

Performance Based Navigation

Performance Based Navigation (PBN) is now being used in many states and areas worldwide.

IFALPA welcomes this development for the next generation navigation application recognizing that PBN is necessary to resolve the current effects on flight operations with an increase in traffic, demands on airspace capacity, an increased concentration on efficiency and environmental requirements.

As PBN is implemented several issues have come to light that must be addressed from an individual user, aircraft, procedural/regulatory, and air traffic system management levels that must be harmonized and standardized. It is important to note that present safety standards should not only be kept but improved with the continuing introduction of PBN.

PBN Concept

The PBN system consists of the RNAV system whose performance requirements are defined in terms of:

- ▶ Accuracy
- ▶ Integrity
- ▶ Availability
- ▶ Continuity
- ▶ Functionality

PBN Advantages

This concept represents a shift from sensor based to performance based navigation and offers a number of advantages:

- ▶ Reduces need to maintain sensor specific applications
- ▶ Avoids the need to develop sensor specific operations
- ▶ Allows more efficient use of airspace
- ▶ Clarifies how RNAV systems are used
- ▶ Eases operational approval process

With the implementation of applications there will be an increase in capacity; reduced environmental impact; expanded surveillance capability and improved airport access.

PBN Issues

1. Proficiency and Training

IFALPA further recognizes that several of the new PBN approaches have made some airports more accessible and replaced hazardous, slow, steep turn departures with a defined vertical performance rate with minimal turns and therefore increased climb performance.

However, IFALPA has concerns regarding the quality and levels of training that will be provided for aircrews. Globally pilots will not have the same knowledge level and not all flight operations departments understand the complexity, requirements, benefits and capabilities. Therefore, there is a need to establish a common level of proficiency by the users.

IFALPA recommends that PBN issues and proficiency are integrated into the flight training curriculum. For example some companies already do this with an initial two-day ground school followed by the practical instruction in the simulator, while others have up to five days of training and some have minimal mention or scenarios. A common standard of proficiency should be defined by the state regulator, complied with by the operator, and demonstrated by the air crews. The training should be taught by qualified personnel with a deep understanding in procedures and regulations. The training media must include conceptual overview, procedures and demonstrated proficiency in full motion simulators.

Training by “bulletin” is NOT an option and distance learning is NOT an option for acceptable proficiency demonstration.

Specific simulator training;

PBN technologies and procedures need introduction in basic functionalities of:

- ▶ RTA (required time of arrival) / Time Based Arrivals
- ▶ APV (approach procedure with vertical guidance); LNAV Missed Approaches
- ▶ CCO (Continuous Climb Operations/ CDO (Constant Descent Operations)
- ▶ ADS-B (Automatic Dependent Surveillance - Broadcast) based In-Trail level changes

Lastly, there needs to be terrain specific introduction and supervision with reference to the airport.

The training needs to cover:

- ▶ Realistic setup/ briefing
- ▶ Required equipment onboard and on the ground.
- ▶ Navigation System/ FMC cross-checks
- ▶ FMC Database integrity checks
- ▶ Phraseology differences
- ▶ FMC as sole navigational source
- ▶ Less or No opportunity to revert to raw data
- ▶ System Degradations/ Failure
- ▶ PBN requirements
- ▶ PBN technologies and procedures create unique failures and most failures require synthetic familiarization
- ▶ Dual FMC failures
- ▶ Loss of vertical guidance path
- ▶ Continue/ Discontinue decision

In addition, contingencies require a greater understanding of abnormal procedures and a mental picture and situational awareness.

The MEL (Minimum Equipment List) interpretation is more complex and there needs to be immediate knowledge of effects of system degradation in regard to RNP capabilities.

