



Performance-based navigation implementation in the European air traffic management network

RELATED NPA/CRD 2015-01 — RMT.0639 — 28.7.2016

EXECUTIVE SUMMARY

This Opinion addresses safety, interoperability, proportionality and coordination issues related to the implementation of performance-based navigation (PBN) within the European airspace.

The specific objective is to ensure a safe, efficient and harmonised implementation of specific International Civil Aviation Organization (ICAO)'s PBN specifications and functionalities in the European air traffic management network (EATMN). The proposal extends the PBN implementation requirements beyond the 24 EU high-density terminal manoeuvring areas (TMAs), as required by Regulation (EU) No 716/2014 (hereinafter referred to as the 'Pilot Common Project Regulation'), and mitigates the risks associated with a non-harmonised implementation, thus ensuring a smooth transition to PBN operations.

This Opinion includes a proposal that air navigation service providers (ANSPs) and aerodrome operators implement:

- PBN approach procedures with vertical guidance (APV) that conform to the requirements of the RNP approach specification (RNP APCH) at all instrument runway ends (IREs) which are not served by precision approach procedures before 30 January 2020;
- PBN standard instrument departure (SID)/standard instrument arrival (STAR) and air traffic service (ATS) routes as required to meet locally defined performance objectives that conform to the RNAV 1 specification or the RNP1 specification including the use of additional functionalities, as of 6 December 2018;
- PBN requirements for the transition between the en route network and the SIDs/STARs to be consistent with the SIDs/STARs served; and
- PBN requirements in support of rotorcraft operations in conformity with the RNP 0.3 specification.

Aircraft operators wishing to operate along these routes and procedures will be required to ensure that their aircraft and flight crew are qualified for the required PBN operations.

The proposed changes are expected to improve safety, ensure a harmonised implementation of PBN operations that are consistent with the ATM Functionality AF 1 — 'Extended AMAN and PBN in high density TMAs' of the Pilot Common Project Regulation and support the implementation of the European Air Traffic Management Master Plan.

Applicability		Process map	
Affected regulations and decisions:	Regulation (EU) No 1332/2011; Regulation(EU) No 965/2012	Terms of reference (ToR):	25.6.2014
Affected stakeholders:	Member States; ATM/ANS providers; aerodrome operators.	Concept paper:	No
Driver/origin:	efficiency/proportionality; Commission Implementing Regulation (EU) No 716/2014).	Rulemaking group:	No
Reference:	European Commission PBN mandate MOVE E2/EMM D(2011) (6.4.2011).	RIA type:	Full
		Technical consultation during NPA drafting:	No
		Publication date of the NPA:	19.1.2015
		Duration of NPA consultation:	3 months
		Review group:	No
		Focused consultation:	Yes
		Publication date of the Decision:	2017/Q1



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1. Procedural information

1.1. The rule development procedure

The European Aviation Safety Agency (hereinafter referred to as the 'Agency') developed this Opinion in line with Regulation (EC) No 216/2008¹ (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure².

This rulemaking activity, RMT.0639, is included in the Agency's Rulemaking Programme for 2016-2020³. The scope and timescales of the task were defined in the related Terms of Reference.

The *draft* text of this Opinion has been developed by the Agency. All interested parties were consulted through NPA 2015-01⁴. 720 comments were received from interested parties, including industry and national aviation authorities (NAAs).

The Agency has addressed and responded to the comments received on the NPA. The comments received and the Agency's responses thereto are presented in Comment-Response Document (CRD) 2015-01⁵, published concurrently with this Opinion.

The *final* text of this Opinion has been developed by the Agency with the aid of focused consultations with specific stakeholders.

The process map on the title page summarises the major milestones of this rulemaking activity.

1.2. The structure of this Opinion and related documents

Chapter 1 of this Opinion contains the procedural information related to this task. Chapter 2, 'Explanatory Note', explains the proposed regulatory provisions, regulatory framework and describes the issues to be addressed. The outcome of the consultation is addressed in Chapter 3. The draft regulations proposed by the Agency are published as annexes to this Opinion and can be found on the Agency's website⁶.

¹ Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1464170711619&uri=CELEX:32008R0216>).

² The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such a process has been adopted by the Agency's Management Board (MB) and is referred to as the 'Rulemaking Procedure'. See MB Decision No 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material (<http://www.easa.europa.eu/system/files/dfu/EASA%20MB%20Decision%2018-2015%20on%20Rulemaking%20Procedure.pdf>).

