

Understand more about PBN and what it means for your operations

Performance based navigation (PBN), has already been implemented in some countries and in some it is about to be. It may be required in specific airspace and at certain airports depending on the situation. The challenge, especially for some small operators and/or flight schools is to understand what they have to do about PBN and its associated rules. This article will give you an easy overview of all the aspects you have to consider. And if you still have any questions after reading this, do not hesitate to add them in the comments!

Some history about navigation in aviation

When we first started flying, navigation was based on looking outside the window at landmarks. The next step in navigation saw beacons on land, which meant we could fly around without needing visual clues. To help even more, Inertial Reference Systems (IRS) were developed to provide electronic references with global coverage. The downside of the land based beacons was their range and errors, and for the IRS that they would wander after a while giving an incorrect position. Although the latest IRS were very precise, there were still challenges. The solution came towards the end of the 20th Century when Global Navigation Satellite NSS systems came into play.

The first GNSS systems were not very accurate, but as time has passed, they have become very precise in location determination as well as elevation. This means that many, expensive ground-based beacons are being dismantled. While an NDB approach is still mandatory to train for your license, it is hardly used anymore for commercial flights. In 2002 ICAO published the Global Air Navigation Plan ([second edition](#)) that stated that states should identify the elements of GNSS that are provided and look at the economic savings when decommissioning ground-based navigational aids. In the [third edition](#) of that plan it is stated that the ultimate goal is to transition to GNSS that would eliminate the requirement for ground-based aids because these systems are more reliable and precise.



Maintenance and navigation errors of ground-based navigation systems like NDB and VORs showed that GNSS would enhance navigation performance and would be more cost efficient. Due to enhancing performance it could create more room for aircraft flying closer to each other. Navigation performance around the world uses different terminology so it was also agreed to convert to a single, standard terminology which is all based on the term PBN. PBN: area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

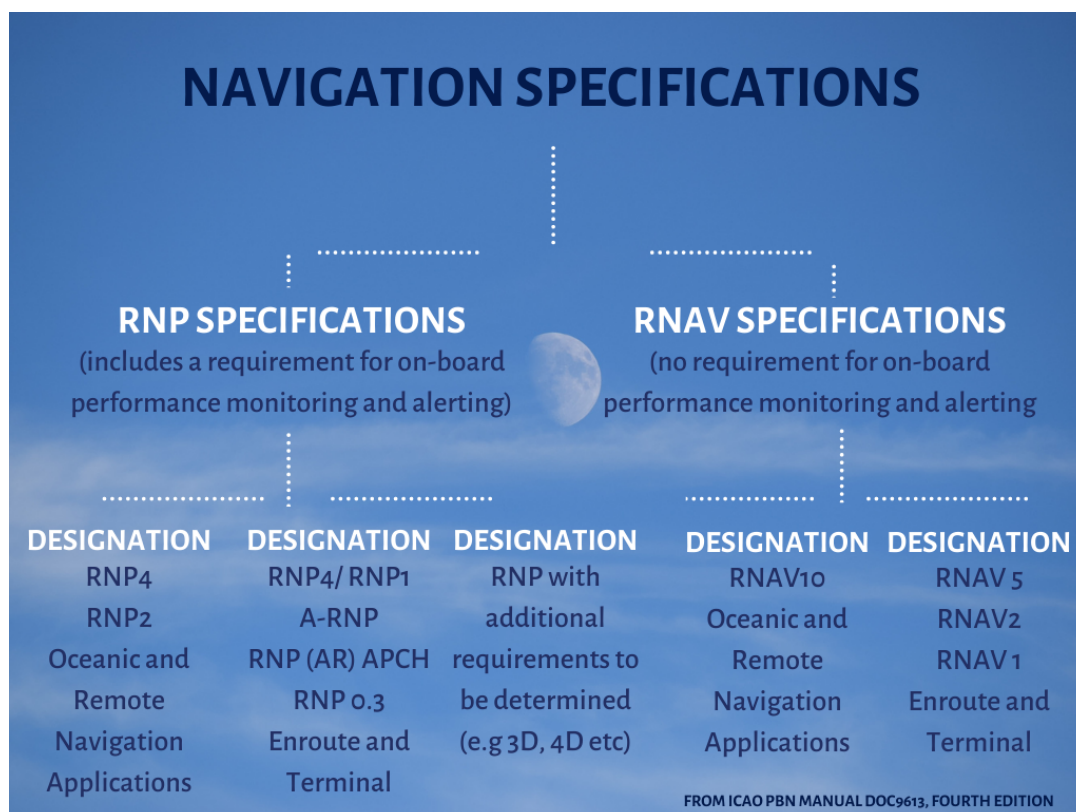
This means four things are needed to utilise PBN:

