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# Introducing Performance Based Navigation (PBN) and Advanced RNP (A-RNP)





## **PURPOSE OF THIS BRIEFING**

This information note explains ICAO's Performance Based Navigation concept and introduces the Advanced RNP specification as the successor in Europe to B-RNAV and P-RNAV. Prepared by EUROCONTROL, this non-technical brief is intended primarily for airspace planners with a view to demonstrating the link that exists between airspace design and navigation capability. However, other ATM stakeholders will benefit as this brief provides a general understanding of PBN and its implementation within European airspace.

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# 1. WHAT IS PERFORMANCE BASED NAVIGATION?

## BACKGROUND

The continued growth of traffic and the need to provide greater flight efficiency makes it necessary to optimize available airspace. This is being achieved world-wide by enhanced Air Traffic Management and by exploiting technological advancements in the fields of Communication, Navigation and Surveillance. More specifically, the application of *area navigation* techniques in all flight phases contributes directly to improved airspace optimisation. Area navigation is enabled by the use of an on-board navigation computer commonly referred to as a RNAV system.

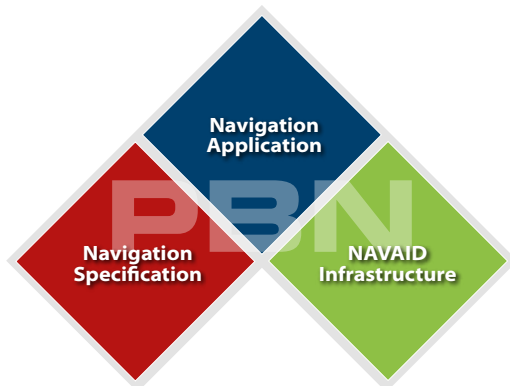
RNAV system capabilities are increasingly being exploited with a view to maximizing airspace resources. To this end, both flight crew and ATC need to understand RNAV system capabilities and ensure that these match airspace requirements. **The use of RNAV systems lies at the core of Performance Based Navigation (PBN), which introduces approval requirements for use of these systems in airspace implementations.**

## THE PERFORMANCE BASED NAVIGATION CONCEPT

ICAO's Performance Based Navigation (PBN) Concept has replaced the RNP Concept; it was introduced through publication of the ICAO PBN Manual (Doc 9613) in 2008. The PBN Concept is geared to respond to airspace requirements.

To these ends, ICAO's PBN concept identifies three components:

- **the Navigation Application,**
- **the Navigation aid (NAVAID) Infrastructure** and
- **the Navigation Specification.**



- The **Navigation Application** is achieved by the use of a **NAVAID Infrastructure** and associated **Navigation Specification**.
- The **NAVAID Infrastructure** refers to ground- and space-based navigation aids (except the Non Directional Beacon (NDB), which is excluded from use in PBN)<sup>1</sup>.
- The **Navigation Specification** is a technical and operational specification that identifies the navigation performance and functionality required of the RNAV system<sup>2</sup>. It also identifies how the navigation equipment is expected to operate in the NAVAID Infrastructure to meet the operational needs identified in the Airspace Concept. There are two kinds of navigation specification: RNAV and RNP. The important difference between the two is that an RNP specification requires on-board performance monitoring and alerting as part of the avionic functionality. The Navigation Specification provides material which States can use as a basis for developing their certification and operational approval documentation.

## WHAT'S NEW ABOUT PBN?

Some fundamental points must be understood about PBN:



- **PBN requires the use of an on-board RNAV system;**
- **PBN creates requirements for airworthiness certification and operational approval to use RNAV systems in airspace implementations;**
- **The RNAV system's functionality as well as its navigation accuracy in the NAVAID Infrastructure environment of the subject airspace must conform to the requirements stipulated in the relevant ICAO navigation specification.**

Simply put, for PBN both the aircraft and flight crew have to be qualified against the particular Navigation Specifications required for operation in the airspace.

