

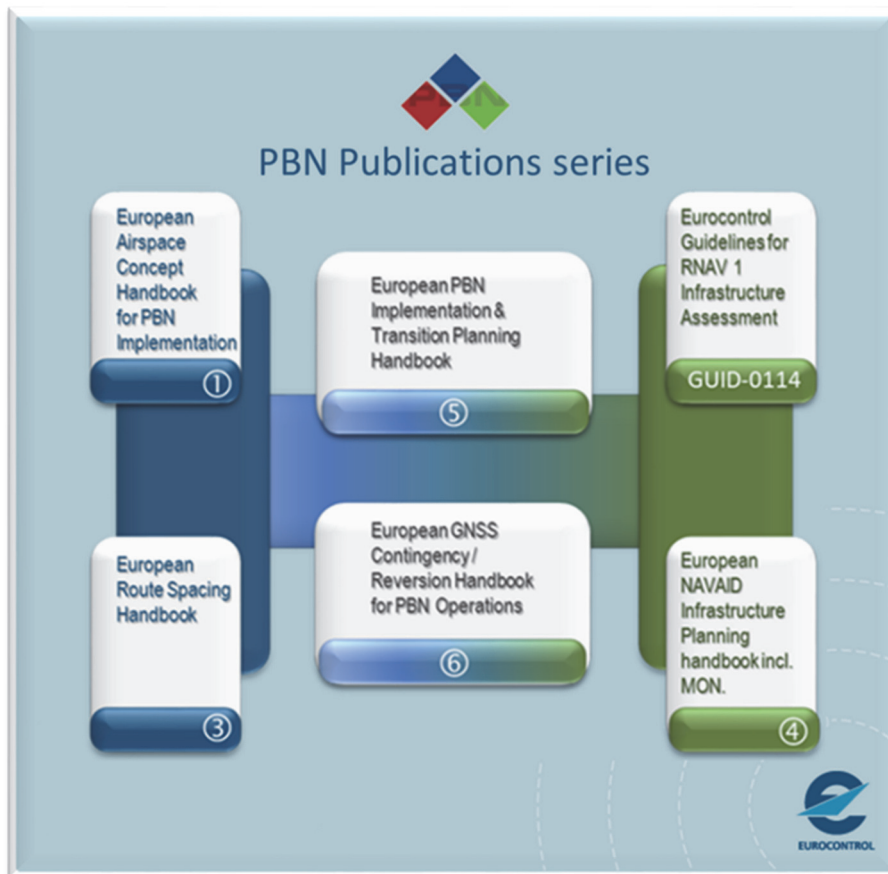


European PBN Implementation and Transition Planning Handbook

PBN Handbook No. 5.

Edition 2, 2021 (Template available for use by States and ANSPs)





This document is one of a series of inter-related PBN publications, each of which can be used independently. Handbooks 1 & 3 are mainly aimed at ATM/operational audiences, whilst the EUROCONTROL Guidelines for RNAV 1 Infrastructure Assessment (EUROCONTROL - GUID – 0114) and Handbook No 4 primarily target Infrastructure Managers. Handbooks 5 & 6, provide the link between the two audiences on subjects of shared importance.

This document is Handbook No 5.

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www.trainingzone.eurocontrol.int — in particular Training Catalogue '+ Navigation'

USING THIS DOCUMENT

European Regulatory requirements [PBN IR, EU Regulation 2018/1048] as well as the ICAO Assembly Resolution 37-11 culminate in a need for a national PBN Transition Plan/PBN Implementation Plan respectively.

Because of the division of responsibility between States and ANSPs in the European context, the competent State Authority (NSA or NAA) often seeks to provide a clear direction to its ANSP, of which there could be several within a given State. Even without such ‘direction’, the ANSPs are usually required to provide a PBN Implementation Plan.

Over the past few years, EUROCONTROL has been increasingly asked by States to assist them in thinking through how to achieve the ICAO objectives set out in Resolution 37-11. More recently, ANSPs in particular, have turned their attentions to the PBN Transition Plan required by Article 4 of the PBN IR and are asking for assistance in this field. Whilst it is not possible to provide a tailor made PBN transition plan outline for each request, and even less desirable to create a ‘one-size fits all’ transition plan, what is possible is to provide a generic architecture showing one example of such a PBN Implementation/Transition Plan; this is what this document seeks to provide.

This document is complemented, more effectively, by forums such as the EUROCONTROL RNP Approach Implementation Support Group (RAiSG) and the Navigation Steering Group (NSG). Both groups have received and shared ICAO PBN Implementation Plans from various States in the context of ICAO Resolution 37-11 and will undoubtedly support the Network Manager in coordination of PBN Transition Plans in the immediate future.

In response to these needs, this document provides a skeleton ‘architecture’ or ‘outline’ which could assist States and ANSPs formulate an ICAO PBN Implementation Plan and/or a PBN IR Transition Plan. (It has been noted that the distinction between an implementation plan and transition plan is debatable, except perhaps that the scope of the ICAO Implementation Plan is greater as it can cover more navigation specifications than those regulated by EU Regulations).

Therefore, this document is written for BOTH State and ANSPs. Whilst the State normally sets the strategy (see part A of this document), it is the ANSPs who need to provide the implementation or transition Plan (see Part B of this document) which needs to be approved by the State.

	PART A	PART B
For use by....	THE “STATE” (also referred to, interchangeably, as the CAA or the NSA)	THE “ANSP” (also referred to as the Service Provider)
Template & guidelines for building a/an	Implementation Strategy	PBN Implementation Plan
	1. High Level Principles (incl. Safety & Security Policy)	1. Statement of Compliance intention Policy
	2. Drivers for Change a. Regulatory b. Operational c. Other	2. Compliance methodology: (outline)
	3. Current Operations a. Analysis b. Identification of additional drivers	3. Analysis a. Drivers for Change b. Current Operations

		<i>c. ID of additional drivers</i>
	<i>4. Strategic Implementation Objectives</i>	<i>4. Implementation Objectives</i>
	<i>5. Processes & Methodology a. To include....Transition Considerations</i>	<i>5. Implementation Methodology</i>
	<i>6. Transition Considerations</i>	<i>6. Implementation Roadmap</i>
	<i>7. Required deliverables</i>	<i>7. Transition Arrangements</i>
	<i>8.</i>	<i>8. Deliverables</i>

The final section (Section 3) is primarily compiled by the Service Provider and signed off (indicating agreement, acceptance and commitment of that document) by the State. This section is the culmination of the joint work created by the NSA and the ANSP. The Process identifies what is to be achieved in terms of PBN implementation and provides the answers to the questions why, what, where, who, when and how.

The skeleton architecture of this document is under a single document cover; however, this does not imply that a State and ANSP have to publish the Strategy & Transition Plan in a single document. In many instances, this would be an unlikely scenario. The single document structure has been done for guideline purposes only and this guidance material is designed in three sections: The State, The Service Provider and the Implementation Deliverables.

Important note: *Any text appearing in “Italics” in “this colour”, constitutes a commentary within the template. Such text would be expected to be removed prior to publication by State and/or ANSP. Text in blue provides the reader with an idea of what may be covered within this section of the document. Such text is also expected to be removed from the final deliverable. Text in black italics details a fictitious working example. This is provided for guidance only and must be removed before the final deliverable. [[Explanatory notes, which are highlighted black text, are also expected to be removed from this document]].*

FOREWORD

ICAO Assembly resolution 37-11 requires States to develop a PBN implementation plan. In the EU, the PBN IR, EU Regulation 2018/1048 requires States to develop a PBN Transition Plan. Mindful that of the overlap between the intention of the PBN IR and the ICAO resolution 37-11, it is logical for States to incorporate their ICAO PBN Implementation and PBN IR Transition Plan in a single document.

