

European Aviation Safety Agency

**Acceptable Means of Compliance and
Guidance Material to**

**Commission Regulation (EU)
No 1332/2011**

and

**Commission Implementing Regulation
(EU) 2018/1048**

**on common airspace usage requirements
and operating procedures
'AMC & GM to AUR'**

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Annex I

Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 1332/2011

AMC1 AUR.ACAS.1010 ACAS II Training

The ACAS II operational procedures and training programmes established by the operator should take into account the procedures contained in:

- (a) ICAO PANS-OPS, Volume I² Flight Procedures, Attachment A (ACAS Training Guidelines for Pilots) and Attachment B (ACAS High Vertical Rate Encounters) to Part III, Section 3, Chapter 3; and
- (b) ICAO PANS-ATM³ Chapters 12 and 15, in regard to ACAS phraseology and applicable procedures.

² ICAO Doc 8168-OPS/611 - PANS-OPS (Procedures for Air Navigation Services-Aircraft Operations), Volume I - Flight Procedures — Fifth edition amendment 7.

³ ICAO Doc 4444-ATM/501 - PANS-ATM (Procedures for Air Navigation Services-Air Traffic Management) — Sixteenth edition amendment 7-A.

Annex II

Guidance Material to Commission Implementing Regulation (EU) 2018/1048

GM1 Article 4 Transitional measures

EVALUATION OF THE OPERATIONAL ENVIRONMENT

As part of the preparation for the transition to performance-based navigation (PBN), it would be advisable that providers of ATM/ANS evaluate the operational environment that is expected to exist at the time when the PBN routes and procedures are to be implemented in accordance with AUR.PBN.2005 and up to the deadline imposed by Article 7(2)(a), i.e. 6 June 2030.

The evaluation of the operational environment could:

- (a) ensure that measures are taken and appropriate information is made available to the ATS units in order to facilitate mixed operations, i.e. operations of PBN capable and non-PBN capable aircraft;
- (b) underpin the transition plan and help to describe the introduction of the new PBN routes and procedures in detail, i.e. the transition along the different stages until the end-state is eventually implemented, together with the rationale for the coexistence with ATS routes and instrument approach procedures that do not meet the requirements stipulated in AUR.PBN.2005; and
- (c) consider both normal operations as well as contingencies, and therefore, be used to define the contingency measures required by Article 6, which are expected to evolve and adapt to the different stages of the implementation.

GM2 Article 4 Transitional measures

RELEVANT ASPECTS OF THE TRANSITION PLAN

In implementing the required routes and procedures, there is an opportunity to optimise the overall safety, capacity and efficiency of flight operations. The transition plan needs to take due account of the complexity of the airspace structures and traffic flows as well as the specificities of the traffic operating at the affected aerodromes. In addition, it is suggested that a transition plan address, at least, the following aspects:

- (a) justification on how the controlled, smooth and safe transfer from the existing procedures and routes is going to be achieved;
- (b) evaluation of the aircraft operational capability expected in the affected airspace, with the purpose of estimating the number of aircraft unable to perform the envisaged PBN operations;
- (c) the decommissioning of navigation facilities (e.g. NDB, VOR, DME, ILS) operated in the airspace and adjacent airspace blocks with a view to retaining only the minimal network of ground-based NAVAIDs that provide the necessary operational coverage for those stakeholders that do not conduct PBN operations prior to 2030, as well as to support contingency operations. It would also be beneficial to take into consideration cross-border synergies and coordination, where applicable;

- (d) the need to consider CAT II/III ground facilities (ILS, MLS) to supplement RNP APCH procedures where operations below CAT I minima are required due to local conditions, as well as the existing and planned GLS facilities that currently provide guidance during CAT I approach and landing operations, but which are anticipated to support CAT II/III operations in the future; and
- (e) the analysis of the supporting communications and surveillance infrastructure that is required to support the operations at all stages during the transition, together with the anticipated means by which ATS are provided to aircraft.

The set of measures planned to achieve an efficient transition should be based on local considerations and, at the same time, be consistent with European communication, navigation and surveillance (CNS) strategies stemming from the ATM Master plan.