³ <https://www.easa.europa.eu/system/files/dfu/Final%20RMP%202016-2020%20v6%2020151210.pdf>

⁴ In accordance with Article 52 of the Basic Regulation and Articles 6(3) and 7 of the Rulemaking Procedure.

⁵ <http://easa.europa.eu/document-library/comment-response-documents>

⁶ <https://www.easa.europa.eu/document-library/opinions>



1.3. The next steps in the procedure

This Opinion proposes the repeal of Regulation (EU) No 1332/2011⁷ and the amendment of Regulation (EU) No 965/2012⁸ (hereinafter referred to as the ‘Air OPS Regulation’) resulting from the repeal. It is addressed to the European Commission to be used as a technical basis to prepare a legislative proposal.

The decision amending ED Decision 2012/002/R⁹, containing the related acceptable means of compliance (AMC) and guidance material (GM) will be published by the Agency when the related regulations are adopted by the European Commission.

⁷ Commission Regulation (EU) No 1332/2011 of 16 December 2011 laying down common airspace usage requirements and operating procedures for airborne collision avoidance (OJ L 336, 20.12.2011, p. 20) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1464703333021&uri=CELEX:32011R1332>).

⁸ Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296, 25.10.2012, p. 1) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1464703399540&uri=CELEX:32012R0965>).

⁹ Decision 2012/002/R of the Executive Director of the Agency of 8 March 2012 on the Acceptable Means of Compliance and Guidance Material for Common Airspace Usage Requirements and Operating Procedures ‘AMC/GM to AUR’ (<http://www.easa.europa.eu/system/files/dfu/ED%20Decision%202012-002-R.pdf>).



2. Explanatory note

2.1. Issues to be addressed

The main issues addressed by the draft regulations proposed in this Opinion are the following:

- An efficiency/economic issue

The continued growth of aviation places increasing demands on the effective and efficient use of the available airspace, thus emphasising the need for its optimum utilisation. Improved operational efficiency and airspace utilisation, derived from the application of PBN, has been demonstrated to bring capacity benefits through the optimisation of ATS routes and approach procedures. PBN is therefore one of the underpinning operational concepts required to improve the efficiency and safety of European aviation operations and is being implemented worldwide as part of the ICAO Global Air Navigation Plan (GANP).

PBN offers a number of advantages over the conventional sensor-specific methods for the development and operations of routes and approach procedures. For instance, PBN:

- (a) reduces the need to maintain sensor-specific routes and procedures, and their associated costs;
- (b) avoids the need for the development of sensor-specific operations. The expansion of global navigation satellite systems (GNSS) is expected to contribute to the continued implementation of PBN operations. The original basic GNSS equipment is evolving due to the development of augmentations such as the satellite-based augmentation system (SBAS);
- (c) allows for a more efficient use of the airspace (route placement, fuel efficiency, noise abatement, etc.), in particular in the terminal areas; and
- (d) improves safety due to greater navigational accuracy and associated obstacle clearance.

- Harmonisation issue

In order to ensure an efficient, harmonised and safe implementation of PBN in Europe, that enables a performance improvement of the EATMN, the harmonised use of particular PBN specifications and functionalities is critical.

Each Member State, ATM/ANS provider or aerodrome operator implementing airspace/procedure design on the basis of a PBN specification or functionality of their choice would lead to a fragmented, disharmonised, inefficient and unsafe PBN implementation in the European airspace. It is therefore necessary to harmonise the PBN implementation in Europe by reducing/limiting the number of options that may be applied.

- ICAO alignment

ICAO Assembly Resolution 37-11 calls for an '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 [...]'.



2.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. The specific objective of this Opinion is to ensure a safe, efficient and harmonised implementation of specific PBN specifications and functionalities in the EATMN.

Furthermore, the provisions as proposed in the draft regulations will:

- (a) contribute to the implementation of the essential requirements of Regulation (EC) No 552/2004¹⁰;
- (b) be consistent with the ATM Functionality AF 1 — Extended AMAN and PBN in high density TMAs of the Pilot Common Project Regulation¹¹, supporting the implementation of the European Air Traffic Management Master Plan; and
- (c) enable a performance-based application of PBN within the EATMN.

2.3. Outcome of the consultation

2.3.1. General

The Agency launched the public consultation of NPA 2015-01 on 19 January 2015. The commenting period expired on 30 April 2015. In total, 720 comments were submitted by 57 stakeholders: The distribution of the commentators is shown in Figure 1.

