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Cancels AIC
92/2003 (Yellow 116)

APPLICATION OF PERFORMANCE-BASED NAVIGATION (PBN) IN UK AIRSPACE.**1 Introduction**

1.1 The purpose of this Circular is to describe the application of Performance-based Navigation (PBN) in UK Airspace. The AIC outlines the timeframe within which navigation capabilities are likely to be available such that; airspace planning should utilise these capabilities and, airline operators should expect a requirement for them to be equipped and certificated to operate to defined navigation performance standards.

1.2 This does not preclude individual airport or airspace development projects assessing their operating fleet capability in order to align development plans, including transition arrangements and timescales. Individual airspace development projects will be required to notify, by AIC, the 'Area navigation and required navigation performance capabilities' required for the relevant airspace, as foreseen by, Articles 124 and 125 of the Air Navigation Order 2009.

1.3 This Circular should be considered alongside the 'Policy for the Application of Performance-based Navigation in UK/Irish Airspace'¹, where further information and background material is set out.

1.4 This Circular forms part of the UK CAA's commitment to the global application of PBN which is seen as providing the backbone of the future global navigation capability.

1.5 A European Commission PBN Implementing Rule (PBN-IR) is planned for the period 2018-2020 implementing Advanced-RNP in European airspace. It is recognised however, that proposers of UK Airspace and airport developments may wish to plan and design utilising this capability earlier than the PBN-IR timeframe. This AIC provides for this situation whilst remaining consistent with the PBN-IR aspiration.

1.6 This Circular supersedes AIC 92/2003 (Y116) and is based on a common Aeronautical Information Circular (AIC) format for all ECAC States.

2 Background

2.1 PBN is an essential component of delivering the objectives underpinning the UK's international obligations and forms a significant part of the Future Airspace Strategy (FAS)² and consequential modernisation of the UK Airspace system. That modernisation envisages transition from airspace, routes and instrument flight procedures (including holds), predicated on conventional navigation systems e.g., VOR, DME, NDB, to airspace described in terms of Performance-based Navigation. This provides the opportunity for a significant airspace re-design, especially of the terminal airspace structure, which will enable the ATM system to be modernised and deliver a series of safety, environmental, capacity and efficiency benefits.

2.2 Under the umbrella of FAS, the CAA supports the implementation of PBN with policy and guidance and a willingness to engage and provide education to sponsors of airspace changes, noting that this is ultimately a business decision to be taken by individual sponsors.

2.3 This Circular is intended to support industry in developing this element of the FAS Implementation Programme 2012-2020 and is therefore consistent with the objectives captured in that programme.

Note: ¹Policy for the Application of PBN in UK/Irish Airspace - 11 October 2011, www.caa.co.uk, (search for PBN Policy)

Note: ²Link to CAA Future Airspace Strategy - www.caa.co.uk/fas

3 Policy for the Application of PBN in UK/Irish Airspace

3.1 The primary purpose of the 'PBN policy' is to set out a specific regulatory framework to support ANSPs and airline and airport operators in helping facilitate development and implementation of airspace changes consistent with the FAS. The policy therefore takes account of the requirements of the ANSPs i.e., those responsible for day-to-day management of the airspace and is consistent with the UK's international obligations.

3.2 The policy addresses the application of PBN in UK/Irish airspace where use is made of area navigation techniques for operation on ATS routes, SIDs and STARs and Instrument Approach Procedures.

4 Fleet Survey

4.1 The airspace concept relies on a greater systemisation of the airspace route structure and therefore the ability of aircraft to fly the required route and profile accurately and consistently.

4.2 Aircraft are equipped to differing standards and specifications as well as varying levels of certification and crew authorisations to use the equipment. The CAA recognises that aircraft fleet capability is key to implementing PBN across UK Airspace, requiring as such a partnership approach between aircraft operators and proposers of ATM and airspace developments. The CAA therefore undertook a survey of operators³ flying in UK Airspace to better understand their navigation equipment capability. The survey had two main objectives:

- To understand the operator fleet capability and identify operator upgrade plans.
- To utilise the information to create an airspace change programme, fully utilising this capability whilst respecting the operator fleet equipage differences and the economic ability to equip.

