short Term (2008-2012)*		
Airspace	**Preferred Nav. Specifications**	**Acceptable Nav. Specifications**
Route – Oceanic	RNP 4	RNAV 10
Route – Remote continental	RNP 4	RNAV 10
Route – Continental en-route	RNAV 2, RNAV 5	
TMA – Arrival	RNAV 1 in radar environment and with adequate navigation infrastructure. Basic-RNP 1 in non-radar environment	
TMA – Departure	RNAV 1 in radar environment and with adequate navigation infrastructure. Basic-RNP 1 in non-radar environment	
Approach	RNP APCH with Baro-VNAV in most possible airports RNP AR APCH in airport where there are obvious operational benefits.	

Implementation Targets

- RNP APCH (with Baro-VNAV) in 30% of instrument runways by 2010 and 50% by 2012 and priority should be given to airports with operational benefits
- RNAV 1 SID/STAR for 50% of international airports by 2010 and 75% by 2012 and priority should be given to airports with RNP Approach
- Re-defining existing RNAV/RNP routes into PBN navigation specification by 2012
- Implementation of additional RNAV/RNP routes

*** Note:** Early completion of an implementation is encouraged within the timeframe on the basis of coordination between affected States and airspace users.

Medium Term Implementation Plan

Route Operations

7.11 Noting the current development of route spacing standards for RNAV 1, RNAV 2, RNP 2, in this phase, it is expected that the implementations of all existing RNAV/RNP routes are consistent with PBN standards. States are encouraged~~,~~ to harmonize their RNAV/RNP routes based on consistent PBN navigation specifications and separation standards. Implementations of additional RNAV/RNP routes are also encouraged.

7.12 With the utilization of ADS and CPDLC, the application of RNP routes in the Oceanic and Remote continental airspace in the APAC Region is expected. This will permit the use of smaller lateral and longitudinal separation, such as 30 NM based on the RNP 4 navigation specification. States should also consider the fleet readiness status during their planning.

7.13 Noting the current development of RNP 2 navigation specification, in this phase, the application of RNP 2 is expected for the continental en-route airspace with high air traffic density. Depending on the sufficiency of DME/DME coverage or GNSS availability, States may consider the use of RNAV 2 navigation specification.

7.14 In this phase, the establishment of a backup system in case of GNSS failure or the development of contingency procedures will be necessary.

TMA Operations

7.15 Noting the current development of Advanced RNP 1 navigation specification, in this phase, it is expected that the application of RNAV 1 or RNP 1 will be expanded in selected TMAs. The application of RNAV 1/RNP 1 will also depend on DME/DME infrastructure, GNSS availability and aircraft navigation capability. In TMAs of high air traffic complexity and movement, the use of RNAV 1 or RNP 1 equipments will be mandatory. In TMAs of less air traffic complexity, mixed operations will be permitted (equipped or non-equipped).

Instrument Approaches

7.16 In this phase, the extended application of RNP APCH with Baro-VNAV or APV in most airports is expected. These applications may also serve as a back-up to precision approaches and provide vertical guided approaches for the runways without precision approach capability.

7.17 The extended application of RNP AR Approaches is expected for airports where there are operational benefits.

7.18 The introduction of application of landing capability using GNSS and its augmentations is expected to guarantee a smooth transition toward high-performance approach and landing capability.

