

# EGNOS



## HOW TO Become compliant with European requirements for RNP APCH operations to LPV minima

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The following document provides a set of simple guidelines for Aircraft Operators within the European Civil Aviation Conference (ECAC) looking to comply with the current operational requirements to perform RNP APCH operations down to Localizer Performance with Vertical guidance (LPV).

This version corresponds to an update of the guidelines released in October 2015 which have been modified to reflect the regulatory changes introduced during the first half of 2016. It has been prepared by European Satellite Services Provider S.A.S. (ESSP SAS) under its EGNOS Service Provision contract with the European Global Navigation Satellite Systems Agency (GSA).

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## 1 SUMMARY OF CONTENTS

### What are LPV approaches?

Technically known as RNP Approach (RNP APCH) procedures down to LPV minima, LPVs were introduced within the PBN concept as new approach operations based on SBAS, a technology providing augmentation to GNSS systems like GPS. This type of approaches allows for ILS look-alike instrument approach procedures down to a decision height as low as 200ft without the need of any ground infrastructure installation. As of October 2016, there are over 300 LPV procedures published in Europe with plans for more than 700 by the end of 2017 (see map below, available [here](#)).



In addition, an Implementing Rule has been published by EASA in 2016 as Opinion to support the implementation of APV procedures [RD-1]. You can find more details on this rule and LPVs characteristics and main benefits in [Section 2](#).

### Do I need a Specific Approval to fly them?

Until very recently, if you held an AOC, the answer was yes. If you were an NCC/NCO, then it was subject to the specific regulations set by your NSA. Some States even required general aviation IR pilots to at least undertake a specific training while others did not have any requirement at all.

Luckily, today, European operators no longer need to apply for a specific approval (SPA) to their competent authority for the majority of PBN specifications, including RNP APCH. However, they still need to provide the appropriate training to their crew, update their procedures and operational manuals accordingly and inform their authority of these changes. In addition, as a prerequisite, the aircraft and its navigation avionics shall have received the corresponding airworthiness certification.

### What regulatory changes made that possible?

Commission Regulation (EU) 2016/539 of 6 April 2016 introduced the necessary changes to Air Crew regulations so as to incorporate PBN in the regular training and checking requirements for pilots. Such regulation also requested all ATOs to introduce PBN privileges to their IR courses by 25 August 2020 at the latest, date from which PBN privileges will become mandatory to all IR pilots.

Shortly after, Commission Regulation (EU) 2016/1199 of 22 July 2016 laid down the corresponding changes to the Air Operations regulations, introducing PBN as standard procedures for authorities and operators, which eliminated the burden to apply for an SPA.

[Section 8](#) provides more insight to the recent changes to regulation, which are endorsed by the latest ICAO Annex 6 update [RD-2].

### What shall I then do to be entitled to fly LPVs?

In the case of commercial operators (CAT), although a formal SPA application is no longer required, certain modifications brought by LPV to key elements like training programmes shall be first checked and approved by the competent authority. Also, operational documentation and procedures shall be modified accordingly and notified to authority in advance.

In the case of NCC/NCO, there is no prior notification to the authority required but they will be subject to regular inspections and audits where to ensure that the appropriate training has been undertaken.

AMC 20-28 used to be EASA's reference on airworthiness and operational requirements for the use of LPVs. However, all the operational

aspects have been now moved to the corresponding Air Ops sections, leaving just the airworthiness requirements in a future AMC 20-28A version. Check [Section 3](#) for more details.

To summarise, there are four main set of actions that the operator must complete to be entitled to perform RNP APCH to LPV:

1. First, ensure that the aircraft **airworthiness requirements** for these operations are met.

If the aircraft is not designed and type-certified for RNP APCH down to LPV minima operations (documented in the AFM or TC) the operator should seek for applicable EASA approved SBs or STCs for that particular aircraft model and variant or liaise with a design organisation for the development of one if there are no solutions available.

You can find more details in [Section 4](#).

2. Second, **amend the operational procedures and corresponding manuals** to account for this type of operations.

As it happens with other approach procedures which are operated under IFR, there are certain operational criteria which apply to the use of LPVs. The way the installed equipment is operated must be in accordance with the AFM or POH. For example, the MEL might have to be amended to identify the minimum equipment necessary to satisfy these LPV approach operations and the operator should determine the operational characteristics of the procedure to be flown, which must be reflected on the Operational Manual.

[Section 0](#) provides guidance on the update of these operational procedures and the corresponding aircraft documentation, including the specific chapters, sections and subsections which should be amended in the Operational Manual.

3. Third, **update the training** and checking programs and **train the crew** accordingly.

As it was previously mentioned, PBN will become mandatory to all IR pilots by August 2020. From that date onwards, all ATOs will

be offering PBN privileges to new pilots while existing IR license holders will be required to demonstrate PBN theoretical knowledge and skills at the first proficiency check.

Until that happens, operators willing to make use of LPVs will need to provide the necessary training, briefings and guidance material to their flight crew.

The training program should be structured to provide sufficient theoretical and practical training using a simulator, training device, or line training in an aircraft, in the concept of RNAV GNSS and RNP approaches and the use of the aircraft's approach system in such operations.

[Section 6](#) provides more details on the different aspects that should be added to the regular training program as it is currently set by Air Crew regulations.

4. Fourth and final, **notify all changes to the competent authority (for CAT operators)**.

Once all previous actions are completed, the operator must elaborate a written "application for change" to the regulator with evidences of these changes.

These evidences are normally extracts from the AFM and STC or SB documentation for the airworthiness part and extracts from the Operational Manuals and copies of ATOs training for the operational part.

The review process with the NSA could take several iterations until the evidences submitted by the operator for all previous requirements are considered sufficient and the changes are therefore authorised.

Some regulators have published notification forms and guidance material to assist the operator during this process.

More details on the notification process are given in [Section 1](#).

### ***Reference documentation and acronyms***

Documentation of reference and a list of acronyms can be found in [Appendix C](#).

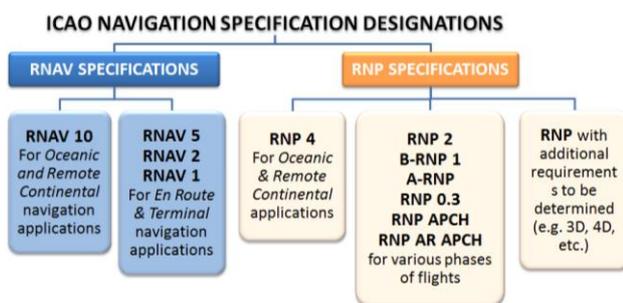
## 2 WHAT ARE LPV PROCEDURES?

### LPV within the PBN concept

The PBN concept, published within the Performance-Based Navigation Manual (Doc 9613) - 4th edition, 2013 [RD-3], defines performance requirements for aircraft navigating on an ATS route, terminal procedure or in a designated airspace.

Through the application of Area Navigation (RNAV) and Required Navigation Performance (RNP) specifications, PBN provides the means for flexible routes and terminal procedures helping the global aviation community to reduce aviation congestion, save fuel, protect the environment and maintain reliable, all-weather operations, even at the most challenging airports. It provides ANSP and operators with greater airspace design flexibility and better operating returns while increasing the safety of regional and national airspace systems.