This document provides guidance to States and ANSPs on how to develop a PBN implementation and transition plan and suggests what such a plan could contain.

*It is expected that the State (Ministry of Transport or CAA) will develop the policy and strategic roadmap and the Service Provider will define a deployment plan to deliver the policy goals. Part A, developed by the State, will detail the strategic vision and Part B, developed by the Service Provider(s,) will lay out its plans for delivering that strategic vision. The PBN Implementation and Transition Plan may, or may not, be completed in partnership; however, a collaborative approach **is** highly recommended.*

*The State's airspace requirements will be developed by the National Supervisory Authority. This section will clearly identify the State's high-level principles before setting out the 'drivers' for change, the '**why**', together with the directive to the Service Provider to undertake the work and the required timeframe for implementation, the '**when**'. The Service Provider will then complete the second section which will identify the actions that must be undertaken to meet the strategic objectives, the '**what**', the location of the required changes, the '**where**', the migration from current operations to the future environment, the '**how**', and the key personnel required to successfully deliver the implementation, the '**who**'. The Deployment Deliverables section of this document is the culmination of the joint work created by the NSA and the ANSP. The Deployment Deliverables identifies what is to be achieved in terms of PBN implementation and provides the answers to the questions **why, what, where, who, when** and **how**.*

Attention is drawn to the fact that the EU Regulations driving European PBN implementation have explicitly specified which navigation specifications and attendant applications are to be implemented in different flight phases. This has minimised the choices to be made by the State and the ANSP, as regulatory compliance is required.

This document does not replicate the requirements of the PBN IR but provides a tabulated resume the regulation for convenience (see below).

Summary of the PBN Implementation Regulation

PBN IR Article 4 & 7 Applicability with AUR.2005		Applies 03/12/2020	Applies 25/01/2024	Applies 06/06/2030
Art 4	Transition Plan (or significant updates) approved (living document) ¹	X ¹	X ²	X ¹
AUR.2005 1/2/3	RNP APCH at IREs without Precision Approach (PA)	X		
	RNP APCH at all IREs (with PA)		X	
AUR.2005 4/5	RNAV 1 or RNP 1 (+ RF if required) SID and STAR - one per IRE		X	
	RNAV 1 or RNP 1 (+RF if required) for all SID and STARs			X
AUR.2005 6	RNAV 5 ATS Routes (excl. SIDs/STARs) at and above FL150 ²	X		
	RNAV 5 ATS Routes (excl. SIDs/STARs) below FL150		X	
AUR.2005 7	Helicopter RNP 0.3 or RNAV 1 or RNP 1 (+RF if required) SID/STAR - one per IRE		X	
	Helicopter RNP 0.3 or RNAV 1 or RNP 1 (+RF if required) for all SID/STAR			X
	Helicopter RNP 0.3 or RNAV 1 or RNP 1 ATS Routes (excl. SIDs/STARs) below FL150		X	

Note 1 - The transition plan will have several iterations; Article 4 requires that the draft/significant updates to the plan must be approved by the competent authority **early enough** to provide sufficient time for the ANSPs to meet the identified implementation date. (Sufficient time would include accounting for the AIRAC cycle dates, publication and regulatory approval and compliance with other national requirements - see the PBN Portal for an example of the implementation scheduling and time required: <https://pbnportal.eu/epbn/main/PBN-Tools/Planning-Estimation.html>). The planned implementation dates detailed in the transition plans should be commensurate with the target date obligations.

Note 2 - CP 1 requires FRA to be implemented with two milestones: 2022 & 2025. FRA is associated with RNAV 5 through the ICAO EUR requirement for RNAV 5 published in ICAO Doc 7030. (CP 1's revised FRA requirements replace previous requirements in the PCP IR).

Table Updated February 2021

Before Common Project One (CP1) referred to in Note 2, above, there was a PCP IR (Pilot Common Project Implementing Regulation [EU] No 716/2014) that also regulated PBN implementation. This PCP IR has been superseded by CP1 and no longer addresses PBN or, by implication, the navigation infrastructure.

Part A
Template for
State PBN Implementation Strategy

EXECUTIVE SUMMARY

1. The State may elect to explain why a PBN implementation/transition plan is to be developed. It is possible that the State will want to highlight the drivers for change and what the expected benefits will be for the airspace users and the service provision. The State may wish to link to its national policies, European regulatory obligations and international commitments under one umbrella. The European regulation impacting on this is the PBN IR.

Regulated ANSP within the EU will need to consider ensuring the availability of a transition plan (PBN IR Article 4) to ensure the transition from current operations to PBN operations, as well as ensuring that the navigational infrastructure evolution supporting these operations is synchronised with the evolving operations.

Example:

Within the national transport strategy, it is the State's desire to ensure that the aviation sector is enabled to grow, meeting passenger demands, without impacting on the safety or capacity of the airspace whilst fulfilling our national environmental commitments. The State also has obligations to ensure that ANSPs comply with EU regulatory requirements, particularly those related to the PBN Implementing Regulation (EU 2018/1048).

To these ends, the State has elected to implement Performance-based Navigation (PBN) applications within the national airspace. The national Service Provider is therefore tasked to develop an airspace strategy which will meet these high level goals. In addition, the Service Provider will develop a supporting PBN implementation/transition plan which will meet national requirements, European regulatory obligations and international commitments.

The State (CAA/NSA) recognises the importance of the ICAO Global Air Navigation Plan (GANP) and wishes to develop air transport according to the ICAO roadmap – which has PBN as a high priority. Furthermore, the State recognises the safety benefit of providing a guided vertical path on approach and will adopt the ICAO Assembly resolution 37/11 which is also required for compliance with the PBN IR 2018/1048. The European regulation additionally requires that SIDs/STARs in terminal airspace operations are to transition to RNAV 1, as a minimum, in a stepped approach up to 2030 (PBN IR) whilst other SIDs/STARs some terminal airspace operations can be RNP 1 with RF. In compliance with safety practice and the requirements detailed in the PBN IR, the State will maintain a conventional capability to support airspace users who will not, through cost, be able to retrofit their aircraft to this capability during a transition period up to mid-2030.

SIDs/STARs and transitions should define airspace 'needs' based on a set of specific 'drivers' in line with the country's high level principles. These 'drivers for change' to the current operations are based on European regulations and/or specific operational needs [list the regulation numbers and/or the operational objective(s)]. The State should define the 'needs' as national objectives to achieve the identified strategic goals and the ANSP will formulate an implementation plan to ensure the national objectives are achieved on time.

The ANSP is to develop an airspace concept which meets all of the national objectives and then to specify the implementation/transition plan with defined timescales in a roadmap to deliver that concept.

When developing the airspace concept, the ANSP is to be cognisant of the State's safety and environmental policies and is required to demonstrate that the new airspace concept has undergone a rigorous safety assessment together with appropriate stakeholder consultation. The State and ANSP will sign off on the strategic roadmap for PBN implementation once the performance targets; safety assessment and stakeholder consultation has been successfully undertaken and the provisions of Article 4 of the PBN IR have been complied with. It is then the responsibility of the ANSP to manage the implementation and transition plan, to ensure that the agreed timelines are met.