GM3 Article 4 Transitional measures

COMPETENT AUTHORITY RESPONSIBLE FOR THE AIRSPACE

The competent authority of the Member State could play an essential role by ensuring coordination of the measures taken by different ATM/ANS providers to meet the requirements in AUR.PBN.2005. In this regard, it is highly recommended that the competent authority set the required timeframes in coordination with the providers of ATM/ANS, so as to guarantee that the transition plans are delivered in due time, meet the applicability dates and are updated whenever substantial changes take place. Moreover, it is recommended that the competent authority verify that the measures adopted are suitably synchronised at national level. This is in order to maximise the benefits of a joint implementation and address potential issues that may result from major implementation projects that affect a particular area, e.g. the construction of a new airport or new runways, and the potential interferences with the existing airspace routes and procedures.

GM4 Article 4 Transitional measures

PROVIDERS OF ATM/ANS

To ensure the effective realisation of AUR.PBN.2005, it is important that the providers of ATM/ANS that are responsible for its implementation develop and maintain coordinated transition plans so as to ensure the smooth implementation of the PBN routes and procedures within their respective airspace in replacement of existing ATS routes and instrument approach procedures which are not conforming to AUR.PBN.2005, including non-compliant PBN applications.

The transition plan may have an impact on a number of interested parties, so its measures and any update thereof clearly benefit from coordination with those stakeholders potentially affected by the changes to the operational environment. In particular, the preparation and relevant updates of the transition plans should be done in consultation with the civilian and military stakeholders that are affected by the corresponding PBN operations, i.e. airspace users and their representatives, aerodrome operators, as well as the neighbouring providers of ATM/ANS and the Network Manager.

In order to ensure the full implementation of AUR.PBN.2005 by 6 June 2030, by when completion of the transition is required as per Article 5(1), it is advisable to commence the drafting of the transition plans as soon as possible and to subsequently keep them up-to-date.

GM5 Article 4 Transitional measures
NON-CAPABLE AIRCRAFT OPERATIONS

The transition phase until 6 June 2030 could be characterised by any combination of PBN applications, as per AUR.PBN.2005, and any of the following measures, which may be considered to ensure operations of non-capable aircraft:

- (a) vectoring of controlled aircraft based on the use of an ATS surveillance system;
- (b) conventional navigation procedures;
- (c) use of any other existing PBN application not conforming to AUR.PBN.2005; and
- (d) procedural control⁴.

GM6 Article 4 Transitional measures
NAVAID INFRASTRUCTURE

It should be noted that the Global Navigation Satellite System (GNSS) is not the only positioning source to support PBN operations. In fact, some of the navigation specifications contemplated in AUR.PBN.2005 could be entirely supported by ground-based NAVAIDs without having to resort to GNSS signals.

In developing the transition plans, it should also be recognised that the implementation of PBN does not imply the need for the provision of a reversionary NAVAID infrastructure. However, when operationally required and where technically feasible, providers of ATM/ANS may provide a reversionary NAVAID infrastructure that is capable of meeting the performance requirements of the navigation specifications set out in AUR.PBN.2005 whenever the primary means of navigation is no longer available. For instance, the arrival and departure procedures within a particular terminal control area (TMA) could be designed in accordance with the RNAV 1 specification and the primary means of navigation could be predicated on the use of GNSS. However, after a GNSS outage, reversion to a secondary DME/DME infrastructure could equally ensure that RNAV 1 applications are flown with the same performance.

The retention of a minimal network of ground-based NAVAIDs (NDB, VOR, DME and ILS) intends to allow the operation of non-PBN capable aircraft during the transition to PBN, as well as providing alternative means of navigation during contingency operations. Nevertheless, the transition plan may reflect, in some cases, an increase in the number of ground-based NAVAIDs, in particular DMEs, in order to support the implementation of PBN, as per AUR.PBN.2005.

GM1 Article 5 Exclusive use of PBN

One of the benefits of PBN is that it allows to decommission more costly or less performing equipment. As PBN allows vertical guidance through RNP APCH procedures down to LNAV/VNAV or LPV minima, this applies, in particular, to a number of the remaining NDB and VOR facilities used for approach, which could be decommissioned by 6 June 2030 as per Article 7(2)(a). However, the implementation of PBN approaches does not currently permit the replacement of landing systems where minima below 200 ft are required, such as those enabled by CAT II or CAT III operations. Therefore, it is

⁴ 'Procedural control' means air traffic control service provided by using information derived from sources other than an ATS surveillance system.

expected that CAT II and CAT III landing systems, primarily predicated on ILS, will remain in service unaffected by this Regulation.

Article 5 precludes the use of instrument approach procedures, other than those predicated on PBN, as per AUR.PBN.2005. As regards CAT I approaches predicated on ILS and MLS, they may in many cases be replaced by SBAS approaches that can be operated down to CAT I precision approach minima. There could be locations at which SBAS approaches cannot offer CAT I minima, so existing instrument approach procedures based on ILS, GLS or MLS may be retained.