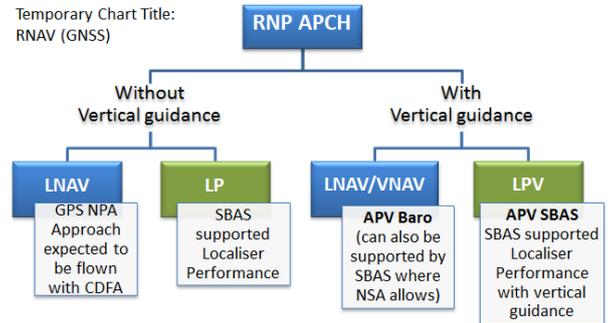
GNSS is identified as a key enabler for most of the navigation specifications defined. Notably SBAS and therefore EGNOS is a key enabler for procedures based on the RNP APCH Navigation Specification. The following figure shows in a schematic way the ICAO PBN Navigation Specification classification included in the PBN manual.



Source: Adapted from Eurocontrol

RNP APCH procedures allow four minima lines: LP, LNAV, LNAV/VNAV and LPV. The RNP APCH procedures are published on charts with the title RNAV (GNSS) RWY XX, which will change to RNP RWY XX by 2020.

The following figure shows the different RNP APCH procedures included within the RNP APCH navigation specification:



Within the ECAC area EGNOS is the main driver for RNP APCH procedures down to LPV minima, allowing for Decision Heights as low as 200ft.

### LPV benefits

LPV approaches enabled by the EGNOS Safety-of-Life (SoL) service provide the following general benefits compared to conventional NPAs:

- Minima reduction, currently down to 250ft and as low as 200ft in specific locations based on the LPV-200 Service Level, which allow successful approaches and increase accessibility in conditions that would otherwise disrupt operations compared to conventional NPAs.
- Safety increase thanks to temperature and barometric independent vertical guidance provided to the aircrew during the approach. This makes the approach easier to fly and reduces the risk of controlled flight into terrain (CFIT).
- Operational Benefits:
  - Reduces trajectory dispersion (predictability and noise footprint reduction);
  - CDO techniques (fuel consumption reduction and noise footprint reduction);
  - More flexible use of airspace;
  - Improved situational awareness;
  - LPVs offer straight-in approaches in some cases where this is not otherwise possible with conventional NPAs and

they also allow the offset (angle) as in some ILS approaches;

- LPVs offer the potential to remove circling approaches.
- Infrastructure rationalization:
  - LPV approaches will be most beneficial at runway-ends where there is no ILS already available;
  - Potentially enabling VOR, NDB, ILS removal/back-up reducing the associated installation and maintenance costs (in accordance with airlines equipage and/or interests).

The number of LPV publications has rapidly increased in Europe since the declaration of the SoL service on the 2<sup>nd</sup> of March 2011, counting on more than 300 procedures available as of October 2016. The current implementation status and future trends, which plan for having more than 700 LPVs by the end of 2017, can be checked in the EGNOS User Support website (<http://egnos-user-support.essp-sas.eu/>).

### Implementing Rule

In addition to these publications coming from individual ANSPs' and airport operators' initiatives, EASA is putting in place an implementation mandate. EASA's Opinion 2016/10 "*PBN implementation in the European Air Traffic Management Network (EATMN)*" [RD-1] addresses the safety, interoperability, proportionality and coordination issues related to the implementation of PBN within European airspace. Among other things, the Opinion proposes that Air Traffic Service Providers and aerodrome operators implement PBN approach procedures with vertical guidance (APV) RNP APCH, such as LPV or LNAV/VNAV, at all instrument runway ends which are not served by precision approach procedures published before 30 January 2020.

Although there is no specific mandate on aircraft equipage, operators wishing to operate these routes and procedures will be required to ensure that their aircraft and flight crew are suitable for PBN operations. The publication date of the Decision, following EU Commission Regulation, is planned for Q1 2017.

## 3 CURRENT MEANS TO OBTAIN LPV AUTHORISATION

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As with any instrument operation, performing LPV approaches requires that the aircraft meets certain airworthiness certification standards, including the necessary navigation system performance and functionality, and that the operator has received the approval from an appropriate regulatory body before the system can be operated.

However, while conventional procedures such as VOR or DME are a standard part of the pilot's Instrument Rating license and standard operating procedures, LPVs are relatively new and, as any other PBN concept, require additional training and authorisation from the regulatory authority of the State of Registry.

Thanks to the recent changes in regulation, as it is described in [Section 8](#), operators wishing to perform RNP APCH operations down to LPV minima do not longer have to apply for specific approvals (SPA) to their competent authority but they still need to ensure that the aircraft is compliant with the relevant airworthiness standard and that the continued airworthiness and flight operations requirements are satisfied.

As previously mentioned, the reference material for LPV in Europe was laid down in EASA AMC 20-28 "*Airworthiness Approval and Operational Criteria related to Area Navigation for Global Navigation Satellite System approach operation to Localiser Performance with Vertical guidance minima using Satellite Based Augmentation System*" [RD-4]. While the airworthiness certification requirements will remain in a new document labelled AMC 20-28A<sup>1</sup>, all the operational aspects have already been moved to

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<sup>1</sup> It is worth noting that AMC 20-28A will remain valid until the airworthiness requirements are incorporated to the new Certification Specification - Airborne Communication, Navigation and Surveillance (CS-ACNS). Additionally, the corresponding "*Instruments and Equipment*" (IDE) sections within CAT, NCC, NCO and SPO annexes to Air Ops will be adapted.

the corresponding Air Operations annexes (Parts ARO, ORO, CAT, SPA, NCC, NCO and SPO).

The document is equivalent to the US Advisory Circulars AC 20-138 [RD-5] *“Airworthiness Approval of Positioning and Navigation Systems”* and AC 90-107 [RD-6] *“Guidance for Localizer Performance with Vertical Guidance and Localizer Performance without Vertical Guidance Approach Operations in the U.S. National Airspace System”* published by the FAA. The former provides the airworthiness requirements while the latter covers the operational aspects.

Private operators do not need to notify the authority of the changes but, in any case, they must ensure that the aircraft has got suitably approved equipment (is eligible), the navigation database is valid, the pilot is suitably qualified and current with respect to the equipment, and adequate procedures and checklists are in place. All these aspects will be subject to regular authorities’ inspections and audits.

The following sections provide a set of common guidelines based on current Air Ops and Air Crew regulations and the former AMC 20-28 content, complemented by ICAO Doc 9997 [RD-7]. These are structured as follows:

- [Section 4](#) provides a set of preliminary requirements like the airworthiness certification of the aircraft for this type of operations;
- [Section 5](#) describes the necessary amendments to the operational procedures and manuals;
- [Section 6](#) provides a series of necessary amendments to the Syllabus training programme;
- [Section 7](#) elaborates on the notification process to the competent authority.

## 4 PRELIMINARY CERTIFICATION REQUIREMENTS

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The airworthiness certification of the aircraft to conduct RNP APCH procedures down to LPV minima is a prerequisite for the operation authorisation. Operators seeking information on

how to achieve this airworthiness certification are encouraged to review the LPV Implementation Guidelines for Airports and Operators developed by ESSP [RD-8]. The document is publicly available in the EGNOS User Support website (<http://egnos-user-support.essp-sas.eu/>).