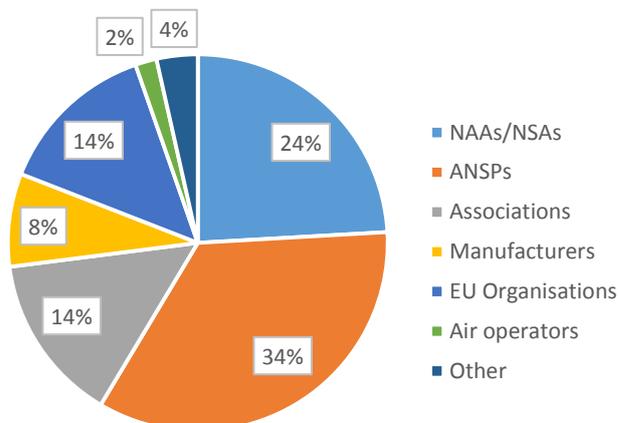


Figure 1: Distribution of the comments received per stakeholders' sector

¹⁰ Regulation (EC) No 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) (OJ L 96, 31.3.2004, p. 26) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1464703807492&uri=CELEX:32004R0552>).

¹¹ Commission Implementing Regulation (EU) No 716/2014 of 27 June 2014 on the establishment of the Pilot Common Project supporting the implementation of the European Air Traffic Management Master Plan (OJ L 190, 28.6.2014, p. 19) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1464704882636&uri=CELEX:32014R0716>).



The Agency highlights that significant number of the comments were duplicates. Nevertheless, the Agency concludes that the public consultation of NPA 2015-01 has brought real benefits to this rulemaking activity and contributed to the development of this Opinion. Stakeholders and interested parties provided valuable comments and, in many instances, alternative proposals to the proposed texts. Those that were accompanied by justifications, facilitated the review and the amendment of the initial proposal made in the NPA.

The distribution of the comments received on the various parts of NPA 2015-01 and the distribution of the Agency responses are shown in Table 1 and Figure 2 respectively.

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Table 1: Distribution of the comments received on the various parts of NPA 2015-01



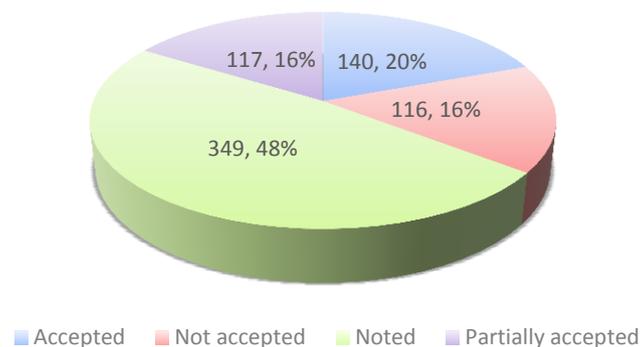


Figure 2: Distribution of the responses to the comments received

2.3.2. Response to the major concerns identified

The four major issues that were raised during the consultation as well as the Agency's responses are addressed in this section. The responses herein are commonly referenced throughout the CRD that contains all the comments submitted by the stakeholders and the responses provided thereto by the Agency, and is published concurrently with this Opinion.

- (1) The proposed implementation dates do not correspond to those promulgated by ICAO Resolution A37/11 and may affect stakeholders' investment plans to achieve the requirements of said resolution.

Response: A37/11 Resolution requires implementation of APV, including LNAV only minima, for all IREs, either as the primary approach or as a back-up for precision approaches by 2016. While recognising the intent of the resolution is to improve the efficiency and safety of approach operations as quickly as possible, it would be impractical at this time to impose a date of 2016 in any implementing regulation. The proposed date of 2024, which was aligned with the Pilot Common Project Regulation, did not preclude the implementation at any time prior to 2024. The Agency acknowledges the implementation progress made to date and the current plans and recognises that it is practical to require APV implementation earlier and is proposing that APV should be implemented by 30 January 2020, that is 4 years in advance of the NPA proposal.

Furthermore, it is only proposed to address those IREs where there is only a non-precision approach procedure in place for the mandated implementation of APV, as this achieves the safety improvements attributed to operating with vertical guidance. The implementation of APV at 24 European aerodromes is addressed within the Pilot Common Project Regulation. The implementation of APV as back-up for precision approach at other European aerodromes is left voluntary on the basis of local performance objectives.