Additionally, it should be noted that when designing the contingency measures foreseen under Article 6, providers of ATM/ANS may decide to retain also a network of CAT I landing systems using, for instance, ILS as a backup. As regards this contingency infrastructure, more information is provided in GM1 Article 6.

GM1 Article 6 Contingency measures

EVALUATION OF THE CONTINGENCY INFRASTRUCTURE

As part of the contingency navigation environment, a minimum network of ground-based NAVAIDs should be retained for the purpose of providing alternative means of navigation to the PBN operations stipulated in AUR.PBN.2005. These remaining ground-based NAVAIDs, e.g. VOR, DME, ILS, MLS, may enable conventional navigation or, alternatively, support less performing PBN applications. The performance necessary during a contingency depends on the evaluation performed by the providers of ATM/ANS. In this regard, it is advisable that this infrastructure should be commensurate with the impact of PBN-related failure modes (e.g. as a consequence of local or wide-area GNSS outages), to ensure safety and an appropriate level of service based on local conditions.

In addition, it is recommended that the surveillance and communication systems be evaluated with regard to their exposure to GNSS and other failure modes and the ability to support the contingency measures, e.g. provision of ATS vectoring. When taking such measures, it should be borne in mind that the ADS-B reported position also depends on the position determined by GNSS, so ATS surveillance services, like vectoring, may need to draw upon other means of surveillance, whereby aircraft position is not determined on board, e.g. secondary surveillance radar (SSR).

As regards the evaluation of safety during contingency modes, Commission Implementing Regulation (EU) 2017/373 requires that providers of ATM/ANS carry out and document the necessary safety (support) assessment(s) to cover the scope of the change, including the supporting communication and surveillance functions under failure conditions, as per ATS.OR.205 and ATM/ANS.OR.C.005.

In the event of PBN-related failure modes, providers' contingency measures may include notification to the Network Manager of the application of the appropriate contingency measures in order to minimise a potential reduction in capacity at network level.

GM2 Article 6 Contingency measures

GNSS FAILURES

As the envisioned PBN operations are primarily predicated on GNSS, and although the robustness of GNSS is expected to be improved through the use of multi-frequency and multi-constellation technologies, a contingency mode based on purely non-GNSS technologies would be considered desirable. This could be achieved, for instance, through the provision of ILS CAT I precision approaches

at certain aerodromes and a network made up of DME and VOR to ensure a minimum coverage within terminal and en route airspace.

In those instances where aircraft are unable to have recourse to a reversionary NAVAID infrastructure, ATS providers should consider other measures to ensure safe operations. Other contingency measures could include provision of tactical vectors using the available ATS surveillance information and the notification of traffic restrictions, including to the Network Manager, when necessary.

GM1 Article 7 Entry into force and application

The following table provides a summary of the implementation timing:

Implementation by 3 December 2020	AUR.PBN.2005 points
RNP APCH or RNP AR to all IREs without PA, except at those airports listed in point 1.2.1 of the Annex to the PCP Regulation ⁵ , and, where required, RF legs	(1) + (2) + (3)
RNAV 5 for all ATS routes at or above FL150	(6)
Implementation by 25 January 2024	
RNP APCH or RNP AR to all IREs, and, where required, RF legs	(1) + (2) + (3)
For all IREs, RNAV 1 or RNP 1(+) for at least one established SID/STAR	(4) + (5)
For all IREs, RNP 0.3 or RNP 1 or RNAV 1 for at least one established SID/STAR for rotorcraft operations	(7)
RNAV 5 for ATS routes established below FL150	(6)
RNP 0.3 or RNP 1 or RNAV 1 for ATS routes established below FL150 for rotorcraft operations	(7)
Implementation by 6 June 2030	
RNAV 1 or RNP 1(+) applicable to all SIDs/STARs when established	(4) + (5)
RNP 0.3 or RNP 1 or RNAV 1 applicable to all SIDs/STARs for rotorcraft operations when established	(7)
IRE: instrument runway end PA: precision approach RNP 1(+): RNP 1 specification including RF and/or vertical paths defined by constraints SID: standard instrument departure STAR: standard instrument arrival RF: radius to fix RNAV X & RNP X: navigation specifications	

⁵ 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

GM1 AUR.PBN.2005 Routes and procedures

Instrument approach procedures and designated ATS routes (e.g. SIDs/STARs) predicated on PBN require the use of an available NAVAID infrastructure (space- and/or ground-based) capable of supporting the performance requirements of the navigation specification.