Summary table & Implementation targets

Medium Term (2013-2016)*		
Airspace	**Preferred Nav. Specification**	**Acceptable Nav. Specification**
Route – Oceanic	RNP 2**, RNP 4	RNAV 10
Route – Remote continental	RNP 2	RNAV 2, RNP 4, RNAV 10
Route – Continental en-route	RNAV 1, RNP 2	RNAV 2, RNAV 5
TMA – Arrival	Expand RNAV 1 or RNP 1 application Mandate RNAV 1 or RNP 1 approval for aircraft operating in higher air traffic density TMAs	
TMA – Departure	Expand RNAV 1 or RNP 1 application Mandate RNAV 1 or RNP 1 approval for aircraft operating in higher air traffic density TMAs	
Approach	Expansion of RNP APCH (with Baro-VNAV) and APV Expansion of RNP AR APCH where there are operational benefits Introduction of landing capability using GNSS and its augmentations	
Implementation Targets • RNP APCH with Baro-VNAV or APV in 100% of instrument runways by 2016 • RNAV 1 or RNP 1 SID/STAR for 100% of international airports by 2016 • RNAV 1 or RNP 1 SID/STAR for 70% of busy domestic airports where there are operational benefits • Implementation of additional RNAV/RNP routes		

*** Note 1:** In circumstances where affected States are agreeable to completing an implementation in advance of the timeline, early implementation is encouraged on the basis of coordination between affected States and airspace users.

** **Note 2:** Related CNS requirements and operational procedures for RNP 2 application in Oceanic Airspace are yet to be determined.

Long Term Implementation Strategies (2016 and beyond)

7.19 In this phase, GNSS is expected to be a primary navigation infrastructure for PBN implementation. States should work co-operatively on a multinational basis to implement GNSS in order to facilitate seamless and inter-operable systems and undertake coordinated research and development programmes on GNSS implementation and operation.

7.20 Moreover, during this phase, States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance.

7.21 With the expectation that precision approach capability using GNSS and its augmentation systems will become available, States are encouraged to explore the use of such capability where there are operational and financial benefits.

8. Transitional Strategies

8.1 During transition to PBN, sufficient ground infrastructure for conventional navigation systems must remain available to serve non-equipped flights. Before existing ground infrastructure is considered for removal, users should be given reasonable transition time to allow them to equip appropriately to attain equivalent PBN-based navigation performance. States should approach removal of existing ground infrastructure with caution to ensure that safety is not compromised. Performance of safety assessments and consultation with users through regional air navigation planning processes will be necessary.

8.2 States should coordinate to ensure that harmonized separation standards and procedures are developed and introduced concurrently in all flight information regions along major traffic flows to allow for a seamless transition towards PBN.

8.3 States should cooperate on a multinational basis to implement PBN in order to facilitate seamless and inter-operable systems and undertake coordinated research and development programmes on PBN implementation and operation.

8.4 States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance**,** taking due consideration of the needs of State aircraft.

8.5 States should encourage operators and other airspace users to equip with PBN-capable avionics. This can be achieved through early introductions of RNP approaches, preferably those with vertical guidance.

8.6 ICAO Asia-Pacific Regional Office should provide leadership supporting implementation and transition towards PBN.

9. Safety Assessment & Monitoring Requirements

Need for a safety assessment

9.1 To ensure that the introduction of PBN applications within the Asia/Pacific Region is undertaken in a safe manner, in accordance with relevant ICAO provisions implementation shall only take place following conduct of a safety assessment by the implementing State or group of States that demonstrates that an acceptable level of safety will be met. This assessment may also need to demonstrate that residual levels of risk associated with specific PBN implementations are acceptable. Additionally, after implementation ongoing periodic safety reviews shall be undertaken by the implementing State or group of States, where required, in order to establish that operations continue to meet acceptable levels of safety.

En-route safety assessment and monitoring

9.2 When considering en-route PBN implementations, the ICAO *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444, Chapter 5, Section 5.4) contains procedures and RNAV procedural separation minima for use in the separation of aircraft in the en-route phase. In some cases, these separation minima require specific RNP capabilities and are based on collision risk modelling which determines communications and surveillance requirements. However, this modelling does not include all operational and technical aspects and is dependent upon parameter values that may vary depending on the particular airspace where the separation minimum will be applied. Therefore, prior

to implementation, a system verification of sufficient duration and integrity must be performed to assess such parameters and conditions including weather deviations or other contingency events for the airspace concerned and to demonstrate that operational and technical requirements will be met.