Although the present guidelines do not deepen in this preliminary step, some clarifications on this matter are given below.

As a start, the equipment of the aircraft navigation system must be qualified with EASA ETSO-C145 or ETSO-C146 to be able to properly receive and process the SBAS correction messages. There are numerous devices from Bendix King, Esterline-CMC, Garmin, Honeywell, Rockwell Collins, Thales Avionics or Universal Avionics which have received such authorisation<sup>2</sup>. On top of it, the complete aircraft installation must be compliant with the airworthiness requirements stated in AMC 20-28.

There are different ways to demonstrate the eligibility or airworthiness certification of an aircraft for LPV operation:

### a) **Through its original Type Certificate (TC)**

The TC is the approved standard for the production of a specified type/series of aircraft. The aircraft specification for that type/series, as part of the TC, will generally include a navigation standard. The aircraft documentation (AFM, AMM) for that type/series will define the system use, operational limitations, equipment fitted and the maintenance practices and procedures.

There is a large number of new manufactured aircraft which offer SBAS certification by default like Bombardier CS Series for commercial aviation. Most new business and general aviation models from Bombardier, Cessna Embraer, Gulfstream, Hawker, Pilatus, Dassault, Piper, Cirrus or Diamond are certified for the use of LPVs too.

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<sup>2</sup> Not exhaustive list. A detailed EASA list of ETSO authorisations can be found at: <https://www.easa.europa.eu/download/etso/etsoa.pdf>

It is important to highlight that, for recently manufactured aircraft, where the PBN capability is approved under the TC, there should be a statement in the AFM limitations section identifying the operations for which the aircraft is approved.

For those aircraft which are not certified from factory (via TC), certain retrofitting or forward fitting modifications are needed, as explained below.

b) **Through a Supplemental Type Certificate (STC)**

EASA can approve aircraft changes through a modification approval process or STC. Although airworthiness certification via STC is granted by EASA, the operator will use it as proof of aircraft eligibility in front of the corresponding NSA, responsible of granting the authorisation for that type of operation. STCs are developed by Part 21 Approved Organisation which design the necessary changes to the aircraft equipment and its configuration and must achieve certification of the first conversion aircraft by EASA.

There are several examples of STCs available for different aircraft models like the Boeing 737, Fokker 50, Bombardier CL600 and legacy ATR 42/72. In the case of business and general aviation, Applicable Model List (AML) STCs exist for Garmin and Avidyne avionics covering a wide range of aircraft models.

c) **Through a Service Bulletin (SB):**

The SB, issued by the aircraft manufacturer, is a document approved by the State of Design (EASA or, by delegation, DOA with valid privileges) to enable changes to the specified aircraft type, and the modification then becomes part of the type design of the aircraft.

The State of Registry accepts the application of an SB and changes to the maintenance programme, while the State of the Operator accepts changes to the maintenance programme and approves changes to the MEL, training programmes and operations specifications. A SB may be obtained for current-production or out-of-production aircraft.

For example, SBs are available to Airbus 350, ATR 42-600 and 72-600, Bombardier CRJ and Dash 8 models, Embraer E-Jets, Piaggio, Gulfstream, Pilatus and Dassault Falcon models.

d) **Through a compliance statement from the manufacturer**

This should have been approved by the State of Design (EASA) and accepted by the State of Registry or the State of the Operator, if different. The aircraft manufacturer may elect to issue an SB with an appropriate AFM update or instead may publish a compliance statement in the form of a letter, for simple changes, or a detailed aircraft-type-specific document for more complex changes. The State of Registry may determine that an AFM change is not required if it accepts the OEM documentation.

To summarise, if the aircraft is designed and certified for LPV operations there is no action required by the operator but to attach the necessary evidences to the notification of change to their NSA.

**If the aircraft is not LPV certified, the operator should seek for applicable SBs or STCs** from the manufacturer or DOAs for that particular aircraft model and variant and perform necessary the aircraft modifications. If there are not EASA approved SBs/STCs solutions, the operator will then have to pursue the development of a new one liaising with a design organisation, implementing the corresponding changes to the aircraft and achieving the necessary STC certification.

EASA Guidance Material considers any reference to AMC 20-28, AC 20-138 and AC 90-107 in documents like the AFM, FCOM, TC, SB, Service Letters or Compliance Statements approved by the State of Design as acceptable for LPV airworthiness certification.

Additionally, TAWS-A equipped aircraft which do not provide Mode-5 protection on an LPV approach can still be certified for LPV although their DH will be limited to 250ft. Furthermore, limitations such as “within the US National Airspace” found in some AFM can be now ignored.

## 5 OPERATIONAL PROCEDURES AND OPERATIONAL MANUAL

As it happens with other approach procedures which are operated under IFR, there are certain operational criteria which apply to their use and that should be properly documented in the operational manuals.

CR (EU) 2016/1199 [RD-9] lays down the general requirements set for PBN operations such as LPV where the operator (for CAT) or pilot in command (for NCC/NCO) shall ensure that:

- Relevant PBN navigation specification is stated in the AFM and the aircraft is operated according to it<sup>3</sup>;
- Space-based facilities are adequate for the planned operation during flight preparation<sup>4</sup>;
- Any navigational database required for performance-based navigation is suitable and current<sup>5</sup>;
- Databases shall be adequate and meet quality requirements. Operator shall ensure timely distribution and report occurrences<sup>6</sup>; and
- Sufficient means are available to navigate and land at the destination or at any alternate aerodrome in the case of loss of capability<sup>7</sup>.

EASA Decision 2016-014-021/R [RD-10] provide the corresponding Guidance Material (GM) and Acceptable Means of Compliance (AMC) associated to this regulation covering aspects such as:

- Normal, abnormal and contingency procedures during pre-flight, departure, arrival and approach;

<sup>3</sup> CAT.OP.MPA.126, NCC.OP.116, NCO.OP.116 and SPO.OP.116

<sup>4</sup> CAT.OP.MPA.135(a)(1), CAT.OP.MPA.175 (b), NCC.OP.145, NCO.OP.135 and SPO.OP.140

<sup>5</sup> CAT.OP.MPA.175(b)(7), NCC.GEN.106, NCO.GEN.105 and SPO.GEN.107

<sup>6</sup> CAT.IDE.A/H.355, NCC.IDE.A/H.260, NCO.IDE.A/H.205 and SPO.IDE.A/H.230

<sup>7</sup> CAT.OP.MPA.182, NCC.OP.153, NCO.OP.142 and SPO.OP.152

- Vectoring and Positioning;
- Alerting and abort;
- Electronic navigation database management;
- Minimum Equipment List (MEL);
- Displays and automation; and
- Flight crew qualification and proficiency constrains;

[Appendix A](#) provides detailed information on the Standard Operating Procedures (SOPs) introduced by these new EASA GMs and AMCs.

The relevant parts and sections of the Operations Manual (e.g. Aircraft Operations Manual, check lists, training of crew) should be revised to take account of the operating procedures detailed above. The operator should make timely amendments to the Operations Manual to reflect relevant procedure and data base checking strategies. Manuals and check lists may need to be submitted for review by the competent authority as part of the notification process.

The following table provides a non-exhaustive list of parts, chapters and sections of a standard<sup>8</sup> Operational Manual that shall be amended.