- (2) The proposed provisions are directly applicable to air traffic service providers (ATSPs) and aerodrome operators and, as such, do not introduce a specific additional obligation to equip aircraft. Such a regulatory approach is seen by some as a limiting factor in the promulgation of PBN operations.



Response: The Agency recognises the concerns pertaining to not requiring an obligation to equip aircraft. However, it should be recognised that the proposal is a performance-based approach to the implementation of PBN operations. The implementation of PBN SIDs/STARs should only be accomplished where it brings performance benefits, as it is in an aircraft operator's interest to make the best use of these procedures. This should therefore incentivise equipage and use of these procedures more widely. For European operators, the aircraft should conform to CS-ACNS or early issued AMC-20 material and operation should be conducted in compliance with the new applicable provisions of the Air OPS Regulation. Furthermore, pilots need to comply with the new Part-FCL rules, which consider PBN operations as an integral part of the training and checking for the instrument rating, and air operators have to consider PBN operations as an integral part of the recurrent training and checking.

Requiring all aircraft to equip would therefore be disproportionate, as they may only operate to locations where no performance benefits from PBN operations can be attained. However, it is also recognised that the numbers of aircraft that are capable of PBN is continually increasing and thus aircraft performance should not be a limiting factor for implementation.

With respect to military aircraft, it is recognised that these aircraft may have difficulties in complying with the civil aviation certification requirements. However, these aircraft may be equipped with a capability that is adequate for the intended operation and achieve the required performance and integrity. These aircraft, as such, are fully capable of unhindered operations in the airspace. Therefore, Member States should endeavour to make the most appropriate use of the existing capabilities.

(3) The proposed provisions to maintain mixed PBN and non-PBN operations based on local or national performance considerations, is seen as a potential limiting factor in the implementation of PBN operations. It is envisaged that it will enable aircraft operators to continue to operate without equipping for PBN operations, thereby reducing the benefit gains and the opportunity for infrastructure rationalisation.

Response: The Agency notes that for earlier implementation of PBN procedures especially in busy TMAs, traffic with varying performance has been seen as a limiting factor. It is also recognised that only a full, 100 % PBN operational environment will return the maximum benefit that can be achieved by PBN.

The proposed provisions, following a performance-based approach and being proportionate, require the implementation of PBN procedures only when a performance need has been established. At the same time and also subject to a decision to be taken locally, operation of non-qualified aircraft or operators can be limited up to the termination of mixed operations. Such entrepreneurial decisions will allow the affected airspace users to decide on their PBN capability and whether they wish to continue to operate to the aerodrome in question. Maintaining such an approach also permits State aircraft to have continued access, without the need for specific exemptions or derogations.

Therefore, implementation will achieve benefits to all parties, and operators will qualify their aircraft and operations accordingly.

(4) The proposed implementation of the RNP 1 specification plus RF and altitude constraints in the TMA and the Advanced RNP (A-RNP) specifications en route could be too demanding for the current aircraft population, therefore consideration should be given to the RNAV 1 specification everywhere, with the use of the RNP 1 specification only where required.



Response: The proposed provisions were based on the earlier work carried by EUROCONTROL and were assumed to be the agreed specifications required for European airspace. The comments received indicated that the implementation of the proposed navigation specifications could be too demanding to be applied to the current European aircraft fleet. Although new aircraft are capable of RNP 1 operations, a significant number of the fleet operating in European airspace are only capable of RNAV operations. It should also be recognised that the en route environment at and above FL310 is to migrate to the use of free routes from 2022 in accordance with the Pilot Common Project Regulation, hereby not supporting the requirement for the use of a more stringent performance standard, that only achieves zero or a marginal operational benefit compared to the current RNAV 5 implementation.

The Agency therefore concludes that the RNP 1 and A-RNP navigation specifications may have been too ambitious for implementation at all locations. However, the use of the RNP 1 specification plus the use of RF and altitude constraints will be maintained for those areas where superior performance is required, otherwise the RNAV 1 specification should be applied. In addition, the RNAV 5 specification will remain applicable for en route phases.

2.4. Summary of the regulatory impact assessment (RIA)

The RIA addressed the needs as stated in the objectives of the task to ensure an efficient and safe implementation of PBN in Europe. In doing so, it primarily addressed the need to ensure a harmonised approach to PBN implementation.

It is recognised that the public consultation provided valuable comments that have contributed to the development of this Opinion. Said comments have resulted in positive changes to the proposed draft regulations that will ensure a simpler and more effective implementation of PBN. The Agency considers that the results of the impact assessment as presented in the NPA¹² are neither significantly changed nor invalidated following the comments received and the resulting changes in the proposed draft regulations.