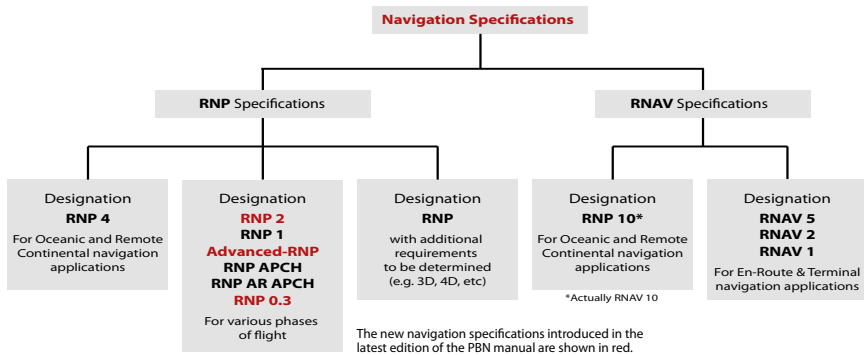
From an airspace planner's perspective, PBN enables the systemisation of air traffic organisation through the strategic deconfliction of published ATS routes (including SIDs/STARs and instrument approach procedures) so as to reduce the need for tactical ATC intervention. Put another way: PBN allows aircraft-to-aircraft separation to be 'built-into' the airspace design, thereby enabling the migration from ATC to ATM.

1- Precision Approach (PA), commonly referred to as xLS (which includes ILS, MLS and GBAS), is not addressed in PBN.

2- When an RNAV system includes on-board performance monitoring and alerting i.e. for a RNP specification, it is called a RNP system.

## UNDERSTANDING NAVIGATION SPECIFICATIONS

In early 2013, the PBN Manual contains **11 navigation specifications**:  
4 of these are RNAV specifications and 7 of these are RNP specifications:



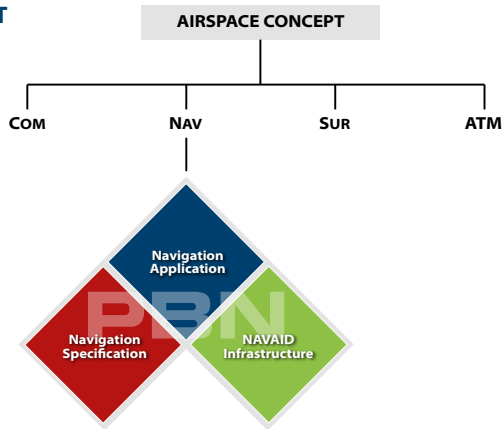
Documented in Volume II of the PBN Manual, each of these navigation specifications is roughly 20 pages in length and contains core and contextual material. Core material relating to the navigation specification includes descriptions as to the performance (accuracy, integrity and continuity) required from the RNAV system, the functionalities required to meet the requirements of the Navigation Application, the approval process, aircraft eligibility and operational approval, etc. The more contextual type of material relates primarily to ANSP considerations and includes requirements related to the Navaid, Communication and Surveillance Infrastructures, air traffic controller training, ATS system monitoring and publication etc.

The PBN Manual also defines additional functionalities (required or optional) which can be used in association with several of the navigation specifications:

Navigation Specification	Flight Phase								Additional Functionalities (Required or Optional)			
	En Route Oceanic Remote	En Route Continental	ARR	Approach				DEP	RF	FRT	TOAC	Baro VNAV
				Initial	Intermed	Final	Missed					
RNAV 10 (RNP 10)	10											
RNAV 5		5	5									
RNAV 2		2	2					2				
RNAV 1		1	1	1	1		1	1				O
RNP4	4									O		
RNP2	2	2								O		
RNP1			1	1	1		1	1	O			O
Advanced RNP	2	2 or 1	1	1	1	0.3	1	1	R	O	O	O
RNP APCH				1	1	0.3	1		O			O
RNP AR APCH				1-0.1	1-0.1	0.3-0.1	1-0.1		Specific requirements for RF & VNAV			
RNP 0.3		0.3	0.3	0.3	0.3	-	0.3	0.3	O			O

The purpose of the additional functionalities (RF, FRT, TOAC and Baro-VNAV) is described in section 3 of this brochure. These functionalities are subject to several limitations which are explained in the PBN manual (Volume II, Part A, Chapter 1).