The survey output is used to ensure:

- Alignment of operator fleet investment plans with ATM and airspace development.
- Timely notification of technical requirements.

4.3 The survey work utilised previous CNS avionics surveys undertaken by EUROCONTROL and IATA over the period 2007 to 2010.

4.4 In-light of the information determined from the fleet survey, the CAA recommends the implementation steps detailed in Section 5 below.

5 Application of the PBN Concept

5.1 Introduction to PBN Specifications

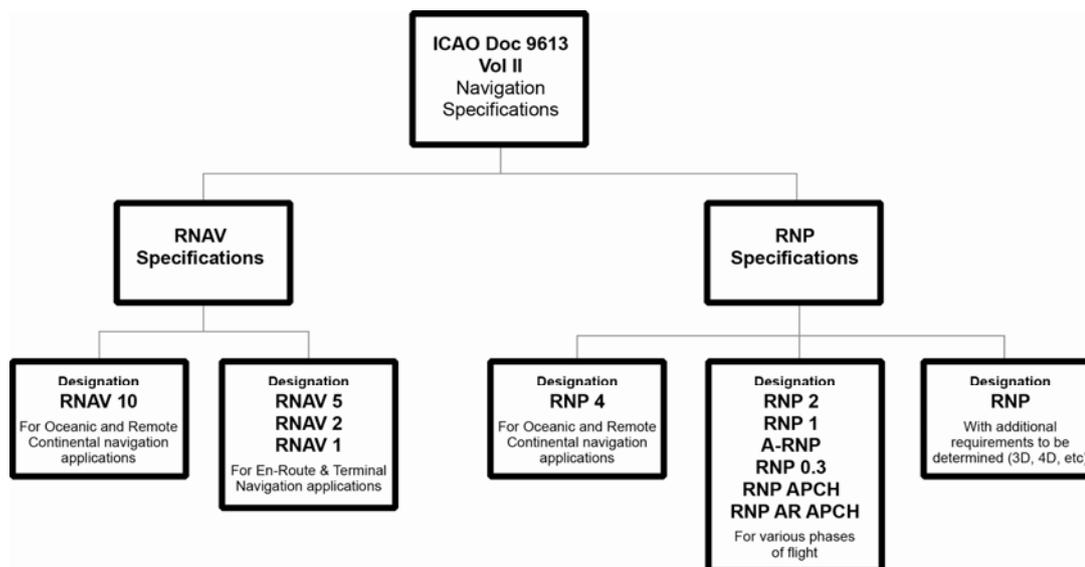
5.1.1 The PBN specifications are described in the ICAO PBN Manual, Doc 9613⁴, where safety assessment considerations and implementation guidance for the identified navigation specifications are considered together with the background and purpose for each specification.

5.1.2 The implementation considerations for the ANSP, the approval processes, the detailed aircraft requirements and operating procedures are identified along with specific pilot knowledge and training where applicable. The navigation specification also details any requirements for control of navigation databases and oversight of operators.

Note: ³Excludes operators of State aircraft and those of General and Business aviation aircraft.

Note: ⁴ICAO PBN Manual - www.ecacnav.com/PBN, ICAO Doc 9613 Third Edition - 2008

5.1.3 An overview of the navigation specifications is detailed below, taken from the UK and Ireland PBN Policy:



RNAV X/RNP X = lateral Total System Error (TSE) must be within $\pm X$ NM for at least 95% of the total flight time.

5.1.4 The use of a designation without navigation accuracy e.g., RNP APCH, indicates that the navigation specification may be applied across multiple flight phases or leg segments with different navigation accuracy values.

5.1.5 Within the PBN concept the term RNP distinguishes one type of RNAV system from another. If an RNAV system has an on-board performance monitoring and alerting capability, then, for the purposes of classification under PBN it is referred to as an RNP capable system and able to support RNP navigation applications.