Two basic options have been considered:

Option No	Short title	Description
0	Do nothing	Baseline option (no change in rules; risks remain as outlined in the issue analysis).
1	Harmonised PBN implementation	Proposed regulations to mandate implementation of APV approaches at all IREs where there is no precision approach procedure and to ensure harmonised PBN implementation in Europe where and when needed to reach performance criteria.

¹² <http://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2015-01>



2.4.1. Impact analysis

The summary of the impacts for each option is provided in the following table:

Table 2: Summary of impact analysis

Scenario and range (4 %, 2016–2033)	Costs of 3D PBN approach procedures	Benefits (avoided diversion flights)	Net Present Value	Benefit Cost Ratio
Main scenario* : 399 IREs without 3D approach in 2013 and without 3D PBN approach implementation plan and 16.7 avoided diversions per IRE per year				
	<i>Not discounted</i>			
Low	-€11 961 222	€3 772 691 677	<i>Not applicable</i>	
High	-€18 938 601			
	<i>Discounted (4 %)</i>			
Low	-€8 739 948	€256 100 466	€247 360 518	29
High	-€13 838 250		€242 262 215	19
Sensitivity analysis				
	<i>Discounted (4%)</i>			
0.3 avoided flight diversion per IRE per year (low unit cost & low benefit)	-€8 739 948	€35 455 001	€26 715 054	4
5.8 avoided flight diversion per IRE per year (high unit cost & high benefit)	-€13 838 250	€56 137 085	€42 298 835	4

*Main scenario = scenario 1 assessed in the RIA of the NPA 2015-01

Table 2: Summary of impact analysis

The RIA has demonstrated clearly that the benefits are outweighing the costs¹³, as shown by the main scenario (called scenario 1 in the NPA) and the sensitivity analysis.

The main scenario is based on:

- the implementation of PBN on 399 IREs without 3D approach in 2013 and without 3D PBN approach implementation plan;
- 16.7 avoided diversions per IRE per year following the PBN IR implementation.

¹³ The average total cost of the development of a single new approach procedure for an ANSP or aerodrome operator is assessed to be approximately EUR 30 000. This cost includes: preparatory surveys, procedure design, procedure validation (including test flights), preparation and submission to the competent authority, and controller training. Where two procedures are developed for the same runway end (e.g. based on BARO-VNAV and SBAS), the costs are estimated to be approximately EUR 47 500. These values are averaged for Europe and it is recognised that there may be significant variations from State to State (NPA 2015-01, Section 4.5.5.2.2).



This gives an average Net Present Value (at 4 % discount rate and for the period 2016–2033) of EUR 245 million, i.e. a Benefit Cost Ratio ranging from a factor 19 to 29 depending on the level of unit cost. A Benefit Cost Ratio factor 3 is already considered as a very good positive case.

A sensitivity analysis was performed on the number of avoided flight diversions per IRE. Even with the worst case:

- 0.3 avoided flight diversions per IRE and per year (instead of 16.7 in the main scenario); and
- highest unit cost (instead of using the lowest unit cost),

the outcome is still highly positive with a 2.5 Benefit Cost Ratio.

2.5. Overview of the proposed amendments

This Opinion proposes to repeal Regulation (EU) No 1332/2011 and to replace it with a recast regulation and as a consequence an amendment to the Air OPS Regulation as the latter contains references to Regulation (EU) No 1332/2011. The scope of the new regulation has been expanded to include all entities that may be responsible for implementing changes to airspace usage and conducting operations within the European airspace.

The proposal contains the same obligations related to the carriage of ACAS II, as defined in Regulation (EU) No 1332/2011 (as amended by Regulation (EU) 2016/583¹⁴), as well as new requirements to support the implementation of PBN within a single regulation that can be easily amended in the future to include other subject matters in support of safety, interoperability and efficiency performance improvements, and the European ATM Master Plan deployment.

2.5.1. Regulatory framework

The creation and proliferation of individual regulations for the implementation of individual technical enablers is considered by the Agency not to be appropriate. Such an approach would result in a complex regulatory environment with identical provisions being repeated in many regulations. The regulatory requirements and means of compliance should be a set of harmonised and complementary provisions, allocated as appropriate within each stakeholder's regulatory domain. This approach reduces the complexity of the regulatory system, thus supporting a better understanding and, hence, implementation of the safety and interoperability requirements in all domains.