1. The aircraft needs to be PBN approved – [965/2012: CAT.IDE.A.345 (for NCO, NCC, SPO similar rules)]
2. The operator needs to establish procedures for PBN – [965/2012: ANNEX IV, Subpart B / CAT.OP.MPA.126].
3. The pilot needs to be PBN endorsed – [1178/2011: article 4a / AMC1 FCL.310; FCL.515(b); FCL.615(b) – LOs / appx 7, appx 9 to ANNEX I]
4. The airspace requires PBN – [applicable AIP]

In addition to this, within PBN there are two categories that needs separate approval, RNP AR APCH and RNP 0.3 (H). Which stands for Required Navigation Performance Authorisation Required and Required Navigation Performance of 0,3 NM for helicopters. In this situation the operator needs an approval as well. This relates to SPA.PBN.100 regulation.

Global differences among regulators

As there are a lot of different regulators around the world, not all are using the same terminology. The existing RNP10 designation for example is inconsistent with PBN RNP and RNAV specifications. RNP 10 does not include requirements for on-board performance monitoring and alerting. Renaming current RNP 10 routes, operational approvals, etc., to an RNAV 10 designation would be an extensive and expensive task, which is not cost-effective. Consequently, any existing or new operational approvals will continue to be designated RNP 10, and any charting annotations will be depicted as RNP 10. [PBN manual ICAO - DOC 9613]



The main difference in PBN when looking at RNAV and RNP is that RNP requires on-board performance monitoring and alerting. To learn more details about PBN have a look at the presentation made by ICAO.

The aircraft needs to be PBN approved

At a regulatory level, the requirement is that the operator of an aircraft shall ensure that, when PBN is required for the route or procedure to be flown, that the relevant PBN navigation specification is stated in the AFM or other document that has been approved by the certifying authority as part of an airworthiness assessment or is based on such approval. Additionally, the aircraft must be operated in conformance with the relevant navigation specification and limitations in the AFM or other document referred above. (CAT.OP.MPA.126)

Most commercial aircraft are already PBN approved. The FMC's are well developed and together with the GNSS systems on board they are easily able to achieve an Actual Navigational Performance (ANP) of 0,05, where the Required Navigational Performance (RNP) is 0,3 for an approach. A different case applies for general aviation traffic. More and more single engine piston, 2 or 4 seater aircraft in use at flight schools are being converted for PBN but the 5000 euro cost of investment is naturally a barrier for many.

As is the complexity of the rules, which hopefully this article will help with. To know if the aircraft is approved Air Operations (EU No 965/2012) gives us information on how to find out if your aircraft is approved. When we look at [GM2 CAT.IDE.A.345](#) this Guidance Material gives you a complete list of acceptable sources of information to check if your aircraft is eligible for PBN operation.



The operator needs to establish procedures for PBN

For operations where a specific navigation for PBN has been prescribed and no specific approval (like in SPA.PBN.100) as the operator you will need to establish procedures for this. These procedures are established to make the use of PBN safer. The operator should establish operating procedures specifying normal, abnormal and contingency procedures.