The details of the specific paragraphs in new Air-Crew and Air-Ops regulations requesting such amendments can be found in [Appendix C](#).

<sup>8</sup> According to the content and structure given in AMC to Part ORO, Initial issue dated 25/10/12: AMC3 ORO.MLR.100 Operations manual – general CONTENTS – COMMERCIAL AIR TRANSPORT OPERATIONS



Table 1–Operational Manual impacted parts chapter and sections.

Chapter	Section	Subsection	Amendments		
<b>Part A. General/Basic</b>					
<b>OM-A</b>	<b>0. Administration and control of OM</b>	<b>0.1</b> Introduction	<b>(d)</b> Explanations and definitions of terms	New RNP definitions and abbreviations	
		<b>0.2</b> System of amendment and revision		Revision update	
	<b>1. Organisation and responsibilities</b>	<b>1.3</b> Responsibilities and Duties		Potential new functions/responsible (See <a href="#">Appendix A</a> ): - NAV data handling, quality and control - Routes, flight plans, NOTAM check and occurrence reporting	
	<b>2. Operational control and supervision</b>	<b>2.2</b> System and responsibility for promulgation of additional operational instructions and information		NOTAMs, AIPs and AICs related information	
		<b>2.3</b> Operational control		- RNP APCH related information distribution process for safe operation. - Aerodrome categorisation	
	<b>3</b> Management system	Quality System – duties and responsibilities		NAV data handling, quality and control processes	
	<b>5</b> Qualification requirements	<b>5.1</b> A description of the required licence, rating(s), qualification/competency (e.g. for routes and aerodromes), experience, training, checking and recency for operations personnel to conduct their duties.		Crew Authorisation required/validation (See <a href="#">Section 6</a> ).	
	<b>8. Operating Procedures</b>	<b>8.1</b> Flight preparation instructions.	<b>8.1.2</b> Criteria and responsibilities for determining the adequacy of aerodromes to be used		- RNP procedure operational evaluation - Use of NOTAM/RAIM to select destination / alternate aerodrome
			<b>8.1.3</b> Methods and responsibilities for establishing aerodrome operating minima.		Calculations for RNP APCH operations (e.g. RVR and DA(H))
			<b>8.1.5</b> Presentation/application of aerodrome operating minima		APCH charts presentation, i.e. RNAV (GNSS)
			<b>8.1.9</b> ATS flight plan		Explanation on ATS flight plans submission (state RNP APCH capability <sup>9</sup> ).
			<b>8.1.10</b> Operational flight plan		Procedures for elaboration and submission of operational flight plans for RNP APCH.

<sup>9</sup> Check for Eurocontrol guidance on how to fill in NAV/COM/SUR information in Flight Plans at

<https://www.eurocontrol.int/sites/default/files/article//content/documents/nm/flight-planning/icao-2012/icao-2012-guidance-latest.pdf>



Chapter	Section	Subsection	Amendments
OM-A	8. Operating Procedures	8.3.2 Navigation Procedures. A description of all navigation procedures, relevant to the type(s) and area(s) of operation. Special consideration given to: <ul style="list-style-type: none"> <li>a. standard navigational procedures; and</li> <li>b. RNP and Minimum Navigation Performance Specification</li> <li>c. in-flight re-planning;</li> <li>d. procedures in the event of system degradation;</li> </ul>	Update (see <a href="#">Appendix A</a> ): <ul style="list-style-type: none"> <li>- RNAV/RNP concepts including NOTAM;</li> <li>- Crew qualification</li> <li>- Database (Type 2 LoA)</li> <li>- Normal and abnormal procedures</li> <li>- Radiotelephony, RTF phraseology</li> <li>- Navigation accuracy assessment at dispatch, for destination and alternates;</li> </ul>
		8.6 Use of the minimum equipment and configuration deviation list(s).	MEL handling (if changes are necessary).
	11. Handling and reporting occurrences	Procedures for handling, notifying and reporting accidents, incidents and occurrences.	Include procedures for RNP issues reporting (See <a href="#">Section 8.6</a> )
<b>B. Aircraft Operating Matters – Type Related</b>			
OM-B	1. Limitations	Description of the certified limitations and the applicable operational limitations: Certification status - EASA (S)TC, Types of approved operations (RNP APCH) and Navigation System limitations	Update STC/TC certification and approved operations
	2. Normal procedures		See <a href="#">Appendix A</a>
	3. Abnormal and/or emergency procedures		See <a href="#">Appendix A</a>
	9. Minimum Equipment List (MEL)		Include MMEL dispatch conditions for RNP APCH.
	12. Aircraft Systems		Update on RNP APCH navigation capability
<b>Part C. Route/Role/Area and Aerodrome/Operating Site Instructions</b>			
OM-C	1	Instructions and information relating to communications, navigation and aerodromes/operating sites including minimum flight levels and altitudes for each route to be flown and operating minima for each aerodrome/operating site planned to be used, including the following	<ul style="list-style-type: none"> <li>- Operating minima</li> <li>- Navigation aids and Communications</li> <li>- Charts description</li> </ul>
<b>Part D. Training</b>			
OM-D	1	Description of scope: Training syllabi and checking programmes for all operations personnel assigned to operational duties in connection with the preparation and/or conduct of a flight.	Setup training program (modules): purpose, scope, requirements, conditions, instructors, etc. (See <a href="#">Section 6</a> and <a href="#">Appendix B</a> ).
	2	2.1 for flight crew, all relevant items prescribed in Annex IV (Part-CAT), Annex V (Part-SPA) and ORO.FC;	Ground and FSTD/Airplane practical training and checking.
		2.5 for operations personnel other than crew members (e.g. dispatcher, handling personnel etc.)	RNP APCH training for supervisors and other than crew personnel
3	3.1 Procedures for training and checking.	Include RNP APCH procedures and simulator/training devices selection criteria	

## 6 CREW TRAINING AND TRAINING PACKAGE UPDATE

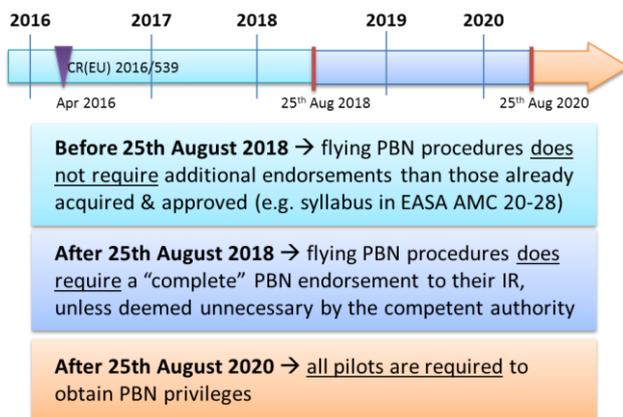
As it was mentioned earlier, CR (EU) 2016/539 [RD-11] introduced the necessary changes to Air Crew regulations as to incorporate PBN in the regular training and checking requirements for pilots.

Such regulation is requesting **all ATOs to introduce PBN privileges to their IR courses by 25 August 2020 at the latest, date from which PBN will become mandatory to all IR pilots.**

Therefore, IR licenses granted after that date will be automatically entitled to fly LPVs, among other PBN operations, while existing IR holders will need to update their TK/PS on PBN at the first proficiency check.