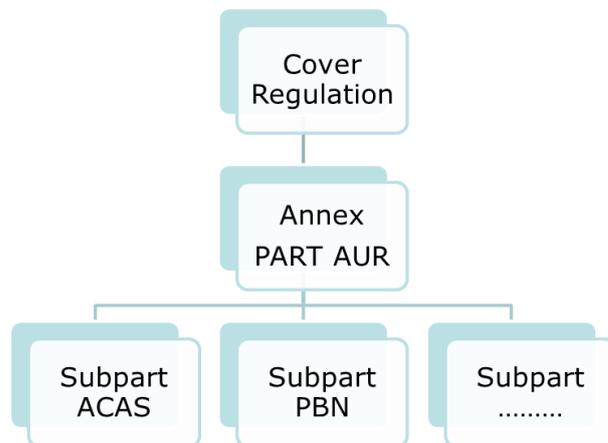
In applying this conclusion, a single regulation to be applied above the territory to which the Treaty applies applicable to **all** airspace users and to the use of the airspace containing the mandated implementation requirements is being proposed by the Agency, within the limitations specified in the Basic Regulation and the SES Framework Regulation¹⁵.

The structure of the proposed regulation is shown in Figure 3.

¹⁴ Commission Regulation (EU) 2016/583 of 15 April 2016 amending Regulation (EU) No 1332/2011 laying down common airspace usage requirements and operating procedures for airborne collision avoidance (OJ L 101, 16.4.2016, p. 7) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1464775724265&uri=CELEX:32016R0583>).

¹⁵ Regulation (EC) No 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) (OJ L 96, 31.3.2004, p. 1) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1464775927977&uri=CELEX:32004R0549>).





- **Cover Regulation:** Full scope, definitions, applicability dates, etc.
- **Subpart ACAS:** Specific scope and ACAS II carriage obligations
- **Subpart PBN:** Specific scope and PBN use obligations
- **Subpart ...:** 'reserved for future'...?

Figure 3: Proposed new regulation structure

2.5.2. Selection of the particular PBN requirements

The specifications proposed as part of the NPA were based on the results of a prior consultation undertaken by EUROCONTROL, as well as on those specified in the Pilot Common Project Regulation.

2.6. Regulation text

2.6.1. Article 1 — Subject matter and scope

The scope of the regulation has been extended compared to that of Regulation (EU) No 1332/2011 and is now applicable to all aircraft operators, aerodromes, ATM/ANS and network management functions.

2.6.2. Article 2 — Definitions

Additional definitions related to navigation that support the introduction of the requirements for the harmonised implementation of PBN are proposed for the draft regulation. These include the terms:

- area navigation (RNAV);
- mixed operation;
- performance-based navigation (PBN);
- radius to Fix (RF);
- navigation specification;
- navigation function;
- standard instrument arrival (STAR); and
- standard instrument departure (SID).

2.6.3. Article 5 — Entry into force

The entry into force of the provisions with respect to PBN implementation will not be until 6 December 2018 and APV implementation at those runway ends that do not have a precision approach will be required by 30 January 2020.

2.6.4. Part-AUR, SUBPART ACAS

In addition to the retained requirements as defined in Regulation (EU) No 1332/2011 (as amended by Regulation (EU) 2016/583), a clause limiting its applicability with respect to aircraft undertaking maintenance, delivery flight-testing or operation with defective equipment has been introduced instead of an article as proposed in the NPA. Evidence has shown that mandating aircraft manufactured, maintained or operated within Europe to be equipped specifically for an one-off operation within the European airspace is disproportionate and overly detrimental to the airspace industry. However, such operations are subject to additional restrictions and conditions.

2.6.5. Part-AUR, SUBPART PBN

In order to enable the harmonised introduction of PBN within the EATMN, a performance-based approach has been followed by the Agency. It is recognised that PBN routes should be implemented where required to meet local performance objectives resulting from business needs, or requirements stemming from the performance scheme¹⁶. With respect to non-precision approach procedures, significant safety improvements shall be achieved and hence a mandate to implement PBN APV is proposed. Thus, and based on the comments received and following further technical consultation with stakeholders, an implementation strategy 'RNAV everywhere, RNP where required' as well as APV replacing non-precision approach procedures is being proposed, as follows:

2.6.5.1. With respect to the technical standards:

An overall less demanding performance for SIDs/STARs than that consulted in the NPA is proposed, with the RNAV 1 specification as the baseline, plus the optional use of the RNP 1 specification and additional functionalities.