The PBN routes and approach procedures should primarily conform to the following:

- (a) ICAO Annex 4, 'Aeronautical Charts', 2009, 11th Edition, Amendment 59;
- (b) ICAO Annex 11, 'Air Traffic Services', 2016, 14th Edition, Amendment 50-A;
- (c) ICAO Document 8168 OPS/611 'Procedures for Air Navigation Services: Aircraft Operations' (PANS-OPS), Volume II, 2014, 6th Edition, Amendment 7;
- (d) ICAO Document 4444 ATM/501, 'Procedures for Air Navigation Services: Air Traffic Management' (PANS-ATM), 2007, 16th Edition, Amendment 7-A;
- (e) ICAO Document 9905 AN/471 'Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual, 2016, 2nd Edition; and
- (f) ICAO Annex 10, Volume I, 'Radio Navigation Aids', as specified in Annex VIII to Commission Implementing Regulation (EU) 2017/373.

In addition to the above references, further information related to the design and implementation can be found in the following manuals:

- (a) ICAO Document 9613 AN/937, 'Performance-based Navigation (PBN) Manual', 2013, 4th Edition;
- (b) ICAO Document 9992 AN/494, 'Manual on the Use of PBN in Airspace Design', 2013, 1st Edition;
- (c) ICAO Document 9426 AN/924, 'Air Traffic Services Planning Manual', 1984, 1st Edition, Amendment 4;
- (d) ICAO Document 9906 AN/472, 'Quality Assurance Manual for Flight Procedure Design', Volumes 1–3, 2009/2010, 1st Edition, Amendment 1;
- (e) ICAO Document 9906 AN/472, 'Quality Assurance Manual for Flight Procedure Design', Volumes 5-6, 2012, 1st Edition;
- (f) ICAO Document 9689 AN/953, 'Manual on Airspace Planning Methodology for determination of separation minima', 1998, 1st Edition, Amendment 1;
- (g) ICAO Document 9643, 'Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR)', 2004, 1st Edition;
- (h) ICAO Document 8697, 'Aeronautical Chart Manual', 2016, 3rd Edition; and
- (i) ICAO EUR Doc 025, RNP APCH Guidance Material, 2012, 1st Edition.

To mitigate the environmental impact, it is recommended that consideration be given to the information included in the following references:

- (a) ICAO Document 9931 AN/476, 'Continuous Descent Operations (CDO) Manual', 2010, 1st Edition; and
- (b) ICAO Document 9993 AN/495, 'Continuous Climb Operations (CCO) Manual', 2013, 1st Edition.

GM1 AUR.PBN.2005(1) Routes and procedures

Contractual arrangements covering the implementation of approach procedures based on the European Geostationary Navigation Overlay Service (EGNOS) are expected to be established between the providers of ATM/ANS responsible for implementing RNP APCH down to LPV minima and the EGNOS service provider, as per paragraph 3.1 of Annex I to Commission Implementing Regulation (EU) No 1035/2011.

Similar provisions in Commission Implementing Regulation (EU) 2017/373 regarding contracted activities, i.e. ATM/ANS.OR.B.015, and the associated AMC & GM, may be of help to providers of ATM/ANS.

GM1 AUR.PBN.2005(3) Routes and procedures

The term ‘appropriate SBAS coverage’ refers to the EGNOS Safety of Life (SoL) service area, as declared in the EGNOS SoL Service Definition Document (SDD). The EGNOS SoL SDD is published by the European GNSS Agency (GSA), including the performance commitment maps, as provided by the certified EGNOS provider.

It is expected that the signal-in-space meets the performance requirements defined in Amendment 89 to ICAO Annex 10, Volume I, prior to implementing SBAS-based procedures.

It is recommended that the 18-month deadline commence from the moment at which the affected aerodrome reference point falls at least 100 NM inside the 99 % APV-I availability area, as published in the EGNOS SoL SDD.

For those areas where the SBAS performance commitment does not meet the average continuity risk specified in Amendment 89 to ICAO Annex 10, Volume I, it is still possible to implement SBAS-based procedures. However, due consideration should be given to the implementation of specific operational mitigations. These operational mitigations should be appropriate to the continuity performance declared by the SBAS service provider and should account for aspects such as the influence of airspace complexity, traffic levels, limiting terrain and obstacles, level of ATS provided, and availability of other navigation and surveillance capabilities.