## AIRSPACE CONCEPT

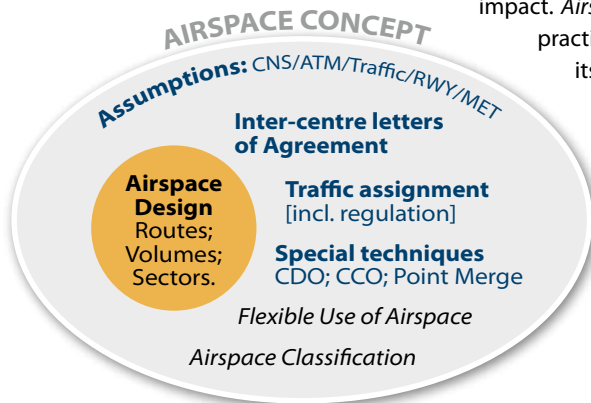


The PBN Manual introduces the *Airspace Concept* as a formal way to set out and respond to airspace requirements. As such, the development of the Airspace Concept is a key step in PBN implementation.

- **From an Air Navigation Service Provider's perspective, PBN is one of several enablers of the *Airspace Concept*.**
- **From an aircraft and flight crew perspective, PBN clarifies and provides a uniform structure to requirements for airworthiness certification and operational approval for use of RNAV systems in airspace implementations.**

An *Airspace Concept* describes the intended operations within an airspace. Airspace Concepts are developed to satisfy strategic objectives such as safety, capacity, flight efficiency, access or to mitigate environmental impact. *Airspace Concepts* include details of the

practical organisation of the airspace and its operations as well as the CNS/ATM, traffic characteristics, runway usage and meteorological assumptions on which it is based. Practical organisation of the airspace includes the ATS route structure, separation minima, route spacing and obstacle clearance. Thus the *Airspace Concept* hinges on the airspace design.



Once fully developed, an *Airspace Concept* provides a detailed description of the target airspace organization and operations within that airspace and can, when complete, be anything from five pages in length (for extremely simple airspace changes) to a document of several hundred pages.

Note: More information on the *Airspace Concept* is published in the *European Airspace Concept Handbook for PBN Implementation* (Edition 3, 2013).

## EUROPE'S HIGH-LEVEL AIRSPACE CONCEPT

At a very generic level, Europe's current airspace concept, which extends well beyond PBN, can be said to have the following characteristics:

- A parallel network of ATS routes, based on B-RNAV, across the continent;
- A system of feeder or link routes based mainly on B-RNAV which connect to P-RNAV or Conventional SIDs and STARs starting at the nominal TMA boundary
- An organised track system (OTS) in the North Atlantic based on MNPS (this is due to change to RNP 2 or RNAV 10).
- The use of Reduced Vertical Separation Minima (RVSM) between FLs 290 and 410.
- Airspace Classification Class C above FL195.
- Extensive use of the "Flexible Use of Airspace" concept;
- Some use of "Free Routes"
- Evolution from State managed upper airspace to Functional Airspace Blocks (FABs).

Europe's Airspace Concept is evolving to include the use of **Advanced RNP** in en-route and terminal operations, and **RNP APCH** on the Approach.

## SOME PBN CONVENTIONS

In the PBN manual, the expressions area navigation, RNAV or RNP are very frequently used. In order to maintain some level of clarity, the expression **area navigation** (written in full) denotes generic concepts related to area navigation techniques. **RNAV** and **RNP**, on the other hand, are always followed by another word eg. RNAV system, RNP specification etc.



## 2. PERFORMANCE BASED NAVIGATION IN CONTEXT

### AMBITIONS FOR A GLOBAL UPTAKE OF PBN

The ICAO Resolution at the 36th Assembly in 2007 and the publication of ICAO's PBN Concept in 2008 effectively triggered the launch of PBN in all phases of flight. The ICAO Resolution was a significant step in that it reflects international concordance as to high-level goals and ambitions for global uptake of PBN. The resolution was reiterated at the 37th Assembly in 2010, with a modification included for the RNP APCH specification, where RNP APCH with lateral guidance only was also recognised as an acceptable alternative if an approach with vertical guidance (APV) cannot be implemented. For legacy reasons, the RNP APCH is known as an RNAV Approach even though the RNP APCH specification distinctly requires on-board performance-monitoring and alerting. *RNP APCH* comes in four 'flavours'.