Thus, ANSPs or aerodrome operators when implementing SID/STAR in order to meet local performance objectives shall conform to the RNAV 1 specification or to the RNP 1 specification plus additional functionalities with respect to the use of RF legs altitude constraints, including the use of the RNP 0.3 navigation specification for rotorcraft operations, as of 6 December 2018.

For en route operations, the current requirement of RNAV 5 (previously known as B-RNAV) will be maintained and no specific requirement has been established. Furthermore, when implementing ATS routes for the specific purpose of providing connectivity to or from the en route fixed network, they shall conform to the requirements of the RNP 2 or RNAV 1 navigation specifications.

¹⁶ Commission Implementing Regulation (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions (OJ L 128, 9.5.2013, p. 1) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1465210077679&uri=CELEX:32013R0390>).



2.6.5.2. With respect to the regulatory approach:

- **The possibility for mixed operation (conventional/PBN) is to be maintained, while local decisions on the availability should remain to be permitted, subject to local performance needs.**

Thus ANSPs and aerodrome operators may permit operations of aircraft that do not conform to the PBN requirements to continue. However, these procedures may be limited as part of a local decision in their application, that is commensurate with the operational performance needs of the aerodrome or terminal airspace.

- **The obligatory mandate for PBN approach operations at all runways ends served by a non-precision approaches shall be by 30 January 2020.**

Thus ANSPs and aerodrome operators shall implement PBN APV conforming to the RNP APCH performance requirements at all IREs, where currently there is only a non-precision approach procedure in place, by 30 January 2020. This is within an acceptable but challenging time frame, but later than foreseen by the ICAO resolution.

Such an implementation date will require as a minimum 2 of the aerodromes listed in the Pilot Common Project Regulation to deploy RNP ACPH with vertical guidance prior to the 1 January 2024 date required by that regulation.

The applicable IREs are those at the aerodromes (591 thereof) that fulfil the requirements defined in Article 4(3)(a) of the Basic Regulation as follows:

- be open to public use; and
 - serve commercial air transport where operations using instrument approach or departure procedures are provided; and
 - have a paved runway of 800 metres or above; or
 - exclusively serve helicopters.
- **Monitoring, ex post evaluation and coordination deployment**

Recognising the need to ensure the affected airspace users are notified in due time so that they may correctly prepare and plan, ANSPs and aerodrome operators are required to provide no less than 2 months' notice of the implementation of new ATS routes or PBN procedures.

Furthermore, as the effective implementation of this regulation will result in the improved efficiency of the EATM, it is imperative that effectiveness is monitored. Thus the Agency will review the effectiveness of the proposed regulation and undertake any amendments as required to improve the effectiveness of PBN operations.

2.6.5.3. Summary of requirements

The draft regulation proposed by this Opinion requires that ANSPs and aerodrome operators implement:

- PBN APV that conform to the requirements of RNP APCH at all IREs which are not served by precision approach procedures before 30 January 2020;



- PBN SIDs/STARs and ATS routes as required to meet locally defined performance objectives that conform to the RNAV 1 specification or the RNP1 specification including the use of additional functionalities, as of 6 December 2018;
- PBN requirements for the transition between the en route network and the SIDs/STARs to be consistent with the SIDs/STARs served and
- PBN requirements in support of rotorcraft operations in conformity with the RNP 0.3 specification.

A summary of the regulatory proposal, existing requirements and those proposed in the NPA are shown in Table 3.



	ICAO Resolution A37-11	Pilot Common Project Regulation (24 EU Aerodromes)	EASA NPA	EASA Opinion
Approach	RNP APCH to LNAV/VNAV, LPV or LNAV minima to all IREs by 2016	RNP APCH to LNAV/VNAV or LPV minima by 2024	RNP APCH to LNAV/VNAV or LPV minima at IREs without precision approaches by 26 January 2024 or RNP-AR as required by obstacles.	RNP APCH to LNAV/VNAV, LPV minima at IREs without precision approaches by 30 January 2020 or RNP-AR as required by obstacles. Plus RNP 0.3 for rotorcraft operations
TMA	RNAV and RNP where required	RNP 1 SIDs, STARs plus radius to fix (RF) by 2024	After 6 December 2018, RNP 1 SIDs, STARs plus <ul style="list-style-type: none"> altitude constraints, radius to fix (RF) 	After 6 December, 2018 RNAV 1 SID/STARs or RNP 1 Plus <ul style="list-style-type: none"> altitude constraints, radius to fix (RF) Plus RNP 0.3 for rotorcraft operations
En route	RNAV and RNP where required	N/A	After 6 December 2018, A-RNP (1 NM accuracy) above FL195 plus <ul style="list-style-type: none"> altitude constraints, fixed radius transition (FRT) A-RNP (1 NM accuracy) below FL 195 plus, <ul style="list-style-type: none"> RNAV Holding 	Maintain current RNAV 5 (in addition to free route airspace required by the Pilot Common Project Regulation)