In the meantime, operators willing to make use of LPV approach procedures before that date will have to provide equivalent training to their flight crew in advance.

Those who already acquired such privileges for certain PBN specifications do not need a “complete” PBN endorsement until 2018.



EASA introduced a new set of Learning Objectives (LOs) for PBN in Annex I to their recent Decision 2016/008/R [RD-12]. These LOs have incorporated the flight crew training syllabus amendments provided in Appendix 4 to former AMC 20-28 which were used as reference in the past<sup>10</sup>. They can also be found in [Appendix B](#) to these guidelines.

<sup>10</sup>It is worth noting that EASA Rule Making Task RMT.0595 is currently working on further updates of these LOs. Annex II to

As for the exams, 5 questions from EASA examination procedures on “Area Navigation Systems and RNAV or FMS” will be replaced by new questions on PBN<sup>11</sup>.

In what regards to skill tests and training, the new EC regulation introduces the following main changes to Part-FCL:

- Content of IR Skill test (Appendix 7): identification of required navaids for approach procedures, check that the correct PBN procedure has been loaded in the navigation system and cross-check it with the departure and arrival charts.
- Cross-crediting (Appendix 8): flying at least three IFR departures and approaches exercising PBN privileges, including one RNP APCH approach in the preceding 12 months will be sufficient to pass Section 6 (Abnormal and Emergency procedures) of the skill test<sup>12</sup>.
- Training (Appendix 9): specific requirements for single and multi-pilot set that, to establish or maintain PBN privileges, one approach shall be an RNP APCH. Where an RNP APCH is not practicable, it shall be performed in an appropriately equipped FSTD. Also, references to ILS are replaced by 3D operations.

[Appendix B](#) deepens into these training requirements and provides further guidance. In addition, ESSP and PPL/IR have developed training material covering EASA LOs as reference which can be found here:

- EGNOS website: [Training Material](#)<sup>13</sup>
- PPL/IR website: [PBN Manual](#)<sup>14</sup>

[RD-12] keeps the original LOs presented in NPA 2014-29, while the new changes have been proposed in NPA 2016-03.

<sup>11</sup> AMC2 ARA.FCL.300(b)

<sup>12</sup> On an SP class or type of airplane in SP operations or, for multi-engine, other than HP complex airplanes. The same applies for Helicopters PinS procedures in SP operations.

<sup>13</sup> [https://egnos-user-support.essp-sas.eu/new\\_egnos\\_ops/?q=content/training-material](https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=content/training-material)

<sup>14</sup> <https://www.pplir.org/latest-news/1038-pbn-manual-published-2>

## 7 NOTIFICATION TO THE AUTHORITY

Before the recent changes introduced by [RD-9], LPV and other PBN specifications required a Specific Approval (SPA) from the corresponding NSA prior to their operation.

The process involved a pre-application phase with a written proposal to the regulator followed by the formal application itself, where the operator provided all documentation evidences at hand. Some regulators made application forms and guidance material available to operators to assist them in the application process, while others offered no guidance at all.

Once this documentation was evaluated by the NSA, the final demonstration and inspection process took place, where the operator demonstrated that all AMC 20-28 requirements were being met. Then, upon successful inspection, the approval was granted by the NSA under the Operations Specification (Ops Spec) associated with the AOC. In the case of general aviation, this could be done through a Letter Of Authorization (LOA).

Although [RD-9] has eliminated the burden to apply for an SPA, operators wishing to obtain PBN privileges are still required to put the necessary operational procedures in place, amend their operational manuals and other documentation accordingly and provide training to their crew<sup>15</sup>.

While a formal SPA application is no longer necessary, **CAT operators shall notify important changes** to the scope of the certificate or the operations specifications like these to their authority in advance<sup>16</sup>.

As it was noted before, AMC 20-28 provides acceptable means that can be used by the operator to obtain airworthiness certification for their aircraft, which is granted by EASA, while [RD-10] provides acceptable means and

guidance material to become operationally eligible.

In the past, the requirements imposed to non-AOC operators when SPAs were still necessary for PBN operations differed from country to country. Some required the same process than for AOC (i.e. a full SPA), others undertaking specific training while others, nothing at all.

Fortunately, [RD-9] has homogenised the approach by eliminating the burden to apply for SPA not only for non-commercial but also for commercial operators. Today, with the new changes in regulation, **non-commercial operators no longer need to notify their authority, although they will be subject to regular inspections and audits** where to ensure that the appropriate training has been undertaken.

In the case of commercial aviation, once the operator has provided the necessary training to their crew, introduced the operational procedures and amended their manuals, a notification to the authority should suffice. This might (or not) lead to discussions between the operator and the NSA until all evidences are found satisfactory and the changes are accepted. The important difference is that now, the NSA has 10 days to provide feedback. Otherwise, the changes are considered satisfactory.

To this end, NSAs usually make notification forms available to those operators seeking for authorisation for changes to their operational manuals which should, in principle, not represent changes to the Operational Specifications or AOC.

In some cases, depending on the particular national policy, the modification of an AOC could require similar steps to the first issue of the certificate.

An example of the submission matrix that a notification form could contain is given in Table 2 below.

<sup>15</sup> ORO.GEN.110 Operator responsibilities.

<sup>16</sup> ORO.GEN.130 and GM3 ORO.GEN.130(b) Changes related to an AOC holder.



**EGNOS HOW TO: Become compliant with European requirements for RNP APCH operations to LPV minima**



Table 2–Notification form - submission matrix example

Section	Sub-section	Description	
<b>1- Applicant details</b>	Operator details	– Name, AOC number, address, mail, etc	
	Airframe details	– Aeroplane Type, Series, Registration, etc	
<b>2- Notes for completion</b>	Applicability	– Changes covered by the application form and limitations (i.e Company Operations, Training and Manuals). – Reference to regulatory material (i.e. CR (EU) 2016/539 and 2016/1199; EASA Decisions 2016/008/R and 2016/014-021/R) and additional documentation (e.g. AMC 20-28, ICAO Docs 9613, 8168, 9997, other national guidance, etc)	
	Submission and enquires	– PoC at NSA for questions and delivery of application.	
	Documents to be included	– Copies of all documents referenced in the submission matrix below (relevant section/pages); – Copies of AFM or POH stating compliance with LPV operations; – Copies of EASA/FAA Type 2 LOA of navigation data supplier; – Extracts from Operations Manuals Parts A, B, C and D; – Copies from approved maintenance program evidences (TC) if applicable. – Copies of ATOs/PTOs training courses contents	
<b>3- Operator's submission matrix</b>			
Item	Sub-item / Description	Reference documentation and requirements	Document reference <sup>17</sup>
<b>1.0 Aircraft Airworthiness</b>	Reference to aircraft navigation system capability airworthiness for RNP APCH down to LPV.	According to EASA Guidance Material <sup>18</sup> , if a statement of compliance with AMC 20-28, AC 20-138 (for LPV specification) or AC 90-107 is found in any of the following documentation <sup>19</sup> listed below, the aircraft is eligible for RNP APCH — LPV operations: <ul style="list-style-type: none"> <li>i. AFM, supplements and documents directly referenced in the AFM;</li> <li>ii. Flight Crew Operating Manual or similar document;</li> <li>iii. Service Bulletin or Service Letter issued by the TC holder or STC holder<sup>20</sup>;</li> <li>iv. Approved design data or data issued in support of a design change approval;</li> <li>v. Written evidence obtained from the State of Design.</li> </ul>	

<sup>17</sup> Compliance statement and document reference to be filled in by the applicant (e.g. AFM/POH extracts, Type 2 LOA letters, extract from Ops Manuals, ATO documentation)

<sup>18</sup> GM2 CAT.IDE.A/H.345, GM1 NCC.IDE.A/H.250, GM1 NCO.IDE.A/H.195 and GM1 SPO.IDE.A/H.220

<sup>19</sup> According to this EASA GM, any limitation such as ‘within the US National Airspace’ may be ignored since RNP APCH procedures are assumed to meet the same ICAO criteria around the world.