9.3 APANPIRG has established the Regional Airspace Safety Monitoring Advisory Group (RASMAG) to facilitate the airspace safety monitoring aspects for implementations of reduced separation minima and CNS/ATM applications within the Asia and Pacific Regions. RASMAG has adopted the term En-route Monitoring Agency (EMA) to describe an organization providing airspace safety assessment, monitoring and implementation services for international airspace in the Asia/Pacific region to assist the implementation and operation of reduced horizontal (lateral and longitudinal) separation minima. To ensure regional harmonization of en-route safety assessment requirements and methodologies, implementing States are encouraged to work cooperatively with RASMAG who will provide guidance and technical assistance to States to support their en-route PBN implementations.

Undertaking a safety assessment

9.4 The implementing State or group of States shall ensure that a safety assessment and, where required, ongoing monitoring of PBN implementations are conducted. The implementing State or group of States may have the capability to undertake such activities or, in the case of en-route implementations, may seek assistance from an En-route Monitoring Agency. The latter course of action is preferred as an EMA can establish the necessary monitoring and data collection activity in an effective manner for the international airspaces in which the EMA holds responsibility.

9.5 In undertaking a safety assessment to enable en-route implementation of PBN, a State authority or EMA shall:

1) Establish and maintain a database of PBN approvals;
2) Pre-implementation - conduct safety and readiness assessments and, for international implementations, report results to RASMAG;
3) Post-implementation - maintain awareness of data link performance and monitor aircraft horizontal-plane navigation performance and the occurrence of large navigation errors (lateral and longitudinal), implement remedial actions as necessary and, for international implementations, report results to RASMAG;
4) Monitor operator compliance with State approval requirements after PBN implementation;
5) Initiate necessary remedial actions in any instances where PBN requirements are not met.

9.6 Detailed information relating to the international airspace jurisdiction, roles and responsibilities of regional EMAs is contained in the *Asia/Pacific En-route Monitoring Agency Handbook*, which is available from the ICAO Asia/Pacific Regional Office.

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Appendix A – CHANGES TO THE ASIA/PACIFIC REGIONAL PBN IMPLEMENTATION PLAN

Whenever a need is identified for a change to this document, the Request for Change (RFC) Form (see below) should be completed and submitted to the ICAO Asia and Pacific Regional Office. The Regional Office will collate RFCs for consideration by the Performance Based Navigation Task Force (CNS/MET Sub-group of APANPIRG).

When an amendment has been agreed by a meeting of the Performance Based Navigation Task Force then a new version of the PBN Regional Plan will be prepared, with the changes marked by an "|" in the margin, and an endnote indicating the relevant RFC, so a reader can see the origin of the change. If the change is in a table cell, the outside edges of the table will be highlighted; e.g.:

Final approval for publication of an amendment to the PBN Regional Plan will be the responsibility of APANPIRG.

PBN Regional Plan REQUEST FOR CHANGE FORM

RFC Nr:	

Please use this form when requesting a change to any part of this PBN Regional Plan. This form may be photocopied as required, emailed, faxed or e-mailed to ICAO Asia and Pacific Regional Office +66 (2) 537-8199 or icao_apac@bangkok.icao.int

1. SUBJECT:			
2. REASON FOR CHANGE:			
3. DESCRIPTION OF PROPOSAL: [expand / attach additional pages if necessary]			
4. REFERENCE(S):			
5. PERSON INITIATING:		**DATE:**	
ORGANISATION:			
TEL/FA/X/E-MAIL:			

6. CONSULTATION		**RESPONSE DUE BY DATE:**	
Organization	**Name**	**Agree/Disagree**	**Date**
7. ACTION REQUIRE :			
8. PBN REGIONAL PLAN EDITOR		**DATE REC'D :**	
9. FEEDBACK PASSED		**DATE :**	

AMENDMENT RECORD

Amendment Number	Date	Amended by	Comments

Appendix B – IATA Traffic Forecast

"By 2010 Asia will be the largest single market for aviation" - IATA 27th Feb 2008. Globally predicted passenger traffic will rise by 4.9 per cent per year between 2007 and 2026, almost trebling in two decades as jet planes got bigger and more people flew on them. Meanwhile airfreight will rise by 5.8 per cent annually in the same period.The greatest demand will come from the Asia-Pacific region, where airlines will take delivery of 31 per cent of new planes in the next 20 years, compared with 24 per cent for Europe and 27 per cent for North America.