Table 3: Summary of requirements and proposals



3. Comparison with other regions

3.1. US PBN implementation

The US are to continue the evolution of PBN that supports the utilisation of appropriate PBN procedures to enhance safety, efficiency, access, and capacity.

To achieve this goal, the US are planning to introduce changes to methods of IFR navigation throughout their airspace such that all IFR aircraft are expected to meet RNAV 2 and RNAV 1 performance requirements supported by GNSS, and are expected to comply with the RNP APCH specification (with LNAV as a minimum). As deployment progresses, the envisioned use will be RNAV 2 for the en route, with the use of RNP specifications for SIDs/STARS and RNP APCH for the major hubs. The less demanding TMAs/aerodromes will conform to RNAV specifications for SIDs/STARS and the RNP APCH specification, while the more remote aerodromes will only be required to have RNP APCH operations.

3.2. Australian PBN implementation

Australia is continuing the evolution of PBN that supports the utilisation of appropriate PBN procedures also to enhance safety, efficiency, access, and capacity. The Australian concept is for the availability and use of both RNAV and RNP navigation specifications and the application of RNP APCH with APV. The plan is for the continued use of the RNAV 5 specification for en route and the RNAV 1 specification for the terminal operations. Use will also be made of the RNP 4 specification for the oceanic and remote en route operations, and the RNP 2 and RNP 1 specifications for continental en route and terminal operations.

3.3. Summary of regional implementation

The similarities between these regions and the EU are summarised in Table 4. From this, it can be concluded that the approach to the implementation of PBN with the European airspace as presented in the draft regulation is consistent with other major regions.

	Europe ¹⁷	USA	Australia
En route	RNAV 5 + Free Route Airspace	RNAV 2	RNAV 5 + RNP 2
TMA operations	RNP 1 Major 24 Hubs RNAV 1 or RNP 1 others	RNP 1 Major Hubs RNAV 1 or 2 for others	RNP 1 or RNAV 1
Approach operations	RNP APCH (with APV)	RNP APCH	RNP APCH (with APV)

Table 4: Summary for regional implementation plans

Done at Cologne, on 28 July 2016.

Patrick KY
Executive Director

¹⁷ Implementation requirements stemming from the Pilot Common Project Regulation and the present Opinion.



4. References

4.1. Affected regulations

Commission Regulation (EU) No 1332/2011 of 16 December 2011 laying down common airspace usage requirements and operating procedures for airborne collision avoidance (OJ L 336, 20.12.2011, p. 20).

Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296, 25.10.2012, p. 1).

4.2. Related decisions

Decision 2012/002/R of the Executive Director of the Agency of 8 March 2012 on the Acceptable Means of Compliance and Guidance Material for Common Airspace Usage Requirements and Operating Procedures 'AMC/GM to AUR'.

4.3. Reference documents

- (a) Mandate to EUROCONTROL to assist the European Commission in the development of an interoperability implementing rule on Performance-Based Navigation (PBN), letter MOVE E2/EMM D(2011), 6 April 2011.
- (b) Single European Sky (SES) Regulations. Regulatory approach for the draft Interoperability Implementing Rule on Performance-Based Navigation, March 2013, Edition 1.0.
- (c) Regulation (EC) No 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) (OJ L 96, 31.3.2004, p. 26).
- (d) ICAO Assembly Resolution A37-11 — Performance-based navigation global goals, November 2010.
- (e) ICAO Doc 9613 — Performance-Based Navigation (PBN) Manual, Fourth Edition, 2012.
- (f) ICAO Doc 9750 — Global Air Navigation Plan 2013-2028.
- (g) European Airspace Concept Handbook for PBN Implementation.
- (h) Commission Implementing Regulation (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions (OJ L 128, 9.3.2013, p. 1).
- (i) Commission Implementing Regulation (EU) No 716/2014 of 27 June 2014 on the establishment of the Pilot Common Project supporting the implementation of the European Air Traffic Management Master Plan (OJ L190, 28.6.2014, p.19).