This should cover areas such as, how do you brief PBN operation, how can you see you have a failure and what do you do in case of a failure. Furthermore the operator should establish procedures specifying electronic navigation database management and relevant entries in the Minimum Equipment List (MEL). As the crew is under control of the operator, it should specify the flight crew qualification and proficiency constraints and also ensure that the training programme for relevant personnel is consistent with the intended operation (AMC1 CAT.OP.MPA.126)

The pilot needs to be PBN endorsed



To obtain a PBN approval you need to fulfil certain requirements. You need to complete a course of theoretical knowledge including PBN, complete flying training including PBN and successfully complete a skill test applicable for the aircraft you want to fly. In your licence the term PBN will be added.

As there are no international standards for this yet, NAA's have established their own processes on how to request this endorsement. EASA has made a cross reference excel sheet to find out how your NAA has implemented this endorsement: <https://www.easa.europa.eu/faq/47756>.

What do you have to do when you already have a licence?

If you are already have a license with Instrument Rating, you will need to follow a ground course and simulator training/checking. This program is written into the FCL.600 Instrument rating and most of the NAAs have information available on how to comply. The basic idea is that this conversion training contains all the new items about PBN. Refer to AMC 1 FCL.310, FCL.515(b), FCL.615(b) for the theoretical part.

For the practical part you may think about how to use your flight manual, performance calculation, use of ATC, ATC flight plan, PBN departures and arrivals, etc. all related to PBN operation. This training needs to be followed at an ATO which has the approval for IR training and the capabilities and equipment to train PBN. So when in doubt, and you need this endorsement, just contact a nearby ATO and ask them what you need to do in your specific case.

EASA		Easy Access Rules for Aircrew (Regulation (EU) No 1178/2011)		ANNEX VI (Part-ARA) SUBPART FSTD – SPECIFIC REQUIREMENTS RELATED TO THE QUALIFICATION OF FLIGHT SIMULATION TRAINING DEVICES (FSTDs)						
(d) FSTD Qualification Level recommended:										
	FFS	A	B	C	D	AG	BG	CG	DG	SC
	FTD	1	2	3						
	FNPT	I	II	III	MCC					
	BITD									
Technical criteria primary reference document:										
Validation data roadmap (VDR) ID-No.:										
3. Supplementary information										
Company representative(s) (FSTD operator, Main FSTD user)										
FSTD seats available										
Visual databases used during evaluation										
Other										
4. Training, testing and checking considerations										
CAT I	RVR	m	DH	ft						
CAT II	RVR	m	DH	ft						
CAT III (lowest minimum)	RVR	m	DH	ft						
LVTD	RVR	m								
Recency										
IFR-training/check										
Type rating										
Proficiency checks										
Autocoupled approach										
Autoland/Roll out guidance										
ACAS I / II										
Windshear warning system/predictive windshear										
WX-Radar										
HUD/HUGS										
GPWS/EGPWS										
ETOPS capability										
RNP APCH LNAV										
RNP APCH LNAV/VNAV										
RNP APCH LPV										
RNP AR APCH										
Other										

If you are training to become a pilot, make sure the ATO you are training at has the approval to train PBN. To obtain the PBN privilege or maintain it, at least one approach during your skill test/LPC shall be a RNP APCH. Mind to check the capability of the FSTD if you are doing your LPC on an FSTD. To check this, you need to look at the FSTD certificate. Part 4 of the certificate “training, testing and checking considerations” indicate if an FSTD is capable for: RNP APCH LNAV, RNP APCH LNAV/VNAV, RNP APCH LPV, RNP AR APCH. If either of these are available this FSTD can be used for establishing or revalidation of your PBN endorsement.

The airspace requires PBN

How do you know if the airspace you are flying through requires a certain Required Navigation Performance (RNP)? Implementing Regulation 965/2012 mandates an operator shall ensure that, where the flight is intended to operate on a route or in an area where a navigation specification is prescribed, it has an appropriate RNP approval, and that all the conditions applying to that approval will be satisfied. To ensure this you need to look at your charts and manuals. Let's start with a big one, the North Atlantic: Next to RNAV, this airspace also has different requirements and procedures, but that's a different article for later. The RNAV for OCEANIC airspace can be found in your route manual. Usually this route manual refers to a system like Jeppesen, Lido or something else. The one I have available is Jeppesen and that tells me.