It is the NSA's responsibility to ensure that the stakeholders involved are appropriately certified and operationally approved and, in terms of the PBN IR, to approve the transition plan. However, it will be the responsibility of the ANSP to communicate with the stakeholders to ensure that the airspace users know about the planned changes and have enough time to equip/retrofit the correct equipment on board the aircraft. Furthermore, the ANSP is required to develop appropriate training material for the stakeholders which is to be approved prior to use.

This document, when complete, will describe in detail the proposed airspace changes to meet the State's needs. The deliverables of the process will be a strategic roadmap defining the PBN implementation and transition plan. The commitment to this plan will be clearly indicated by both the NSA and the Service Provider (s) signing the finalised document. The Service Provider (s) will also be responsible for developing the relevant aircraft documentation, ensuring stakeholder awareness through appropriate communication channels and laying out the transition plan for the implementation. Finally, the NSA will be required to approve the specific training required for the PBN implementation which the Service Provider will develop as one of the transition activities.

PBN “STRATEGIC ROADMAP” OR “POLICY”

1. NATIONAL AVIATION POLICY

In this section the State may elect to highlight what the national transport policy is for the aviation sector and what the high level drivers for change are.

Example:

The State’s national transport policy is to enable the growth of the aviation sector to meet the expectations of the electorate. To that end, the State aims to enhance fuel efficiency for the primary airspace users by providing more direct ATS routes and through the effective use of Performance-based Navigation (PBN) to deconflict the flows into and out of the key aerodromes within the country. This strategic deconfliction should provide improved efficiency for the airspace users whilst enabling the State to comply with its environmental commitment to reduce in greenhouse gas emissions and noise around the airports through the use of continuous climb and continuous descent operations (CCO/CDOs). The redesign of the airspace will also provide extra capacity allowing the growth of the aviation sector in a safe and environmentally sustainable fashion whilst providing access to the smaller aerodromes by the use of advanced navigational capabilities.

The State is bound by the following high-level principles:

The State endorses ICAO and is committed to following the Global Air Navigation Plan (GANP) – stipulate any non-compliance listed in the AIP.

The State endorses the PBN Manual (ICAO Doc 9613 Edition x dated 20xx).

The State recognises and is committed to complying with General Assembly Resolution 37/11 of 2010.

The State recognises as a minimum the following European regulations and requires compliance thereto (<for regulated parties, only>):

- a. SES regulations*
- b. SERA*
- c. PBN IR (EU) 2018/1048*

In the implementation of the aviation policy, the State expects the service provider to apply, as a minimum, the following:

- Safety policy xxx and associated SMS complying to ISO9001*
- Quality policy xxx and associated QMS complying with ISO14001*
- Security policy xxx and associated SeMS complying with ISO 9001*
- Environmental policy xxx and associated EMS complying to ISO14001*
- High level civil/military policy on airspace use. This defines military activities that must be segregated and defines the rules for those activities which can be separated tactically.*

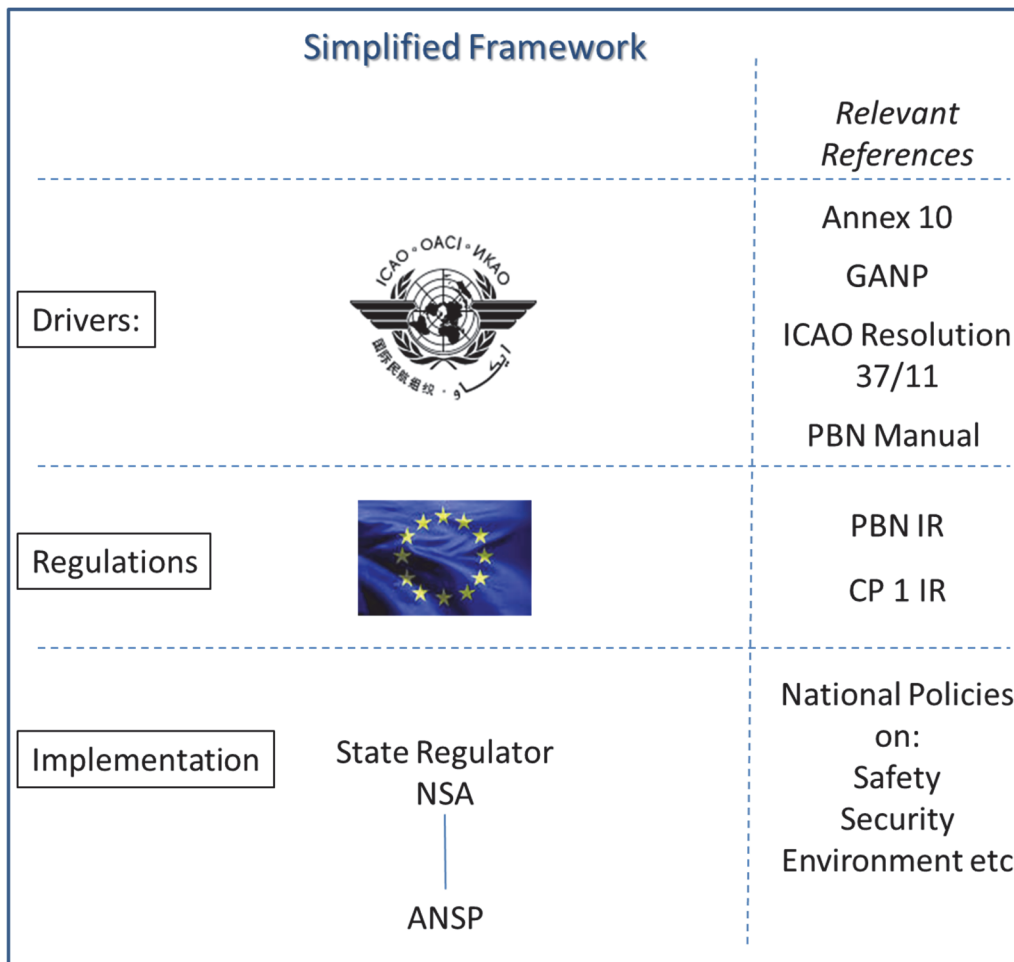


Figure 1 – Drivers for Change

2. DRIVERS FOR PBN IMPLEMENTATION

Within this section, the State could identify the specific reasons why an airspace change is needed.

Example:

Global Plans

ICAO Resolution 37/11: Urges all States to implement RNAV and RNP air traffic services (ATS) routes and approach procedures in accordance with the ICAO PBN concept laid down in the Performance-based Navigation (PBN) Manual (Doc 9613). This resolution covers all phases of flight, and only specifies the kind of specification for the final approach phase. Thus, the wording is broad though the intention clear.

ICAO Doc 9750, the Global Air Navigation Plan (GANP) identifies PBN as the “highest priority” and outlines implementation issues involving PBN planning and implementation as part of the Aviation System Block Upgrades (ASBUs).

European Regulation:

States are required to implement PBN operations in accordance with EU Regulation 2018/1048 – Airspace usage requirements and operating procedures concerning performance-based navigation.

Note: The Table showing the snapshot of these Regulatory requirements is in the Foreword of this document.