For proficiency it should be recognized that some pilots fly PBN procedures often and some not so often. Therefore there needs to be:

- ▶ Tools and Standard Operating Procedures help to maintain a standard performance criteria
- ▶ Quick Reference Lists
- ▶ PBN section in Normal and Supplementary Procedures
- ▶ Training Information Manual
- ▶ CBT (Computer Based Training)

IFALPA further recommends the introduction of a navigational expert/manager per flight operations department and be responsible for:

- ▶ Performance monitoring
- ▶ Training and procedural concept
- ▶ Train-The-Trainer program
- ▶ Chart and database quality review
- ▶ Q & A

2. Aircraft Systems

Aircraft automation will become more precise and possibly more complex resulting in divergent user platforms based on the buyer's avionics and aircraft manufacturer requirements. These future displays should be capable of displaying any or all technological advances that improve situational awareness with regard to traffic, terrain as well as vertical and lateral profile management.

Therefore IFALPA calls for the systems to be made upgradable, have common "look and feel" characteristics with common procedures between applications and aircraft, and be intuitive for the pilot to readily interpret the information displayed and perform the proper procedure(s).

3. Procedures and design

As with any new technology there are many definitions, names and criteria and these are still evolving. For example currently there are issues with RNP APCH being charted as RNAV (GNSS); the naming Conventions - BRNAV instead of RNAV5; RNP10 instead of RNAV10.

RNP AR APCH – the term RNP understood as a synonym for RNP AR APCH; RNP AR vs. RNP SAAAR.

There are also a diversity of navigation application types:

RNAV 1, RNAV 2, Advanced RNAV 1, RNP AR, RNP, APV, LTS, OTS (Organized Track System), GLS (GNSS Landing System), etc.

This all creates confusion among pilots, airlines and regulators.

Therefore, IFALPA would recommend that the aircrews are trained in:

- ▶ The definitions of RNAV and RNP and the difference of those two.
- ▶ The definitions of Performance requirements that are defined in terms of accuracy, integrity, continuity, availability and functionality.
- ▶ The explanation of ABAS; Aircraft-Based Augmentation System, GRAS; Ground-based Regional Augmentation System, GBAS; Ground-Based Augmentation System, SBAS; Satellite-Based Augmentation System.
- ▶ The definitions of APV; approach with vertical guidance.
- ▶ The definitions of Baro-VNAV and actual operation how to do Baro-VNAV.
- ▶ The definitions of RNAV GNSS Approach and RNP AR.
- ▶ The explanation of RAIM (Receiver Autonomous Integrity Monitoring).

4. Charting and information display

Charting requirements are changing, as one chart contains different types of approaches for example:

RNAV GPS VNAV = Approach Procedure with vertical guidance (APV) will have a Decision Altitude (DA).

RNAV GPS LNAV = Approach Procedure without vertical guidance (NPA) will have a Minimum Descend Altitude (MDA).

RNAV GPS LPV = Approach Procedure with Vertical Guidance by SBAS.

RNAV GPS RNP 0.1 = RNP AR Approach Procedure with Vertical Guidance by BaroVNAV.

Pilots need to know about the consequences; they need to recognize the minima they need to fly and how the minima is flown.

They need to be educated about the technology.

There are many chart inconsistencies which need to be resolved over time but for now there needs to be clear interpretation.

There also appears to be multiple approach identifiers which need to be clearly defined and inevitably there will be times when aircrew could be faced with something they have not seen before.

5. Global Harmonization and Implementation

Despite a global PBN plan there appears to be no harmonized state implementation of PBN. SESAR (Single European Sky ATM Research) and NextGEN have provided regional implementations of PBN but there is little global harmonization. ICAO should be encouraged to promote this by upgrading the procedures to a SARP (Standards and Recommended Practices). There is also a lack of harmonized state implementation of PBN phraseologies. ICAO should publish standard phraseologies for PBN approaches for use by ANSPs and Operators when clearing aircraft for a PBN approach.

Work continues for recognition that aircrews operate globally and that they need a globally harmonized procedure.

Conclusions

The PBN procedures, technology and charts must be globally harmonized. This new method of navigation relies on standardized procedures and regulations. It is incumbent on the aircraft operators that they provide meaningful training to the pilots and that a minimum level of proficiency is demonstrated and maintained. The evolution of using these procedures must be done in a proactive and supportive manner by the operator. This is a much more complicated method of navigating that requires a greater level of precision. There are many safety and efficiency benefits that should be a result of proper implementation. If this is not properly implemented the outcome of a safe aviation system is put at risk with potentially disastrous outcomes.