- RNP APCH LNAV (Lateral Navigation only and relies on GPS).
- RNP APCH LNAV/VNAV (with Vertical Navigation added and relies on GPS and Barometric VNAV). This is also referred to as an *APV Baro*.
- RNP APCH LP (Localizer Performance only and relies on GPS and EGNOS, the European satellite-based augmentation system (SBAS)).
- RNP APCH LPV (with Vertical Navigation added and relies on GPS and EGNOS). This is also referred to as an *APV SBAS*.

Resolution 37-11 reads as follows:

***AR 37-11 resolves that: States complete a PBN implementation plan as a matter of urgency to achieve:***

- 1. implementation of RNAV and RNP operations (where required) for en-route and terminal areas according to established timelines and intermediate milestones;***
- 2. implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV only minima, 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; and***
- 3. implementation of straight-in LNAV only procedures, as an exception to 2) above, for instrument runways at aerodromes where there is no local altimeter setting available and where there are no aircraft suitably equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more;***

## EUROPEAN PBN IMPLEMENTATION

ICAO published its PBN concept in 2008, but European requirements for airworthiness certification and operational approval for use of RNAV systems have been in place since 1998. In *en-route* operations, the European starting point was the European-wide 1998 mandate for **Basic RNAV (B-RNAV, now known as RNAV 5)**. For *terminal area* operations, this was followed through with the 2001 introduction of **Precision RNAV (P-RNAV)**, closest to RNAV 1 – see note 1) and the subsequent introduction of **RNP APCH operations: RNP APCH** to LNAV and LNAV/VNAV minima from 2009 and RNP APCH to LPV minima since 2011. Although the first European RNP approach requiring special authorisation was published in 2005, the introduction of RNP AR APCH really started in 2010. PBN evolution is set to continue with the introduction of other navigation specifications like **Advanced RNP**, and possibly **RNP 1** together with **RNP 0.3** (for helicopter operations).

**Advanced RNP** is set to become the next ECAC-wide navigation specification used in en-route and terminal airspace, including the approach, missed approach and departure phases of flights.

*Note 1: in Europe, the main difference between P-RNAV and RNAV 1 is that P-RNAV permits the use of VOR/DME in limited circumstances. For more information see the PBN Manual Volume II, Part B, Chapter 3.*

## PBN EVOLUTION: FROM RNAV TO RNP

The PBN concept suggests that RNAV specifications are effectively legacy specifications and that no new RNAV specifications will be developed. Indeed, PBN's sights are firmly set on RNP which relies primarily on the use of satellite technologies. This explains why all the new navigation specifications in the 2013 update to the PBN Manual are RNP specifications.

Three of these new RNP specifications could have application in Europe:

- **Advanced RNP specification** whose inclusion in the PBN Manual as a global standard was initially championed by EUROCONTROL (following extensive consultation and identification of Operational Requirements with ECAC member states) and whose requirements resonated in other ICAO regions.
- **RNP 1 specification** (the RNP 'version' of P-RNAV/RNAV 1) which may legitimately find application in ECAC.
- **RNP 0.3 specification** (championed by the USA for metropolitan helicopter operations), may find application in urban or sea helicopter operations in Europe.

The rest of this brochure focuses on Advanced RNP.

# 3. GENESIS OF THE ADVANCED RNP SPECIFICATION

The idea of a navigation specification to succeed B-RNAV and P-RNAV was first considered in 1999 when the first edition of the ECAC Navigation Strategy identified 'RNP 1' as this next Step. In 2002, operational requirements for terminal airspace related to RNAV and RNP operations were defined by EUROCONTROL's Terminal Airspace Task Force (TATF) and in 2007 an ECAC Airspace Concept for 2015 was elaborated by EUROCONTROL's Airspace and Navigation Strategy Orientation Task Force (ANSO-TF). EUROCONTROL's Route Network Development Sub-Group (RNDSG) also identified its operational requirements in the same year. When the ECAC Navigation Strategy was updated in 2008, it translated the airspace requirements from the TATF, RNDSG and ANSO into navigation functional requirements and these served to confirm the intended trajectory of the navigation strategy originally published in 1999 – and it saw these functional requirements included in the SESAR ATM Master Plan. Post 2008, designers of the Functional Airspace Blocks have also identified airspace requirements related to RNAV and RNP.