National Needs:

The State requires efficiency, coherency and connectivity throughout the airspace by the provision of:

An increase in **capacity** – This could involve closer route spacing through the provision of RNP 1 with RF for terminal operations.

An improvement in **safety** – Through the deployment of RNP approaches to replace conventional NPAs.

Improved **access** to aerodromes – Through the provision of new RNAV or RNP routes and the introduction of RNP Approaches.

A reduction in **environmental impact**: Implementation of Free Route Airspace which is expected to provide more efficient routing for the airspace users and meets the State's obligation to CP 1.

Improved **flight efficiency** through the introduction of RF turns on SIDs/STARs, which will enable shorter routes to be developed and noise sensitive areas to be avoided.

As RNP operations **require** the use of GPS, States should authorise the use of GPS in all flight phases within the airspace.¹

¹ It should be noted that PBN operations rely on the use of GPS and any State implementing PBN must allow the use of GPS in its airspace.

3. ANALYSIS OF CURRENT OPERATIONS

The State may decide that detailing the current operations would provide the Service Providers with the initial input to the PBN implementation. This detailing of current operations is known as the Reference Scenario is described in Activity 4 of the European Airspace Concept Handbook for PBN Implementation. The Reference Scenario includes all existing ATS Routes, SIDs/STARs, airspace volumes, ATC sectorisation, air traffic data and as well as all the existing coordination agreements. Description and analysis of the Reference Scenario is a crucial exercise

The Reference Scenario provides a 'baseline' to understand and analyse the current operations, within the national airspace and airports could cover the following elements:

Example:

Airspace:

- a. Structure*
- b. Airspace Classification*
- c. Sectorisation*
- d. TMA and CTR*
- e. Route Structure*

Aircraft Fleet

- f. Fleet Equipage Assessment*
- g. Categories of Airspace Users*
- h. Aircraft certification*
- i. Crew operational approval*

Communication Infrastructure

- j. Communications coverage and limitations*

Navigation Infrastructure

- k. Conventional Navigation Aids*
- l. Precision Approach Landing Aids*
- m. GNSS status*

Surveillance Infrastructure

- n. Surveillance coverage and limitations*

Any PBN applications already implemented.

4. STRATEGIC IMPLEMENTATION OBJECTIVES

An analysis of current operations could identify possible changes to the current airspace operations, which may be made to enable the State to comply with the regulations/targets/requirements or to achieve additional benefits. These 'drivers for change' could then be translated into national objectives.

Example:

The analysis of current operations has identified that the following changes to current airspace operations will enable the State to comply with the ICAO resolution 37/11, EU regulation 2018/1048 as well as meeting the national transportation policy goals for travelling public. These ‘drivers for change’ can be translated into the following national objectives:

- *Within the TMA, fully implement RNAV 1 SIDS/STARS by June 2030 with an option of RNP 1 with RF (as appropriate) as per the PBN IR.*
- *Above FL305, implement Free Route Airspace in line with CP 1 AF#3 by December 2022 (with limitations) and cross-border and TMA interaction by December 2025.*
- *In en-route airspace at and above FL150, introduce RNAV 5 ATS routes in accordance with the PBN IR by 3 December 2020.*
- *In en-route airspace below FL150, introduce RNAV 5 ATS routes in accordance with the PBN IR by 25 January 2024.*
- *Replace conventional NPAs with the introduction of APVs. Provide APVs at all IFR runway ends either as primary approach capability or as a back up to precision approach capability.*

Given that the PBN IR requires contingency measures to be put in place as part of the regulatory compliance with the PBN IR, the NSA may direct the ANSP to provide detail contingency procedures for GNSS reversion in the event of a GNSS outage as part of the transition planning. Such contingency measures, would of necessity, need to take account of available infrastructure and the minimum operational network.

See – European GNSS Contingency/Reversion Handbook for PBN Operations , Ed. 1, EUROCONTROL 2020

See - European Navaid Infrastructure Planning Handbook including MON, Ed. 1, EUROCONTROL 2021

5. PROCESS

The State may then elect to detail the process by which they wish the Service Provider to undertake the PBN implementation and the evidence to be provided in support of the safety assessment.

Example:

*The State tasks the **Service Provider** to develop an airspace concept, which addresses the identified national and regulatory objectives as a minimum, complies with current national safety, security and environmental policies and provides an efficient flow of traffic through the airspace. The airspace concept is to provide a coherent set of paths for aircraft to fly both within the national airspace and across its borders. The Service Provider is to ensure the airspace concept is as efficient as possible in terms of stakeholders’ costs and should publicise the expected benefits to the individual stakeholders.*

The *Service Provider XXX* is then to develop an implementation plan to realise this airspace concept. The implementation plan may follow the methodology described in the EUROCONTROL Airspace Concept Handbook for PBN Implementation (PBN Handbook No 1) which provides simple and clear guidance on the implementation cycle: Plan, Design, Validate and Implement.

Once the Airspace Concept and its implementation plan, together with appropriate transition plans, have been developed they will be agreed and signed off by both the State and the Service Provider. Finally, it will be the Service Provider's task to ensure the PBN implementation respects the milestones identified in the plan while the State will ensure that the required certifications and approvals are granted in a timely fashion.

6. METHODOLOGY

Should the State have elected to detail the process it wishes the Service Provider to undertake, then the State could also wish to detail a methodology for PBN implementation.

Example:

(Extract from the EUROCONTROL Airspace Concept Handbook for PBN Implementation):

The State requires the Service Provider to apply the following methodology when implementing the airspace concept:

A. PLANNING

1. Development of the high level airspace concept – identify what needs to be addressed/changed and by when to fulfil the national objectives.
2. Creation of an Implementation Team
3. Development of a PBN Implementation plan
4. Analysis of current operations – what works and can be kept and what needs to be changed/adapted.
5. Agree specific safety and performance targets and how to measure them.
6. Agree the enablers, constraints and assumptions

B. DESIGN

7. Placement of the routes, IFPs and holds – separate flows laterally and if not vertically
8. Protection of the ATS routes - volumes
9. Management of the airspace – sectorisation
10. Confirmation of the navigation specification

Note: In Developing the New Airspace Concept the ANSP is to demonstrate that it has catered for contingency measures in the event of a GNSS outage.

C. VALIDATION – To confirm safety and performance targets will be met

11. Concept validation through FTS/RTS and possibly shadow operations

12. *Design of Instrument Flight Procedures (IFPs)*
13. *Validation of IFPs – Ground and flight & Flight Inspection, if needed*

D. IMPLEMENTATION – *Following GO/NO GO decision*

14. *ATC system integration – FDP, RDP, Tools etc.*
15. *Development of training and awareness material; Training of pilots and controllers*
16. *Implementation*
17. *Post implementation review.*

Detail the benefits to the different stakeholders:

- i. *State*
- ii. *Airspace Users*
- iii. *Service Provider*

7. TRANSITION CONSIDERATIONS

The State may wish to direct the Service Provider in how the transition should be undertaken.

Example:

The following are considerations the Service Provider is to address in the development of the implementation plan:

1. *Mandate or Mixed Mode or both*
 - a. *Impact on Safety*
 - b. *Impact on Efficiency*
2. *Conventional procedures:*
 - a. *Required or not?*
 - b. *Provision of required procedures for how long?*
 - c. *Limitations on operations (BEBS)*
3. *Targeted infrastructure reduction*
 - a. *Withdraw 30% of VORs by 2020; 60% by 2025, 80% by 2030.*
4. *Exemption*
 - a. *Periods*
 - b. *Parties*

Part B
Template for
ANSP PBN Deployment Plan

(BY THE SERVICE PROVIDER(S))

EXECUTIVE SUMMARY

1. The ANSP(s) may elect to explain why a PBN implementation plan is being developed. It is highly likely that the NSPs will want to highlight why the changes are required and what the expected benefits will be for the airspace users.