<sup>20</sup> Or any other formal document issued by the TC or STC holders stating compliance with PBN specifications, AMC, Advisory Circulars (AC) or similar documents issued by the State of Design;



**EGNOS HOW TO: Become compliant with European requirements for RNP APCH operations to LPV minima**



Item	Sub-item / Description	Reference documentation and requirements	Document reference
<b>2.0 Operational Criteria</b>	Flight Operations Documentation	The relevant parts and sections of the Operational Manual <sup>21</sup> , check lists and training documentation should be revised.	
	Normal Procedures	As indicated in EASA AMC & GM (CAT.OP.MPA.126, CAT.OP.MPA.175 and 182) <sup>22</sup> : <ul style="list-style-type: none"> <li>– Flight preparation;</li> <li>– Departure;</li> <li>– Prior to commence the Procedure; and</li> <li>– During the Procedure.</li> </ul>	
	Abnormal Procedures	As indicated in EASA AMC & GM (CAT.OP.MPA.126)	
<b>3.0 Operations Manuals</b>	<b>Part A. General/Basic</b>	<ul style="list-style-type: none"> <li>– Definitions, abbreviations, responsibilities and duties;</li> <li>– Operational control (RNP info, aerodrome categorisation);</li> <li>– Management and quality systems (NAV data);</li> <li>– Qualification requirements for crew;</li> <li>– Flight procedures (RNAV concepts; navigation accuracy assessment at dispatch for destination/alternates; phraseology; MEL handling; SOPs; etc); and</li> <li>– Incidents and occurrences handling and reporting.</li> </ul>	
	<b>Part B. Aircraft Operating Matters – Type Related</b>	<ul style="list-style-type: none"> <li>– Limitations, Normal and Abnormal procedures; and</li> <li>– Technical information and MEL.</li> </ul>	
	<b>Part C. Route and Aerodrome instructions and information</b>	<ul style="list-style-type: none"> <li>– Aerodrome information: operating minima, navigation aids, communications and charts description.</li> </ul>	
	<b>Part D. Training</b>	Training syllabi and checking programmes.	
<b>4.0 Training package</b>	Flight crew should receive appropriate simulator training, briefings and guidance material covering both normal and abnormal procedures.	<ul style="list-style-type: none"> <li>– Air Crew Part FCL Appendix 7 (IR test), 8 (cross-crediting) and 9 (training);</li> <li>– EASA AMC7 FCL.615(b) Instrument Rating Learning Objectives (062 07 00 00);</li> <li>– ATOs courses documentation;</li> <li>– AMC 20-28 Appendix 4 or ICAO Doc 9997;</li> </ul>	
<b>5.0 Electronic navigation data management</b>	Navigation database	Navigation data supplied by Type 2 LoA holder.	
	Quality monitoring	Navigation data products and process monitoring in accordance with quality system.	
	Data distribution	Ensure timely distribution of current and unaltered electronic navigation data to aircraft.	
	Reportable events	Company procedures dealing with AMC2.ORO.GEN.160 occurrence reporting	

<sup>21</sup> See Table 1 in Section 0.

<sup>22</sup> See all specific AMC & GM references for Part-CAT and equivalent Parts- NCC, NCO and SPO in Appendix C.

## 8 RECENT EC REGULATORY CHANGES ON PBN

The introduction of PBN in Air Crew and Air Ops regulation was set as the main goal of EASA Rule Making Tasks (RMT) 0256 and 0257, which first Terms of Reference (ToR) were published in July 2012 as it is shown in the Figure 8-1 below.

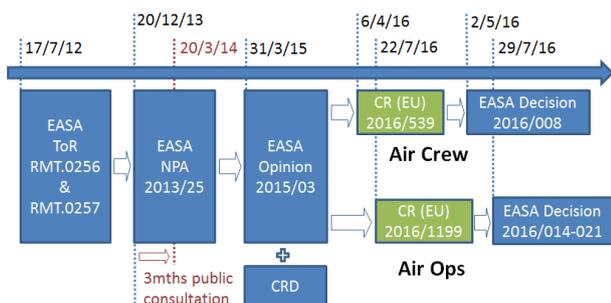


Figure 8-1 PBN introduction to regulation process

While RMT.0256 was set to look into the necessary changes to the existing Air Ops and Air Crew regulations, RMT.0257 focused on the corresponding changes to the related AMCs and GM material.

The Notice of Proposed Amendment with the proposed changes, NPA 2013-25 [RD-13], was released by EASA on the 20<sup>th</sup> of December 2013. It remained open for comments during a 3 months consultation period. The final EASA Opinion 03/2015 “Revision of operational approval criteria for performance-based navigation (PBN)” [RD-14] and the associated Comments Review Document (CRD) 2015-25 to the received comments were published on the 31<sup>st</sup> of March 2015.

The Opinion was then addressed to the European Commission, which used it as a technical basis to prepare the amendments to Air Crew [RD-11] and Air Ops [RD-9] Commission Regulations, published on the 6<sup>th</sup> of April and 22<sup>nd</sup> of July 2016 respectively.

Soon after, Decisions containing the corresponding amendments to the Certification Specification (CS), Acceptable Means of Compliance (AMC) and Guidance Material (GM) were published by the Agency on the 2<sup>nd</sup> of May [RD-12] and 29<sup>th</sup> [RD-10] of July respectively.

Figure 8-2 below shows EASA Basic regulation and the Annexes which are impacted by these amendments.

The Regulatory Impact Assessment (RIA) included in NPA 2013-25 [RD-13] concluded that removing the obligation for SPA was possible for the majority of PBN specifications provided that, in order to maintain safety, PBN elements were included into pilot training and checking for IR.

The main changes brought by these amendments to regulation are the following:

- **SPAs are removed<sup>23</sup>** for all PBN specifications except RNP 0.3 and RNP AR APCH. That includes not only RNP APCH but also RNAV 1, 2, 5 and 10 and RNP 1, 2 and 4;
- **PBN operational aspects** such as navigation database management, displays and monitoring, occurrence reporting, NOTAMs checking and missed approaches **are introduced to Parts CAT, NCC, NCO and SPO.**
- **Part FCL rules** on training and checking are adapted to reflect the changed requirements in Theoretical Knowledge (TK) and Practical Skills (PS) in order to cover PBN;
- PBN elements are added for the **initial qualification of the IR pilots from the 25<sup>th</sup> of August 2020 onwards.** Existing **IR holders** are mandated to update their TK on PBN while PS shall be demonstrated in courses or at the first periodic check<sup>24</sup> after that date;
- **Approved Training Organisations (ATOs)** shall introduce PBN privileges to their courses by 25 August 2020 also and notify the competent authority;

[Appendix C](#) provides more details on the specific new requirements that have been introduced to Air Crew and Air Ops regulations as well as their associated EASA AMCs and GMs.