Passenger
Asia Pacific airlines saw a marginal drop in demand growth from 6.2 per cent in December 2007 to 5.7 per cent in January 2008. Currently, airlines in the region benefited from increased competitiveness due to the strong Euro and the booming economies of both India and China.

Cargo
Steady year-on-year airfreight growth of 4.5 per cent was recorded in January 2008. In the larger freight markets there is continued strength. Asia Pacific airlines saw demand increase 6.5 per cent, up from 6 per cent in December 2007, boosted by the booming economies in China and India.

For the period 2002-2020 aircraft movements are expected to increase at an annual growth rate of 5.4 per cent, to reach almost 294 thousand aircraft movements by the year 2020. Average annual growth rates of 6.5, 5.7 and 5.2 per cent are forecast for the periods 2005 - 2010, 2010-2015 and 2015 - 2020, respectively.

TRANSPACIFIC PASSENGER FORECAST			
Average Annual Percentage Growth Rates			
	Low	Medium	High
2005-2010	5.3	6.5	7.8
2010-2015	4.5	5.7	7.0
2015-2020	4.0	5.2	6.5
2002-2020	4.1	5.4	6.7

The Intra-Asia/Pacific passenger aircraft movements are expected to increase at an average annual growth rate of 4.6 per cent to the year 2020. The growth rates for the intermediate periods of 2005-2010, 2010-2015 and 2015-2020 are 5.0, 4.3 and 4.2 per cent, respectively.

INTRA ASIA /PACIFIC AIRCRAFT MOVEMENT FORECAST			
Average Annual Percentage Growth Rates			
	Low	Medium	High
2005-2010	3.6	5.0	5.5
2010-2015	3.1	4.3	5.2
2015-2020	3.1	4.2	5.2
2002-2020	3.3	4.6	5.6

New Aircraft Deliveries by Region
Record new aircraft orders were placed by the airline industry in 2005 – 2007. The large numbers of new orders represent strong confidence in the future prospects of the global airline industry. In its

latest forecast of aviation growth, European aircraft maker Airbus said the world's fleet of large passenger jets (of more than 100 seats) would double in the next 20 years to nearly 33,000. The greatest demand will come from the Asia-Pacific region, where airlines will take delivery of 31 per cent of new planes in the next 20 years, compared with 24 per cent for Europe and 27 per cent for North America.

New Aircraft Deliveries by Region	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012+**
	Existing						
Africa	**665**	**26**	**15**	**20**	**16**	**13**	**28**
Asia Pacific	**3,578**	**329**	**428**	**407**	**344**	**267**	**440**
Europe	**5,301**	**292**	**348**	**364**	**251**	**153**	**297**
Latin America/Caribbean	**1,031**	**93**	**91**	**45**	**66**	**43**	**65**
Middle East	**626**	**41**	**57**	**44**	**36**	**27**	**164**
North America	**6,987**	**240**	**293**	**309**	**222**	**163**	**412**
Total	**18,188**	**1,026**	**1,237**	**1,208**	**944**	**679**	**1,551**
Increase in Global aircraft fleet (%)	**4.2**	**4.9**	**4.6**	**4.9**	**3.4**	**2.4**	**2.4**

Appendix C - Reference documentation for developing operational and airworthiness approval

TO BE DEVELOPED.

Appendix D – Practical Example of tangible benefits

TO BE DEVELOPED.