Example:

The NSA has tasked the ANSP to develop an airspace strategy and a supporting PBN implementation/transition plan to ensure regulatory compliance with the PBN IR and ICAO Resolution 37-11, and to meet passenger demands, without impacting on the safety or capacity of the airspace whilst fulfilling our national environmental commitments.

This airspace concept, which is to meet all of the national objectives, will be supported by a PBN implementation plan that will have clearly defined transition plan with timescales to deliver the concept. The ANSP will consider the transition from current operations and ensure the connectivity of the ATS network throughout the airspace. The concept and implementation plan will be cognisant of the national safety and environmental policies and will demonstrate that the new airspace concept is as safe as current operations, if not safer, through a rigorous safety assessment. Furthermore, we will undertake appropriate stakeholder consultation to ensure a smooth transition during implementation. We will present the strategic roadmap for PBN implementation to the NSA for acceptance and confirmation once the performance targets, safety assessment and stakeholder consultation have been successfully undertaken. Following acceptance, it will be our responsibility to manage the implementation to ensure that the agreed timelines are met. The NSA will be responsible for ensuring the stakeholders involved are appropriately certified and operationally approved. However, it will be our responsibility to communicate with the stakeholders (airport operators, airlines, adjacent ANSPs and the Network Manager) to ensure that the airspace users know about the planned changes and have enough time to equip/retrofit the correct equipment on board the aircraft. Finally, the ANSP will develop appropriate training material for the stakeholders which is to be approved by the NSA prior to use.

The final document, when fully complete, will describe the proposed airspace changes to meet regulatory requirements and the State's strategic intent. The deliverables of the process will be a strategic roadmap defining the PBN implementation. The State commitment to this plan will be clearly indicated by the NSA signing the finalised document. We will also be responsible for developing the relevant aircraft documentation, ensuring stakeholder awareness through appropriate communication channels and laying out the transition plan for the implementation. Finally, the NSA will be required to approve the specific training required for the PBN implementation which we will develop as one of the transition activities.

1. Statement of Strategic Compliance - Intention Policy

The Service Provider would be expected to respond to the PBN implementation request from the State and may do so as follows.

Example:

*The **Service Provider XXX** undertakes to develop an airspace concept and an associated PBN implementation plan to meet the national objectives as detailed by the State. This concept and its associated implementation plan will be developed in collaboration with all the involved stakeholders, it will follow the high level principles elaborated by the State and will comply with both European and national regulatory requirements, particularly as regards:*

- PBN IR
- CP 1 IR, AF#3

*The airspace concept will be developed to ensure efficient and cohesive flows of traffic and provide opportunities to safely improve capacity whilst meeting environmental commitments. The associated PBN implementation plan will be developed to ensure that the airspace concept is achieved in a timely fashion and ensure that the State meets its specified goals. Throughout the development and deployment of the airspace concept, the **Service Provider XXX** will ensure that performance targets are clearly defined and met and that the future airspace changes are at least as safe as current operations if not safer. Furthermore, through the involvement of the stakeholders, the **Service Provider XXX** will ensure that the concept and plan are balanced and deliverable in coordinated timeframe. The PBN implementation plan will be supported by a transition plan which will ensure that the evolution from today's operations to tomorrow's environment is communicated, coordinated and executed in the most efficient and cost beneficial way. Finally, to ensure the 'buy-in' from the local neighbours, the **Service Provider XXX** undertakes that transparent public consultation will be conducted prior to implementation.*

2. Compliance Methodology

The Service Provider may then continue with a statement on how it plans to roll out the PBN implementation.

Example:

*The **Service Provider XXX** will follow the EUROCONTROL guidance on PBN implementation by applying the seventeen activities laid out in the European Airspace Concept Handbook for PBN Implementation (Edition 4 published in 2021). The **Service Provider XXX** will review the national objectives set out by the State and EU Regulatory requirements, and derived a set of operational requirements to fulfil the strategic goals. These operational requirements will form the basis of the airspace concept which the **Service Provider XXX** will provide to the State for acceptance. Once mutual agreement on the airspace concept has been achieved, the **Service Provider XXX** will develop the implementation and transition plans necessary to deliver the operational requirements. The **Service Provider XXX** will draw together an implementation team consisting of all involved stakeholders to then develop a set of implementation objectives to achieve the operational requirements. These objectives will be prioritised to ensure that a timely and coordinated set of successful implementations will deliver the future airspace concept; the prioritisation will form the basis of the transition plan. Each*

individual objective will require a team of involved stakeholders to manage the implementation and it will be at this granularity that specific performance targets will be set and safety demonstrated in accordance with the national safety policy. The careful coordination of the implementation objectives will ensure the connectivity through the airspace and at its boundaries is maintained and that the airspace users will have an efficient, cost beneficial set of flows within the national airspace.

3. ANALYSIS

The Service Provider is now expected to analyse the ‘Drivers for Change’ and identify where the State needs to be and by when.

Example:

What are the identified ‘Drivers for Change’?

PBN IR Article 4 & 7 Applicability with AUR.2005		Applies 03/12/2020	Applies 25/01/2024	Applies 06/06/2030
Art 4	Transition Plan (or significant updates) approved (living document) ¹	X ²	X ²	X ²
AUR.2005 1/2/3	RNP APCH at IREs without Precision Approach (PA)	X		
	RNP APCH at all IREs (with PA)		X	
AUR.2005 4/5	RNAV 1 or RNP 1 (+RF if required) SID and STAR - one per IRE		X	
	RNAV 1 or RNP 1 (+RF if required) for all SID and STARS			X
AUR.2005 6	RNAV 5 ATS Routes (excl. SIDs/STARS) at and above FL150 ²	X		
	RNAV 5 ATS Routes (excl. SIDs/STARS) below FL150		X	
AUR.2005 7	Helicopter RNP 0.3 or RNAV 1 or RNP 1 (+RF if required) SID/STAR - one per IRE		X	
	Helicopter RNP 0.3 or RNAV 1 or RNP 1 (+RF if required) for all SID/STAR			X
	Helicopter RNP 0.3 or RNAV 1 or RNP 1 ATS Routes (excl. SIDs/STARS) below FL150		X	

Note 1 - The transition plan will have several iterations; Article 4 requires that the draft/significant updates to the plan must be approved by the competent authority **early enough** to provide sufficient time for the ANSPs to meet the identified implementation date. (Sufficient time would include accounting for the AIRAC cycle dates, publication and regulatory approval and compliance with other national requirements - see the PBN Portal for an example of the implementation scheduling and time required: <https://pbnportal.eu/epbn/main/PBN-Tools/Planning-Estimation.html>). The planned implementation dates detailed in the transition plans should be commensurate with the target date obligations.

Note 2 - CP 1 requires FRA to be implemented with two milestones: 2022 & 2025. FRA is associated with RNAV 5 through the ICAO EUR requirement for RNAV 5 published in ICAO Doc 7030. (CP 1's revised FRA requirements replace previous requirements in the PCP IR).