5.2 The Transition to Advanced-RNP

5.2.1 Although RNAV 1 is the basis of future terminal airspace developments prior to the PBN-IR, this does not preclude the use of Advanced-RNP functionality, as foreseen in the future PBN-IR, where appropriate.

5.2.2 Therefore, implementation can only proceed in a series of steps that will need to have regard to the aircraft fleet capability as airspace redesign developments are introduced. These are set out below for the time steps 2014, 2016 and 2018.

5.2.3 The capability steps described below are applicable to all airspace developments as required and where it can be justified. Any terminal airspace development should take account of airport approach developments including the introduction of RNP APCH (LNAV, LNAV/VNAV and/or LPV).

5.2.4 The capability steps are considered to be aligned with the development of the PBN-IR utilising Advanced-RNP features.

5.3 From 2014:

The following capabilities should be considered for use in future airspace development projects:

- RNAV 1 (P-RNAV) should form the baseline design standard.
- Holding capability will be designed based on manually flown holding defined using a RNAV fix. Aircraft systems providing an automated RNAV or RNP holding capability can be utilised.
- Initial utilisation of vertical constraints e.g., use of AT or ABOVE vertical path constraints to establish high/optimised departure performance.
- RNAV 1 Route Spacing⁵:
 - En-route, minimum spacing of 7 NM (subject to validation) for straight parallel routes for same and opposite direction traffic, based on a 5 NM minimum radar separation, ATM monitored but without reliance on radar vectors to provide separation assurance.
 - Terminal, 5 NM for straight parallel routes for same and opposite direction traffic, based on a 3 NM minimum radar separation, ATM monitored but without reliance on radar vectors to provide separation assurance.

Note: ⁵Published EUROCONTROL and ICAO studies support en-route spacing of 9 NM. The ANSP should demonstrate route spacing appropriate for the airspace and ATS operation being undertaken.

5.4 From 2016:

The following capabilities should be considered for use in airspace development projects:

5.4.1 Advanced-RNP Required Capabilities:

- Predicated on mandatory carriage of GNSS supporting Onboard Performance Monitoring and Alerting (track assurance), with DME/DME/IRU providing reversionary capability supporting RNAV 1 performance and monitored by radar.
- Apply RNP 1 where required in the en-route airspace.
- Tactical Parallel Offset (en-route only).
- Radius to Fix (RF) - Turn assurance through RF Leg capability in terminal airspace.
- RNAV Racetrack Holding - Automatic holding, where holding is required, to contain primary areas.
- Altitude and speed constraints coded in the aircraft navigation data base.

5.4.2 Optional Capabilities (where supported by fleet survey):

- Utilise the range of RNP navigation accuracies from 1 NM to 0.3 NM in terminal airspace to alleviate airspace interaction constraints from earlier RNAV 1 designs and reduce ATC radar monitoring requirements.
- VNAV - Develop vertical path definitions in-line with airline operator's capabilities where available
 - Vertically constrained fix construction.
 - Vertical path definition.

5.5 From 2018:

- Consistent with the planned European PBN-IR and the required carriage of Advanced-RNP and additional to paragraph 5.4.1:
 - Fixed Radius Transition (en-route, FL195+ only on RNP 1 routes)
- Advanced-RNP optional capabilities (where supported by fleet survey) and additional to those features outlined in paragraph 5.4.2:
 - Time of Arrival Control (TOAC) - Controlled Time of Arrival (CTA) and then Required Time of Arrival (RTA) into terminal airspace of 30 seconds
 - Final approach intercepts - RNP to RNP APCH or RNP to xLS (ILS, MLS or GLS) to mimic vectors.

6 Contact us, further information

6.1 If you wish to discuss any of the navigation capabilities outlined here or your future development plans please contact:

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7 Related Information Notices

7.1 This Circular updates the UK position on PBN implementation and replaces AIC 92/2003 (Y116) Precision Area Navigation (P-RNAV) In Terminal Airspace-Application.