## AIRSPACE REQUIREMENTS

The airspace applications elaborated by the TATF, ANSO-TF, RNDSG and FAB developments are virtually identical. These include:

### Lateral navigation

- a. Closer route spacing, particularly in the en-route;
- b. Maintaining same spacing between routes on straight and turning segments without a need to increase route spacing on the turn\*;
- c. Reduction of the size of the holding area to permit holds to be placed closer together or in more optimum locations;
- d. Aircraft ability to comply with tactical parallel offset instructions as an alternative to radar vectoring;
- e. Means of enabling curved approaches, particularly through terrain rich areas but also to support environmental mitigation.\*

\* *Note: Repeatable and predictable turn performance is the basic operational requirement.*

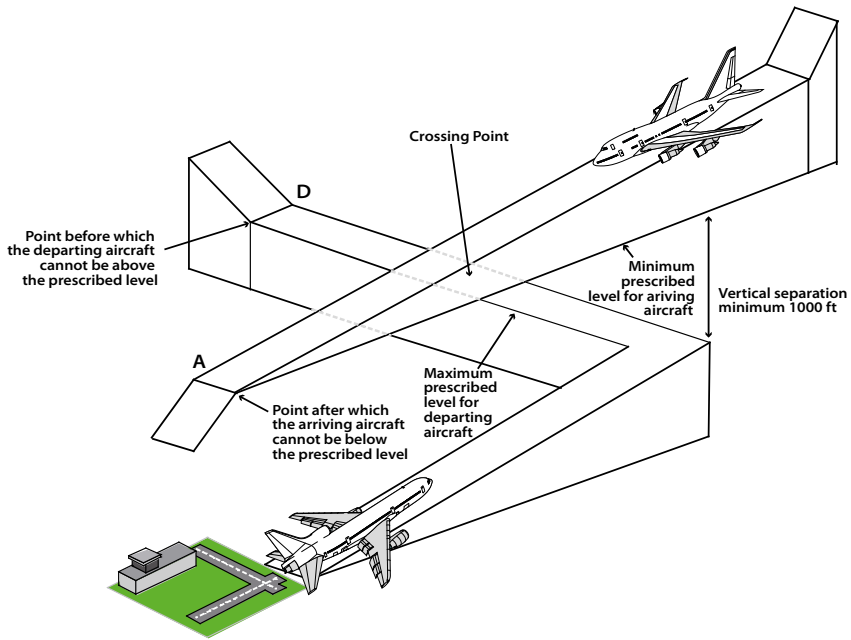
### Longitudinal navigation

- f. Some means to enable the metering of traffic from en-route into terminal airspace;

### Vertical navigation

- g. Effective management of vertical windows to segregate arrival and departure flows (example in diagram)
- h. Effective use of CDOs and CCOs (again for environmental mitigation);