Table Updated FEB2021

CP 1 IR, AF#3 – requiring FRA above FL305 by December 2022.

Flight Phase	NAV-application	When	NAV specification	NAV infrastructure	NAV back-up infrastructure
En-route	FRA (above FL310)	DCT by 31/12/2017 FRA by 31/12/2021	-	GNSS	VOR/DME +Radar as required
	ATS-routes ≥ FL150	03 DEC 2020	RNAV 5		
	ATS-routes > FL150	25 JAN 2024			
TMA	SID/STAR	03 DEC 2020	ALL RNAV 1	GNSS	DME/DME
		03 DEC 2020	Conventional SID/STAR (contingency only)	DME/DME VOR/DME	NDB
		25 JAN 2024	1 RNAV 1 SID/STAR per IRE	GNSS	DME/DME VOR/DME
		6 JUN 2030	RNAV 1 for all SID/STAR	GNSS	DME/DME VOR/DME
APP	IAP	Type A or Type B by 25 JAN 2024	RNP APCH or RNP AR APCH	GNSS	Conventional (ILS, VOR/DME, NDB)

Fleet:

Current capabilities:

	Airline 1		Airline 2	Operator 3	Operator 4	Operator 5
Airframe	757	737	737	Q400	A320	Trilander
Certified	RNP 10 RNAV 5	RNAV 5	RNAV 5 RNAV 1 RNP APCH	RNAV 5	RNAV 5 RNAV 1	RNAV 5 RNP APCH
Capable	-	RNAV 1 RNP 1 RNP APCH	RNP 1 A-RNP	RNAV 1 RNP 1 RNP APCH	RNP 1 RNP APCH A-RNP	RNAV 1 RNP 1
Sensors	INS DME/DME VOR ILS ADF	GPS DME/DME VOR ILS GBAS	GPS DME/DME VOR ILS ADF	GPS DME/DME ILS	GPS DME/DME VOR ILS ADF	SBAS ILS ADF
Functionalities		RF	RF		RF	

4. NATIONAL AIRSPACE CONCEPT

Based on the data detailed in the last section the Service Provider can then propose a national airspace concept.

Example:

The *State of XXX* will comply with all European legislation and the Service Provider will ensure that all national obligations and performance targets will be met. Therefore, the introduction of Free Route Airspace within the national boundaries above FL305 with defined entry/exit points at that flight level will be completed by the end of 2022. The transition to a total FRA environment will be achieved by a stepped approach with completion by the end of 2025.

Within terminal airspace, to comply with the ICAO General Assembly resolution 37/11 and the EU's PBN IR, the introduction of RNP APCH to each instrument runway end to replace conventional NPAs and provide back-up to precision approach. Whilst ICAO considered this a primarily a safety initiative to reduce CFIT, EU regulation also wishes to ensure the transition to GNSS based approaches using PBN, and to enable access to aerodromes which previously were not supported with approach procedures.

To provide an efficient flow of traffic without impacting on capacity, the FRA will be connected to the TMAs with most direct fixed ATS routes possible. Capacity demand will drive the performance requirement on these ATS routes with current RNAV 5 routes maintained in low traffic demand areas and the implementation of a reduced route spacing in high demand airspace.

Within the TMAs, to minimise delay and to reduce the amount of holding, the introduction of point merge will provide the opportunity to maximise runway throughput. Furthermore, to reduce environmental impact, the application of continuous climb and continuous descent operations (CCO/CDO) through the strategic deconfliction of the arrival and departure flows will reduce noise and emissions and provide fuel savings to the airspace users. In addition, the application of consistent, highly repeatable turn performance will enable arrival and departure routes to be placed in the most beneficial location.

To ensure equality and freedom of access to all airspace users, advanced flexible use of airspace (AFUA) will be applied throughout the national airspace and dynamic airspace configurations will be designed to optimise the airspace for a particular demand. In addition, the provision of Class G airspace below 1500' will be provided outside of protected airspace enabling GA and RPAS operations.

{ The following text is an example of how a State could accommodate aircraft unable to comply with the PBN IR for a defined period after the activation of the provisions }

Finally, consideration is given to managing lower capable aircraft and the provision of some conventional operations will be maintained for a two-year period post PBN implementation. Following that exemption period, only aircraft appropriately certified and approved will be permitted to operate on the ATS routes within the national airspace from 06:00 to 21:00 daily.

5. OPERATIONAL REQUIREMENTS AND PBN IMPLEMENTATION OBJECTIVES

The Service Provider would now detail both what is planned to be implemented together with timescales.

Example:

Introduction of Free Route Airspace (FRA):

Initially DCT was foreseen during low traffic periods when capacity is not impacted, with the expectation to switch off the ATS route structure in night periods.

Identify primary flows of traffic in FRA and provision waypoints at those entry/exit points; this will require the provision of entry/exit through the base of the airspace. Ensure that at exit and entry points on the sector boundaries and at the FIR that these waypoints are a minimum of 10NM spaced to ensure connectivity with the neighbouring States. Implementation by Q2 2022.

Full provision of FRA above FL305 with user defined waypoints to be implemented in Q3 2022. A full safety assessment will be required to identify whether this operation will only be at low traffic densities or whether this can be applied at high traffic levels. Capacity planning will be key to the provision of FRA.

Separation assurance is provided by ATC and independent surveillance and DCPC are required

ICAO Doc 7030, EUR Supplementary Procedures, effectively mandated the application of RNAV 5 en route airspace in 1998. This means that to operate in the European FRA, RNAV 5 is required due to the ICAO provision.

Deployment of fixed ATS routes to connect FRA to Terminal Airspace:

Segregate inbound and outbound flows laterally wherever possible.

Where traffic levels permit, maintain a XX NM route spacing which enables all aircraft access.

RNAV 5 ATS routes will connect the FRA and terminal airspace. Then to connect these RNAV 5 ATS routes with the runway, RNAV 1 SIDs and STARs could be developed with the RNAV 1 STARs connecting to the runway via a RNP APCH. (Should planners and designers need to achieve lower route spacing and predictable and repeatable turn performance, RNP 1 with RF could be used as the basis for SIDS/STARs).

SIDs and STARs:

Identify required navigational performance for operations within the TMAs.

Identify whether consistent, highly repeatable turn performance is required for avoiding noise sensitive areas or reducing track length. In this case develop RNP 1 operations and identify RF functionality as a requirement.

Enable CCOs/CDOs by segregating inbound and outbound flows laterally wherever possible:

- a. Assess climb and descent performance of aircraft fleets operating within the State. Develop a climb and descent profile chart.
- b. Crossing points to be near departure end of runway or at distance from aerodrome. Close crossing points allow all departures to have uninterrupted climb passing under arrival flow. Distant crossing points allow arriving aircraft an uninterrupted descent whilst departing traffic crosses above the arrival flow.

Maintain conventional procedures at all aerodromes over the exemption period. Continue to provide conventional procedures at aerodromes whilst conventional navigation aids remain available and equipage is not above a certain threshold. This provides the ability for the State to manage less capable aircraft although operator options may be impacted.

What the ANSP proposes for the TMAs:

TMA	ATC or AFIS airports	SID	STAR	Infrastructure
TMA 1	Airport A	RNP 1	RNAV 1	GNSS
TMA 2	Airport B	RNAV 1	RNAV 1	GNSS
	Airport C	RNP 1	RNP 1	GNSS
TMA 3	Airport D	RNAV 1 Conventional	RNAV 1 RNAV 5 > 30NM to Conventional	DME/DME VOR/DME (NDB – Non PBN)
TMA 4	Airport E	Conventional	Conventional	VOR (NDB – Non PBN)
...				