<sup>23</sup> SPA.PBN.100 and ARO.OPS.240

<sup>24</sup> According to EC 1178/2011, Subpart G, FCL.625 “IR — Validity, revalidation and renewal From”, an IR shall be valid for 1 year and it shall be revalidated within the 3 months immediately preceding the expiry date of the rating

## Regulations Structure

Each Part to each implementing regulation has its own Acceptable Means of Compliance and Guidance Material (AMC/GM). These AMC and GM are amended along with the amendments of the regulations. These AMC/GM are so-called 'soft law' (non-binding rules), and put down in form of EASA Decisions. A comprehensive explanation on AMC in form of questions and answers can be found on the FAQ section of the EASA website.

Furthermore, Certification Specifications are also related to the implementing regulations, respectively their parts. Like AMC/GM they are put down as Decisions and are non-binding.

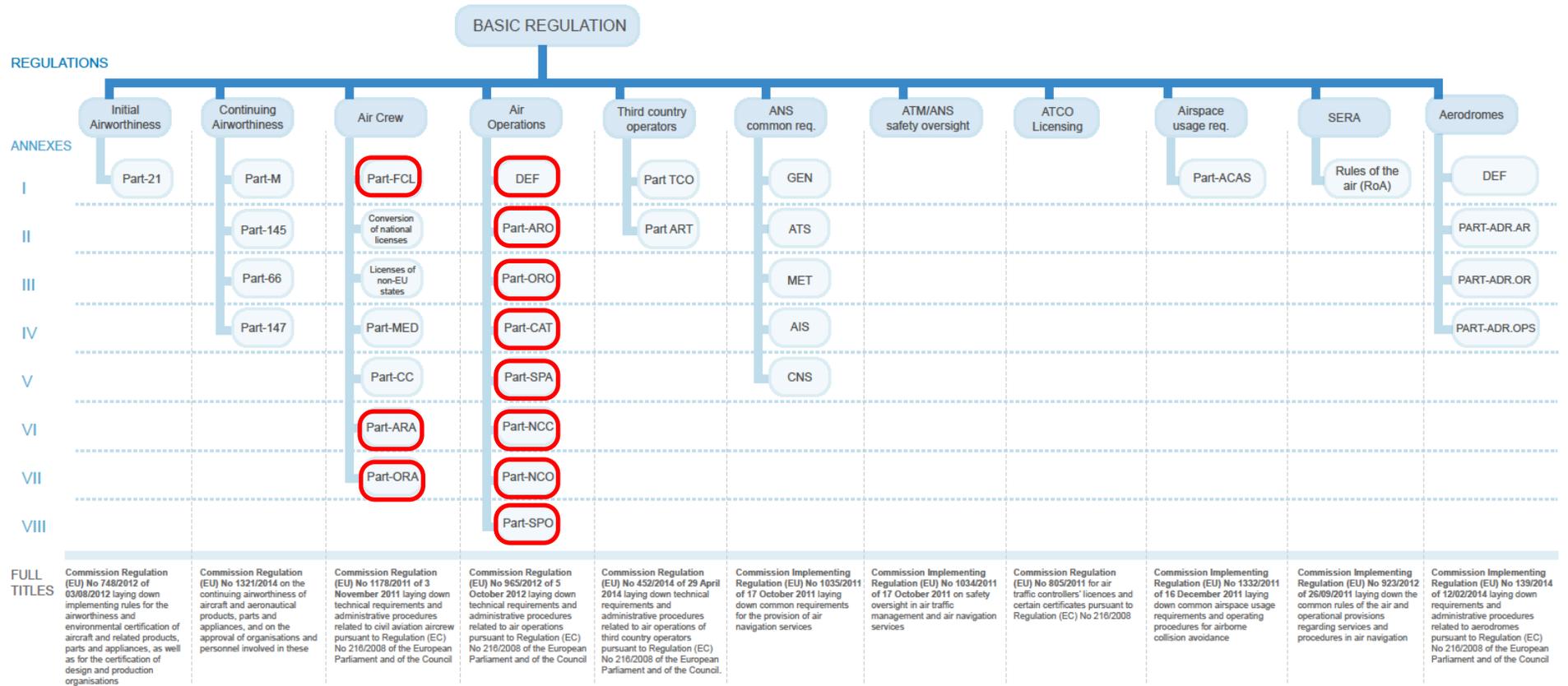


Figure 8-2 EASA regulation Annexes impacted by Opinion 03/2015

## APPENDIX A STANDARD OPERATING PROCEDURES (SOPS)

EASA AMC and GM were amended by [RD-10] in response to the changes introduced to Air Ops regulations [RD-9] so as to establish the standard operating procedures for the new PBN specifications, including RNP APCH to LPV minima.

Generally speaking, most of these SOPs were already contained in former AMC20-XX and have now been introduced in the corresponding Parts ORO, CAT, NCC, NCO, SPO and SPA from Air Ops and even in Part-FCL from Air Crew. [Appendix C](#) below provides details on the exact items or requirements which have been introduced or modified in the above mentioned Parts but, for the sake of clarity and easier reading, these are presented now aggregated per topic or time of applicability during the flight.

### 8.1 Airworthiness certification requirements or aircraft eligibility

According to Air Ops, the aircraft shall meet the airworthiness certification requirements for the PBN navigation specification in question, which is usually stated in the AFM, and the Operator shall ensure that the aircraft is operated according to it. Where such a reference cannot be found in the AFM, other information provided by Service Bulletins, Supplemental Type Certificates, FCOM or similar documents should be sufficient.

In the case of RNP APCH to LPV minima, a statement of compliance with any of the following specifications or standards in such documentation is acceptable: AMC 20-28, FAA AC 20-138 and FAA AC 90-107. Also, for aircraft that have TAWS Class A installed and do not provide Mode-5 protection (excessive deviation below glideslope) on an LPV approach, the DH is limited to 250 ft.

Additionally, any limitation such as *'within the US National Airspace'* may be ignored since RNP APCH procedures are assumed to meet the same ICAO criteria around the world.

### 8.2 Management of navigation database

Existing Air Ops regulation (CAT.IDE.A.355) already set the operator requirements to manage electronic navigation data products. The only change introduced by the new regulation is the prohibition for the flight crew to either insert or modify waypoints by manual entry into a procedure (departure, arrival or approach) that has been retrieved from the database. User-defined data may be entered and used for waypoint altitude/speed constraints on a procedure where said constraints are not included in the navigation database coding.

Existing regulation on navigation database management require the operator to only use products meeting standards of integrity that are adequate for the intended use (i.e. Type 2 letter of acceptance - LoA), to continuously monitor their integrity and to ensure the timely distribution and insertion of current and unaltered electronic navigation data to all aeroplanes that require it.

LPV approaches are characterised in the navigation database by the so called FAS Data Block. Each FAS Data Block contains the lateral and vertical parameters, which define the approach to be flown and that have been calculated, validated and promulgated by the Air Navigation Service Provider. In addition, each FAS Data Block ends with a CRC, which wraps around the approach data to guarantee integrity.

