

*INTERNATIONAL CIVIL AVIATION ORGANIZATION***SEVENTH MEETING OF THE PERFORMANCE BASED NAVIGATION
TASK FORCE (PBN/TF/7)****Bangkok, Thailand, 1 – 3 September 2010****Agenda Item 5: State / Industry Presentations****PBN MANUAL UPDATE**

(Presented by Australia)

SUMMARY

The ICAO PBN Study Group (PBNSG) is responsible for the rationalisation of global navigation specifications and promulgation of the same in the PBN Manual. New PBN navigation specifications are being finalised and are due for publication in the Fourth Edition of the PBN Manual due for release in March 2011.

1. INTRODUCTION

1.1 Performance Based Navigation (PBN) is an ICAO initiative aimed at improving global aviation safety and efficiency and reducing environmental impact. This is achieved through global harmonisation of navigation specifications permitting greater interoperability between regional ATM systems and reduced administrative requirements. PBN also facilitates reduced separation between aircraft, fewer track miles flown and less time in the air.

1.2 In order to implement the PBN initiative, detailed navigation specifications need to be documented. This process has been undertaken over several years through the development of ICAO Document 9613; The Performance Based Navigation Manual. The PBN Manual has been developed through the combined contribution of State regulatory authorities, air navigation service providers, aircraft manufacturers and other industry representatives.

1.3 The PBN Manual Study Group (PBNSG) meets biannually and is responsible for the future development of the manual, notably new navigation specifications, consistent with technological advancements in aircraft and air traffic management systems. This year has seen additional meetings to accommodate the significant workload required to meet the Fourth Edition publication deadline of March 2011. This paper will discuss developments on the following navigation specifications due for inclusion in the Fourth Edition of the PBN Manual:

- a) Advanced RNP
- b) RNP 2
- c) RNP 0.3

- d) RF (Radius to Fix) Turns
- e) RNP APCH –
 - i. LNAV,
 - ii. LNAV/VNAV,
 - iii. LP, and
 - iv. LPV.
- f) RNP AR Operations
 - i. APCH,
 - ii. DEP (Departure), and
 - iii. EOSID (Engine Out SID).

2. **ADVANCED RNP**

2.1 Advanced RNP is a route specification that is intended for use from terminal area to enroute to terminal area. Advanced RNP uses a variable RNP value from 2.0NM to 0.3NM and is inclusive of Standard Instrument Departures (SIDs) and Standard Arrival Routes (STARs) and RNP APCH – LNAV and LNAV/VNAV approach procedures. Advanced RNP encompasses the following PBN navigation specifications:

- a) RNAV 5,
- b) RNAV 1 and RNAV 2,
- c) Basic RNP 1,
- d) RF Turns, and
- e) RNP APCH – LNAV and LNAV/VNAV.

2.2 It is intended that Advanced RNP would also include RNP 2 as an enroute component of the specification once the navigation specification for RNP 2 has been finalized.

3. **RNP 2**

3.1 A draft RNP 2 navigation specification is being developed and may have applications to both continental enroute and oceanic airspace. RNP 2 could therefore be used as a standalone enroute navigation specification, be encompassed into Advanced RNP or be used as a replacement navigation specification in oceanic airspace for existing specifications such as MNPS.

4. **RNP 0.3**

4.1 An RNP 0.3 navigation specification is being developed for use in areas with limited or no surveillance and is intended primarily for use by helicopters but may also be used by appropriately equipped fixed wing aircraft. RNP 0.3 is intended for use in all phases of flight from departure to the final approach fix.

5. **RF (Radius to Fix) Turns**

5.1 RF turns has been developed as an attachment to Part C of the PBN Manual that will permit the use ARINC 424 Radius to Fix (RF) path terminator functionality when used in association with the following RNP navigation specifications:

- a) Advanced RNP,
- b) Basic RNP 1,
- c) RNP 0.3 and
- d) RNP APCH.

5.2 RF legs are an optional capability rather than a minimum requirement and this functionality can be used in the initial and intermediate approach segments, the final phase of the missed approach, SIDs and STARs.

6. RNP APCH

6.1 RNP APCH includes four sub-categories of approach procedures namely:

- a) LNAV (a non-precision approach (NPA) currently known as RNAV_(GNSS) with lateral guidance provided by non-augmented GNSS),
- b) LNAV/VNAV (an approach with vertical guidance (APV) with lateral guidance provided by non-augmented GNSS and vertical guidance provided by barometric vertical navigation (Baro-VNAV),
- c) LP (an NPA with lateral guidance provided by augmented GNSS resulting in Localizer Performance (LP)), and
- d) LPV (an APV with lateral and vertical guidance provided by augmented GNSS resulting in Localizer Performance with Vertical guidance (LPV)).

6.2 The RNP APCH navigation specification has been divided into Part A and Part B (PBN Manual, Volume II, Part C, Chapter 5) with Part A addressing approaches flown down to LNAV and LNAV/VNAV minima (ie: without GNSS augmentation) and Part B addressing approaches flown down to LP and LPV minima (ie: with GNSS augmentation).

6.3 Typically, the lateral path of an RNP APCH procedure will be the same for all sub-categories of the approach. Where this is the case the available lines of minima published on the approach plate are the indication to the pilot of the type of RNP APCH procedure that can potentially be flown. Individual pilot qualifications, aircraft approach capability and area of operation (ie: inside or outside an SBAS service area) will determine the actual line of minima that the aircraft may be operated to.

6.4 ICAO State Letter SP 65/4-10/53 dated 23 July 2010 provides an attachment detailing the revised RNP APCH navigation specification which has been released ahead of the publication of the Fourth Edition of the PBN Manual for use as interim guidance.

7. RNP AR OPERATIONS

7.1 The RNP AR APCH navigation specification is being expanded to include departures and engine out SIDs. RNP AR DEP, and particularly EOSID, provides significant safety, environmental and operational benefits that go well beyond the boutique application of the navigation specification at terrain challenged aerodromes.

7.2 RNP AR operations use a highly accurate defined path (typically TF to TF and TF to RF path terminators) and are extremely effective at aerodromes in complex airspace (reduced separation standards); remote aerodromes (reduced minima and alternate aerodrome

requirements); and non-ILS runways where Category I ILS like performance can be achieved without associated infrastructure overheads (LLZ and GS equipment, HIAL etc).

7.3 RNP AR APCH and DEP operations are premised on All Engines Operating (AEO) and an RNP value of 0.3 or above. RNP AR APCH is supported by ICAO through the RNP AR Procedure Design Manual which will be amended to include RNP AR DEP procedures. RNP AR APCH and DEP operations are well within the capabilities of most jet passenger aircraft and are simple to fly, but they do have modest crew training, operations manual and regulatory oversight liabilities.

7.4 RNP AR EOSID operations are premised on One Engine Inoperative (OEI) and an RNP value of 0.3 or below. RNP AR EOSID is not supported by ICAO procedure design but rather the navigation specification will be provided as guidance for States and operators who wish to utilize the advanced capabilities and benefits of EOSID operations. EOSID are within the capabilities of the latest jet passenger aircraft such as A320-200 and B737-800 and are relatively simple to fly, but they do have significant crew training, operations manual and regulatory oversight liabilities.

8. ACTION BY THE MEETING

8.1 The meeting is invited to note:

- a) The PBN navigation specifications currently under development and scheduled for inclusion in the Fourth Edition of the PBN Manual due for publication in March 2011.

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