“Horizontal Navigation Requirements for unrestricted NAT HLA AIRSPACE Operations

(a) Lateral Navigation: The navigation system accuracy requirements for NAT MNPSA/HLA operation should only be based on the PBN specifications, RNP10 (PBN application of RNAV10) or RNP 4 (see ICAO PBN Manual Doc 9613).”

This is of course the usual way to find out what you need. But if you want to find the official regulation you will have to look at the respective AIP of the NAT ATS provider (AIP IRELAND for Shanwick, AIP US for New York, AIP Canada for Gander)

The NAT HLA is of course a big area. If we have a look at Europe and we fly from the UK to Greece we cross several countries. For each country the respective AIP tells you the requirements for PBN. Luckily systems like Jeppesen has summarised the information and we don't have to do that ourselves.

Now let's have a look at a specific country, Holland for example, my home country: In Jeppesen, the part for the state rules and procedures – Netherlands, it indicates that for the Amsterdam FIR all aircraft (other than state aircraft) operating on routes above FL 95 shall be equipped with RNAV equipment meeting RNAV 5. No worries so far. But the Amsterdam TMA requires RNAV 1 (except for state aircraft, VFR operations and helicopter operations). I challenge you to do the same for your country. Find out in the AIP what it tells you about PBN.

If we go to a smaller scale, and go to a specific airport, you may find out that NDB/VOR approaches are disappearing and RNP approaches are put in place. This all fits in the concept of upgrading the way we navigate. NDBs and VORs are expensive to maintain and suffer from errors. The approach charts you use indicate what type of RNP approach you can fly. This can be RNP AR, RNP LNAV/VNAV, RNP LNAV, RNP LPV. Where for the RNP AR approach a separate approval is required for the operator and airport.



The future.....

Regulation (EU) 2018/1048 describes the laying down airspace usage requirements and operating procedures concerning performance-based navigation. In this regulation it is stated that from 1 June 2030 all approaches and SIDs should be based on PBN. This means that providers of ATM/ANS should implement at all instrument runway ends of 3D approach procedures and, where those providers have established SID routes or STAR routes, PBN. From that date only in the case of contingency other means than PBN are allowed.

This raises the question if Flight Training Organisations should amend their training program as GNSS based navigation will become the normal way of navigation. A pilot must still be able to fly an NDB/VOR/ILS approach. However NDB's and VOR's will disappear more and more like previously stated in this article. This calls for a review of the training program: How much emphasis should you put on training the old school way of navigation. Do you need to train it a lot, because it is more difficult, or only now and then because the chance of using it is small. It's useful to compare it with arc flying. I have trained this a couple of times during my flight training. Due to the technical advancements, the rare times I had to fly it, it was programmed into the Navigation system that produced a track for me to follow, the Flight Director told me how to fly the airplane to follow that track, and if I only want to monitor I could switch on the auto pilot!

In time these type of approaches will disappear when GNSS gets more reliable and we get used to it. Like we don't use landmarks anymore to fly from Holland to India. It depends as well on your aircraft, what type of automation has it for navigation.

Keep an eye out on more information in these series of explaining aviation subjects in an easy and simple way! If you have any questions after reading this article please let us know, we are happy to help!

What's on your safety playlist?



We finish by starting the conversation aviation with a new song for our Safety Music Playlist....

This guide is part of your PBN journey. Together4Safety is here to start positive safety conversations so that we can solve our challenges together as a community. We also add another song to our Safety Music Playlist, Navigate by Band of Skulls. Share you thoughts with us by email at safetypromotion@easa.europa.eu



Many thanks to Stephen van Houwelingen from the STAC aviation consultancy for the support and assistance in developing this guide along with EASA colleagues Antonio Gonzalez Gomez, Brian Jolley, Giovanni Cima and John Franklin.