Introduction of RNP APCH:

Identify all published approach procedures for every instrument runway end.

Implement RNP APCH at all instrument runway ends with three lines of minima. ICAO Doc 025 [Ref] provides useful high-level guidance on RNP approach Implementation.

Prioritise development of RNP APCHs based on:

- a. Traffic demand and aircraft capabilities; develop the procedure as an APV based on demand and the capabilities of the aerodrome and aircraft.
- b. Provision of full obstacle surveys.
- c. Provision of precision approach; replace all Type A procedures before developing procedures for runways supported by Type B operations (i.e. ILS).

Implement as soon as possible.

What ANSP proposes for the aerodromes:

ICAO Code	Airport Name	IFR RWY	LNAV	LNAV/VNAV	LPV	RNP AR	Notes
EXBA	Blabla	05 ILS	Implemented	Planned Q4 2023	Planned Q4 2023	-	Rationalisation of NPAs (VOR & NDB) in 12/2018
		23	No plan	No plan	No plan	Planned Q3 2020	APV not possible due to terrain
EXTA	Toa	10 ILS	Planned Q1 2023	Planned Q1 2023	No plan	No req	Airport outside EGNOS commitment area
		28 ILS	Planned Q2 2023	Planned Q2 2023	No plan	No req	Maintenance of conventional NPAs (VOR) until Dec 2023 Withdrawal of VOR ABC in 2025
EXKG	Koihg	18	Planned Q4 2020	Planned Q4 2020	Planned Q4 2020	No req	No CAT Maintenance of conventional NPA (NDB) until 2020 Withdrawal of NDB XXX in 2023
EX....							

6. CONSIDERATIONS FOR PBN IMPLEMENTATION

Following the PBN Implementation objectives, the Service Provider would then need to stipulate how it plans to migrate from current operations to the future planned PBN environment.

Example 1:

The operational requirements identified above will require an implementation and transition plan. This will be the task of the individual implementation teams which will be created from the different stakeholder groups impacted by the airspace change. Each implementation will follow the EUROCONTROL methodology for PBN implementation as detailed in the Airspace Concept Handbook for PBN Implementation [Ref]. Each implementation team is to ensure there is lateral and vertical connectivity:

- i. RWY to TMA*
- ii. TMA to En-route*
- iii. En-route to Neighbouring States*
- iv. En-route to FRA*

Example 2:

The operational requirements identified above will require contingency measures to be provided as part of the implementation and transition plan. This will be the task of the collective of various implementation teams, using as a basis, the individual implementation teams which will be created from the different stakeholder groups impacted by the airspace change. Each implementation will follow the EUROCONTROL methodology for PBN implementation as detailed in the Airspace Concept Handbook for PBN Implementation [Ref]. Each implementation team is to ensure there is lateral and vertical connectivity.

7. PBN TRANSITION PLAN

The Service Provider should now detail the timescales for implementation and include any identified exemption periods.

Example:

The national Service Provider has identified the following dates for implementation and they can be broadly split into short, medium and long-term dates for introduction:

- Short-term (next 2 years)
- Medium-Term (3 to 5 years)
- Long-Term (Beyond 5 years)

The following shows a calendar for the introduction of the operational requirements and phasing out of obsolete operations by phase of flight:

	Short Term		Medium Term			Long Term		
	2020	2021	2022	2023	2024	2025	2026	2027
<i>FRA</i>			<i>Implement DCT</i>			<i>Implement FRA</i>		
<i>En Route</i>	<i>Implement RNAV 5 > FL150</i>		<i>Full RNAV 5</i>					
<i>SID/STAR</i>	<i>Implement RNAV 1 in major TMA1</i>	<i>Implement RNAV 1 in TMA2</i>	<i>Implement new RNP 1 routes in TMA2 & RNAV 1 in TMA3</i>					
<i>IAP</i>	<i>EXBA</i>	<i>EXTA</i>	<i>EXTA/EXKG</i>					
<i>Rationalisation (ATS Routes and Procedures)</i>			<i>Withdrawal of TMA1 conventional procedures</i>	<i>Withdrawal of TMA2 conventional procedures</i>				
<i>Rationalisation (Infrastructure)</i>				<i>NDB - XXX</i>		<i>VOR - ABC</i>		

Any and all exemption policies will be detailed by the individual implementation teams. However, by 2023 at the latest, all aircraft are to be certified either to RNAV 1 or RNP 1 with RF (as appropriate) as well as RNP APCH and crews hold PBN privileges in their instrument ratings.

8. PBN IMPLEMENTATION ACTIVITIES

The Service Provider could now detail the required implementation team composition and the process methodology the PBN implementations will follow.

Example:

Identify Implementation Team

- a. *Composition*
- b. *Roles and Responsibilities*

Stipulate the Implementation Expectations

- a. *Planning*
- b. *Conceptual design*
- c. *Validation*
- d. *Implementation*
- e. *Post Implementation*

9. PBN IMPLEMENTATION

Should the Service Provider plan to follow the EUEOCONTROL PBN implementation process this can be identified here or alternatively the planned process should be clearly detailed as a series of steps.

Example:

The PBN implementation will follow the steps detailed below. Further considerations in each step of the implementation process will include:

- a. *Planning:*
 - v. *Confirm operational requirements will meet Airspace Concept*
 - vi. *Timelines*
 - vii. *Consultation – stakeholder and public*
 - viii. *Cost Benefit Analysis*
 - ix. *Safety and Security assessments*
 - *Reversion capabilities*
 - x. *Assumptions*
- b. *Conceptual design*
- c. *Validation:*
 - xi. *Ground*
 - xii. *Airborne*
- d. *Implementation:*
 - xiii. *Go/No Go decision – Performance and Safety targets met?*

- xiv. System changes*
- xv. Awareness and Training*
- xvi. Publication*
- e. Post Implementation:*
 - xvii. Monitoring*
 - xviii. Confirming performance and safety targets met*
 - xix. Constant review cycle*

Part C
Template for
ANSPs PBN Deployment Deliverables

(COMPLETED BY THE SERVICE PROVIDER(S) AND SIGNED OFF BY THE NSA)

SECTION 3: THE DEPLOYMENT DELIVERABLES (TO BE COMPLETED BY THE STATE AND THE SERVICE PROVIDER(S))

*This section is the culmination of the joint work created by the NSA and the ANSP. The Process identifies what is to be achieved in terms of PBN implementation and provides the answers to the questions **why, what, where, who, when and how.***

Deliverables

This final section is primarily compiled by the Service Provider and signed off (indicating agreement, acceptance and commitment of that document) by the State.

Example:

The following are the expected PBN deliverables from this project:

- 1. PBN Implementation strategic roadmap and plan signed by both NSA and Service Provider(s)*
- 2. Aircraft documentation (developed by SP)*
- 3. Stakeholder awareness through publication (developed by SP)*
- 4. Transition plan – to be communicated to all stakeholders (developed by SP)*
- 5. Contingency operations plan*
- 6. Ensure that the necessary training is provided.*

Appendix A: Glossary of Terms

AIP: Aeronautical information publication

Airspace concept: An airspace concept describes the intended operations within airspace. Airspace concepts are developed to satisfy explicit strategic objectives such as improved safety, increased air traffic capacity and mitigation of environmental impact. Airspace concepts can include details of the practical organization of the airspace and its users based on particular CNS/ATM assumptions, e.g. ATS route structure, separation minima, route spacing and obstacle clearance.