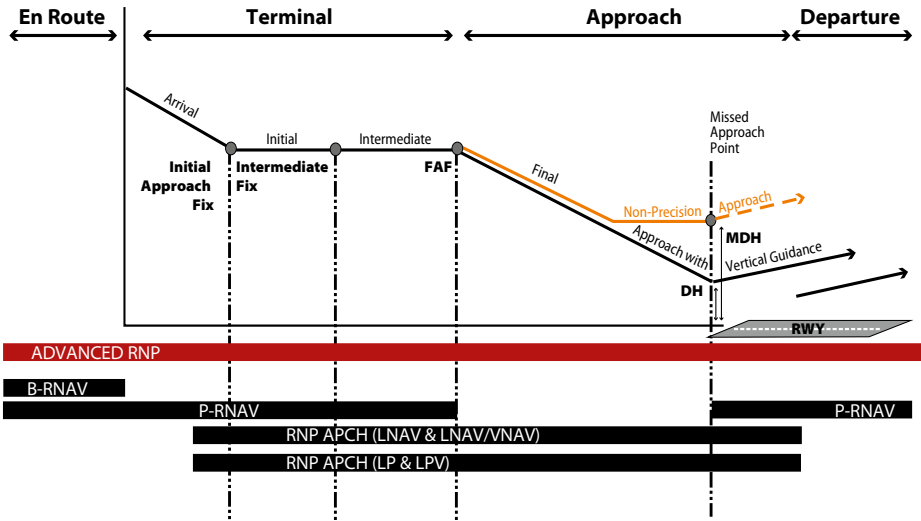
The above requirements serve various benefits viz. capacity, flight and ATM system efficiency (particularly requirements b, c, e, f and h), airport access (requirement e), enhanced system and sequencing predictability (requirements b and f) etc.



## WHAT'S INCLUDED IN ADVANCED RNP?

The above airspace requirements were extensively analysed and debated with respect to cost, avionics compatibility and feasibility by navigation experts in European and International fora. (Note that the introduction of the PBN Concept meant that European requirements had to dovetail into an international context because the PBN concept is anchored in international harmonisation of navigation specifications). Included in these analytical exercises were airspace users such as General Aviation, Military aviation, air transport aviation and organisations such as IATA.

These wide-ranging debates made it evident that **Advanced RNP's first and foremost characteristic had to be an all-encompassing navigation specification addressing all phases of flight to maximise the benefit and to minimise cost to operators in gaining operational approval.** To this end, unlike the previous specifications applying to en-route and terminal operations, the performance sought to meet the operational requirements for all phases of flight including Final Approach. Furthermore, one of the main requirements of Advanced RNP proved to be the need for track repeatability and predictability in the turn. For this reason, the Radius to Fix (RF) functionality is required in Advanced RNP.



One of the biggest challenges in writing the Advanced RNP specification was how to ensure its flexible application particularly in the terminal environment. For this reason, early drafts of the Advanced RNP specification proposed the flexibility to choose one of a series of accuracy values in each flight phase; this capability is called "Scalable RNP". Nevertheless, subsequent analysis of both European and US fleets demonstrated that 'scalability' was too ambitious to be included as a requirement in the Advanced RNP specification. As such, the specification has now been published with 'conservative' default lateral accuracy values in all flight phases but scalable RNP remains an optional function in Advanced RNP. The idea is to have Advanced RNP with this option as a candidate replacement for RNP AR APCH in those cases where terrain challenges are not significant (RNP AR APCH is the only other specification including scalability, but it requires 'special authorisation' because of its rigorous requirements, and is therefore costly). The table in section 1 illustrates the **default** conservative lateral accuracy values in NM required in the Advanced RNP navigations specification.

Other options can be associated with the Advanced RNP specification including FRT, Baro VNAV and TOAC (see table in section 1).

These navigation functional requirements as well as others included in the Advanced RNP navigation specification are expected to respond to the following airspace requirements:

Nav Function	Corresponding Airspace Requirement	
<p><b>RNP</b></p>	<p><b>Close route spacing, particularly in the en-route.</b></p> <p>There are two kinds of navigation specifications within the PBN Manual - RNAV and RNP. RNP specifications have an additional requirement for on-board performance monitoring and alerting. This means that if the RNP system does not perform the way it should then an alert should be provided to the flight crew. In practical terms what this means is that ATC can have greater confidence in the track keeping performance of the aircraft and this greater confidence translates into being able to place routes closer together.</p> <p><i>Note: Some P-RNAV / B-RNAV aircraft have RNP capability i.e. on-board performance monitoring and alerting may be available (even though it is not required for either P-RNAV or B-RNAV). The absence of this requirement in P-RNAV and B-RNAV partly explains why the route spacing is larger than the expected route spacing for Advanced RNP.</i></p>	<p><b>Lateral</b></p>
<p><b>RF/FRT</b></p>	<p><b>By relying on repeatable and predictable turn performance:</b></p> <p><b>Maintaining the same spacing between routes on straight and turning segments without a need to increase route spacing on the turn; and</b></p> <p><b>Means of enabling curved approaches, particularly through terrain rich areas (applicable to RF only).</b></p> <p>RF stands for Radius to Fix and FRT stands for Fixed Radius Transition and in PBN, both functionalities are associated only with RNP specifications. RF is a path terminator used for SIDs, STARs and Approach. FRT is a leg transition used when the FMS is in en-route mode.</p> <p><i>Note: Neither P-RNAV or B-RNAV include either of these functions which is why extra space has to be added between the turning segments of P- or B-RNAV parallel routes.</i></p> <p>The use of both RF and FRT ensures aircraft turn on a repeatable path. This means that if closely-spaced routes have turns on them, there is no need to increase the spacing between the routes on the turn when RF or FRT is coupled to RNP. In the terminal environment, RF also makes it possible to design curved approaches in terrain rich areas, or to avoid noise sensitive areas. Whereas RF was only available in the RNP AR APCH context prior to the 4th edition of the PBN Manual in 2013, RF is now available for use with certain RNP applications, but is a required function for Advanced RNP.</p>	

## Corresponding Airspace Requirement

<p><b>RNAV Holding</b></p>	<p><b>Reduction in the size of the holding area to permit holds to be placed closer together or in more optimum locations.</b></p> <p>With conventional navigation, aircraft hold at a conventional fix or intersection. RNAV holding allows aircraft to hold at a waypoint which can effectively be placed anywhere (which is an advantage). One of the difficulties currently under discussion is the size of the RNAV holding area. It is not as small as airspace planners would like it to be, so at this stage the only advantage RNAV holding seems to provide is that the hold can be placed anywhere.</p> <p><i>Note: Although many P-RNAV or B-RNAV certified aircraft have this function, it is not a requirement in these specifications.</i></p>	
<p><b>Parallel Offset</b></p>	<p><b>Aircraft ability to comply with tactical parallel offset instructions as an alternative to radar vectoring.</b></p> <p>If a fast aircraft is following a slow aircraft on the same track, an instruction by ATC to 'Fly Offset by X nautical miles' can allow the faster aircraft to overtake and be climbed/descended through the slower aircraft. This is a handy shortcut alternative to radar vectoring.</p> <p><i>Note: Although many P-RNAV certified aircraft have this function, it is not a required function with P-RNAV.</i></p>	
<p><b>TOAC</b></p>	<p><b>Some means to enable the metering of traffic from en-route into terminal airspace.</b></p> <p>TOAC stands for Time Of Arrival Control and enables an aircraft to reach a waypoint within X number of seconds of a specific time. When timed-sequencing of traffic is being done, this feature is a must.</p> <p>Trajectory Based Operations (TBO) and 4D trajectories will be achieved based on the use of airborne functions like TOAC, also called Required Time-of-Arrival (RTA) or Controlled Time of Arrival (CTA) functions in the context of SESAR and Next-Gen.</p>	<p>Long.</p>
<p><b>Baro-NVAV</b></p>	<p><b>Effective management of vertical windows to segregate arrival and departure flows ; and</b></p> <p><b>Effective use of CDOs and CCOs for improved flight efficiency and environmental mitigation.</b></p> <p>VNAV stands for Vertical Navigation; it is a function in the FMS which allows the vertical path of the aircraft to be better controlled and managed which makes it possible to FMS to plan and design optimal profiles such as those enabled by continuous descent operations and to build vertical constraints into the airspace design.</p>	<p>Vertical</p>

## INCREASED FLIGHT AND ATM EFFICIENCY WITH ADVANCED RNP

One of the main benefits provided by Advanced RNP is the potential it has to increase flight efficiency and overall efficiency of the ATM system. Increased flight efficiency stems from the great flexibility of being able to place ATS Routes, SIDS and STARs in the most convenient place. The predictable turn performance inherent in Advanced RNP through the RF in terminal operations and by associating FRT en-route, also makes it possible - due to enhanced track keeping in the turn - to place routes where they cannot necessarily be placed today with RNAV 1 or RNAV 5. This has a two fold benefit: the ATM system can benefit in terms of efficiency by a route capable of being placed in a more optimum place; aircraft efficiency is enhanced by the route capable of being placed where it better suits the aircraft performance, and the predictable turn and track keeping performance inherent in Advanced RNP through RF and RNP mean that the noise footprints are reduced.