ANSP: Air navigation service provider

APCH: Approach

APV: Approach procedure with vertical guidance

Area navigation: A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these. Area navigation includes Performance-based Navigation as well as other RNAV operations that do not meet the definition of Performance-based Navigation.

Area navigation route: An ATS route established for the use of aircraft capable of employing area navigation.

ATC: Air Traffic Control

ATM: Air traffic management

ATS: Air Traffic Service

ATS surveillance service: A term used to indicate a service provided directly by means of an ATS surveillance system.

BARO VNAV: BARO metric VNAV means an Area Navigation System where vertical navigation and guidance is relying on pressure altimeter as the source of vertical position information.

CAA: Civil aviation authority

CNS: Communications, navigation and surveillance

CP 1: Common Project One

EASA: European Aviation Safety Agency

ECAC: European Civil Aviation Conference

EGNOS: European Geostationary Navigation Overlay Service

GNSS: Global Navigation Satellite System

ICAO: International Civil Aviation Organisation

IFR: Instrument Flight Rules

ILS: Instrument Landing System

LNAV: Lateral Navigation means the subset of functions and performance of the Area Navigation System related to horizontal navigation and guidance

LPV: Localiser Performance with Vertical guidance.

MLS: Microwave landing system

Navigation aid (NAVAID) infrastructure: NAVAID infrastructure refers to space-based and or ground-based NAVAIDs available to meet the requirements in the navigation specification.

Navigation specification: A set of aircraft and aircrew requirements needed to support Performance-based Navigation operations within a defined airspace.

Performance-based navigation: Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

Receiver autonomous integrity monitoring (RAIM): A form of ABAS whereby a GNSS receiver processor determines the integrity of the GNSS navigation signals using only GPS signals or GPS signals augmented with altitude (Baro-aiding). This determination is achieved by a consistency check among redundant pseudo-range measurements. At least one additional satellite needs to be available with the correct geometry over and above that needed for the position estimation, for the receiver to perform the RAIM function.

RNAV: Required Navigation accuracy means a subset of navigation specifications defined in the ICAO PBN Manual (Document 9613 Edition 4) relying on lateral position error being contained within X nautical miles (e.g. X = 5 corresponds to RNAV 5 specification) during 95 % of the flight time.

RNAV operations: Aircraft operations using area navigation for RNAV applications. RNAV operations include the use of area navigation for operations which are not developed in accordance with this manual.

RNAV specification: A navigation specification based on area navigation that does not include the requirement for on-board performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1.

RNAV system: A navigation system which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these. An RNAV system may be included as part of a flight management system (FMS).

RNP: Required Navigation Performance means a subset of navigation specifications defined in the ICAO PBN Manual (Document 9613 Edition 4) relying on lateral position error being contained within X nautical miles (e.g. X = 1 corresponds to RNP 1 specification) during 95 % of the flight time and providing integrity indicators and alerting.

RNP operations: Aircraft operations using an RNP system for RNP navigation applications.

RNP route: An ATS route established for the use of aircraft adhering to a prescribed RNP navigation specification.

RNP specification: A navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH.

RNP system: An area navigation system which supports on-board performance monitoring and alerting.

SBAS (Satellite-based augmentation system): A wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter.

SID (Standard instrument departure): A designated instrument flight rule (IFR) departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the en-route phase of a flight commences.

STAR (Standard instrument arrival): A designated instrument flight rule (IFR) arrival route linking a significant point, normally on an ATS route, with a point from which a published instrument approach procedure can be commenced.

VHF: Very high frequency

VNAV: Vertical Navigation

VOR: VHF omnidirectional radio range

VOR/DME: An airborne sensor providing aircraft position data derived from DME range(s) and VOR angle(s).

Appendix B: Reference Documents

1. ICAO ANNEX 10, Aeronautical Telecommunications, Volume I, Radio Navigation Aids.
2. ICAO ANNEX 11, Air Traffic Services.
3. ICAO Doc 4444 - Rules of the Air and Air Traffic Services.
4. ICAO Doc 8168 - PANS-OPS vol. I and vol. II.
5. ICAO Doc 9613 - Performance Based Navigation (PBN) Manual 4th edition, 2013.
6. ICAO Doc 9750 – 2020-2030 Global Air Navigation Plan Fifth Edition
7. ICAO Doc 9854 - Global ATM Operational Concept
8. ICAO Doc 9958 – Assembly Resolutions in Force (as of 8 October 2010)
9. ICAO EUR DOC 025 - EUR RNP APCH Guidance Material
10. Regulation (EC) N° 549/2004 of the European Parliament and of the Council of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation)
11. Regulation (EC) N° 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of air navigation services in the single European sky (the service provision Regulation)
12. Regulation (EC) N° 551/2004 of the European Parliament and of the Council of 10 March 2004 on the organisation and use of the airspace in the single European sky (the airspace Regulation)
13. Regulation (EC) N° 552/2004 of the European Parliament and of the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation)
14. Commission Regulation (EC 2150/2005) - Common Rules for the Flexible Use of Airspace,
15. Commission Implementing Regulation (EU) N° 923/2012 of 26 September 2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Implementing Regulation (EU) No 1035/2011 and Regulations (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010
16. Regulation (EC) N° 1070/2009 of the European Parliament and of the Council of 21 October 2009 amending Regulations (EC) N° 549/2004, (EC) N° 550/2004, (EC) N° 551/2004 and (EC) N° 552/2004 in order to improve the performance and sustainability of the European aviation system
17. Commission Implementing Regulation (EU) No 2018/1048 of 18 July 2018 laying down airspace usage requirements and operating procedures concerning performance-based navigation. General Acceptable Means of compliance for Airworthiness of Products, parts and Appliances for B-RNAV EASA AMC 20-4
18. Commission Implementing Regulation (EU) No 2021/116 of 1 February 2021 on the establishment of the Common Project One supporting the implementation of the European Air Traffic Management Master Plan provided for in regulation EC No. 550/2004 of the European Parliament and of the Council, Amending Commission Implementing Regulation [EU] No 409/2013 and repealing Commission Implementing Regulation [EU] No 716/2014.
19. EASA CS-ACNS, Certification Specifications and Acceptable Means of Compliance for Airborne Communication, Navigation and Surveillance, Issue 2, 26 April 2019
20. AIR-OPS Regulation (EU) No 965/2012, Acceptable Means of Compliance & Guidance Material (AMC & GM) to Annex V (Part-SPA), Special Authorisation, Issue 1, Amendment 8 [ED Decision 2019/019/R, Update of the acceptable means of compliance and guidance material to the Air OPS Regulation, 17 September 2019].
21. European Route Network Improvement Plan (ERNIP) Part 1 – Airspace Management Handbook Guidelines for Airspace Management (EUROCONTROL Edition 5.2 published 27 November 2015)
22. EUROCONTROL Airspace Planning Manual Volume 2, Section 5 – Terminal Airspace Design Guidelines, Ed 2.0 -Amendment 1, 17.01.2005.
23. European Airspace Handbook for PBN Implementation (Edition 4 published April 2021)



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