## CLOSER ROUTE SPACING WITH ADVANCED RNP

Of particular interest to airspace planners is the closer route spacing that can be enabled with Advanced RNP on both straight and turning segments (the latter due to the RF/FRT requirements). In the table below, the interpreted results of various EUROCONTROL route spacing studies are shown. The route spacing advantages of Advanced RNP are contrasted to those of P-RNAV and B-RNAV.

▼ Parallel Routes / based on ►	Advanced RNP		P-RNAV		B-RNAV
	En-route	Terminal	En-route	Terminal	En-route
Same Direction	7 NM	7 NM	9 NM	8 NM	16.5 NM
Opposite Direction					18 NM
Other					10-15 NM with increased ATC intervention rates
Spacing on turning segments	As above using FRT en-route and RF for SIDs/STARs		Larger than above because no FRT		Much larger than above because no automatic leg change.

Attention is drawn to the fact that the above route spacing 'results' were obtained through collision risk assessment undertaken for generic European airspace using conservative assumptions. Subsequent Real-Time Simulations using Advanced RNP<sup>3</sup> demonstrated that a 7 NM route spacing en-route with FRT and 5 NM using RF<sup>4</sup> in the terminal area could be achieved with this specification. This smaller route spacing in the terminal area can partially be explained by the scale of the radar display used by the controllers and the slower speeds of the aircraft operating on SIDs and STARs. For more information on Route Spacing please see Attachment 5 of the European Airspace Concept Handbook for PBN Implementation (EUROCONTROL, Edition 3, 2013).



## NEXT STEPS FOR ADVANCED RNP

To provide the benefits, Advanced RNP needs to be used ECAC-wide in the upper airspace. A mix and match of P-RNAV / B-RNAV / Advanced RNP will not provide the benefits that Advanced RNP alone can deliver. This is because it becomes labour intensive for ATC to manage the mix of aircraft navigation performance. Moreover, additional routes would need to be created for differently qualified aircraft; this will result in airspace capacity limitations and additional controller workload (and can also result in airborne navigation databases starting to run out of space). For the efficiency of intra-FAB and intra-European operations to be assured, one size must fit all in the upper airspace (A discussion on mixed mode is included in Attachment 7 of the European Airspace Concept Handbook for PBN Implementation (EUROCONTROL, Edition 3, 2013).

*Note: Over the last 12 years at every en-route simulation related to RNAV or RNP, ATC has consistently provided feedback that the most efficient way to manage the air traffic is to have a homogenous aircraft population where everyone is qualified to the same standard – in this case, Advanced RNP.*

It is important to note that whilst it is clear that the upper airspace needs a uniform requirement for Advanced RNP so that benefits can be realised, an equally persuasive argument cannot yet be made for terminal airspace. This is because each terminal airspace is different with unique operational requirements.

Advanced RNP is currently being tackled on two fronts:

- **Development of an Implementing Rule for Performance Based Navigation.** The European Commission mandated EUROCONTROL to draft a PBN Implementing Rule (IR) by May 2013. The IR will define the navigation requirements and identify the functionalities required in en-route and terminal airspace, including arrival, departure and approach. The development of the draft PBN IR follows EC and SSC processes and the necessary steps in the process include economical, safety and civil-military impact assessments. The deployment of Advanced RNP is foreseen to be the candidate to respond to some of the requirements identified. This could result into a mandate for Advanced RNP on the ground and in the air around 2018-2020.
- **Development of an EASA Acceptable Means of Compliance for Advanced RNP.** This process has already started in the context of the development of the CNS CS (Communication, Navigation and Surveillance Certification Specification) and is estimated for completion by the end of 2014 timeframe.

## NOTES

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