### 8.3 Recurrent training and checking

Operator proficiency checks at recurrent checking requirements are amended to replace the terms *"precision instrument approach"* and *"non-precision approach"* by *"3D approach operation"* and *"2D approach operation"*, providing a new classification which naturally accommodates the new concepts brought by PBN.

Even more, it is actually mandated that at least one of the 3D or 2D approach operations during the proficiency check should be an RNP APCH (or RNP AR APCH) operation.

## 8.4 Normal procedures

The following operational requirements are introduced for flight preparation and execution:

### 8.4.1 Flight preparation

#### 1. Navigation systems, NOTAM and RAIM checking

- The flight crew should verify that the navigation systems required for the intended operation are operational.
- The flight crew should check that the navigation aids critical to the operation of the intended PBN procedure are available. Therefore they should take account of any NOTAMs or operator briefing material that could adversely affect the aircraft system operation along its flight plan including any alternate aerodromes.
- The flight crew should confirm the navigation aids that should be excluded from the operation, if any.
- The flight crew should ensure that RNAV 1, RNAV 2, RNP 1 RNP 2, and RNP APCH routes or procedures to be used for the intended flight, including for any alternate aerodromes, are selectable from the navigation database and are not prohibited by NOTAM.
- When PBN relies on GNSS systems for which RAIM is required for integrity, its availability should be verified during the pre-flight planning. In the event of a predicted continuous loss of fault detection of more than five minutes, the flight planning should be revised to reflect the lack of full PBN capability for that period.

#### 2. Database suitability

- The flight crew should check that any navigational database required for PBN operations includes the routes and procedures required for the flight.
- At navigation system initialisation, the flight crew should confirm that the navigation database is current (AIRAC cycle) and verify that the aircraft position has been entered correctly, if required. The active flight plan, if applicable, should be checked by comparing the charts or other applicable documents with navigation equipment and displays. This includes confirmation of the departing runway and the waypoint sequence, reasonableness of track angles and distances, any altitude or speed constraints, and, where possible, which waypoints are fly-by and which are fly-over. Where relevant, the RF leg arc radii should be confirmed.
- Navigation databases should be current for the duration of the flight. If the AIRAC cycle is due to change during flight, the flight crew should follow procedures established by the operator to ensure the accuracy of navigation data, including the suitability of navigation facilities used to define the routes and procedures for the flight.
- An expired database may only be used if the following conditions are satisfied:
  - the operator has confirmed that the parts of the database which are intended to be used during the flight and any contingencies that are reasonable to expect are not changed in the current version;
  - any NOTAMs associated with the navigational data are taken into account;
  - maps and charts corresponding to those parts of the flight are current and have not been amended since the last cycle;
  - any MEL limitations are observed; and
  - the database has expired by no more than 28 days.

#### 3. Selection of destination and alternate aerodromes

- The pilot-in-command should only select an aerodrome as a destination alternate aerodrome if an instrument approach procedure that does not rely on GNSS is available either at that aerodrome or at the destination aerodrome.
- The limitation applies only to destination alternate aerodromes for flights when a destination alternate aerodrome is required. A take-off or en route alternate aerodrome with instrument approach procedures relying on GNSS may be planned without restrictions. A destination aerodrome with all instrument approach procedures relying solely on GNSS may be used without a destination alternate aerodrome if the conditions for a flight without a destination alternate aerodrome are met.
- The term 'available' means that the procedure can be used in the planning stage and complies with planning minima requirements.

#### 8.4.2 Departure

- Prior to commencing a take-off on a PBN procedure, the flight crew should check that the indicated aircraft position is consistent with the actual aircraft position at the start of the take-off roll (aeroplanes) or lift-off (helicopters).
- Where GNSS is used, the signal should be acquired before the take-off roll (aeroplanes) or lift-off (helicopters) commences.
- Unless automatic updating of the actual departure point is provided, the flight crew should ensure initialisation on the runway or FATO by means of a manual runway threshold or intersection update, as applicable. This is to preclude any inappropriate or inadvertent position shift after take-off.

#### 8.4.3 Prior to commencing the procedure

- For multi-sensor systems, the flight crew should verify, prior to approach, that the GNSS sensor is used for position computation.
- Flight crew of aircraft with RNP input selection capability should confirm that the indicated RNP value is appropriate for the PBN operation.
- The flight crew should verify that the navigation system is operating correctly and the correct arrival procedure and runway (including any applicable transition) are entered and properly depicted.
- Any published altitude and speed constraints should be observed.
- The flight crew should check approach procedures (including alternate aerodromes if needed) as extracted by the system (e.g. CDU flight plan page) or presented graphically on the moving map, in order to confirm the correct loading and the reasonableness of the procedure content.
- Prior to commencing the approach operation (before the IAF), the flight crew should verify the correctness of the loaded procedure by comparison with the appropriate approach charts. This check should include:
  - the waypoint sequence;
  - reasonableness of the tracks and distances of the approach legs and the accuracy of the inbound course; and
  - the vertical path angle, if applicable.

*Note: requirements for altimetry settings and temperature compensation for RNP APCH operations using Baro VNAV set by the new regulation are not included here as they are not applicable to LPV approaches.*

- ATC tactical interventions in the terminal area may include radar headings, 'direct to' clearances which bypass the initial legs of an approach procedure, interceptions of an

initial or intermediate segments of an approach procedure or the insertion of additional waypoints loaded from the database.

- In complying with ATC instructions, the flight crew should be aware of the implications for the navigation system.
- 'Direct to' clearances may be accepted to the IF provided that it is clear to the flight crew that the aircraft will be established on the final approach track at least 2 NM before the FAF.
- 'Direct to' clearance to the FAF should not be acceptable. Modifying the procedure to intercept the final approach track prior to the FAF should be acceptable for radar-vectored arrivals or otherwise only with ATC approval.
- The final approach trajectory should be intercepted no later than the FAF in order for the aircraft to be correctly established on the final approach track before starting the descent (to ensure terrain and obstacle clearance).
- 'Direct to' clearances to a fix that immediately precede an RF leg should not be permitted.
- For parallel offset operations en route in RNP 4 and A-RNP, transitions to and from the offset track should maintain an intercept angle of no more than 45° unless specified otherwise by ATC.

#### 8.4.4 During the procedure

- For RNAV 1, RNP 1, and RNP APCH operations, the flight crew should use a lateral deviation indicator, and where available, flight director and/or autopilot in lateral navigation mode.
- The appropriate displays should be selected so that the following information can be monitored:
  - (1) the computed desired path;
  - (2) aircraft position relative to the lateral path (cross-track deviation) for FTE monitoring;
  - (3) aircraft position relative to the vertical path (for a 3D operation).
- The flight crew of an aircraft with a lateral deviation indicator (e.g. CDI) should ensure that lateral deviation indicator scaling (full-scale deflection) is suitable for the navigation accuracy associated with the various segments of the procedure.
- The flight crew should maintain procedure centrelines unless authorised to deviate by air traffic control (ATC) or demanded by emergency conditions.
- Cross-track error/deviation (the difference between the area-navigation-system-computed path and the aircraft-computed position) should normally be limited to  $\pm \frac{1}{2}$  time the RNAV/RNP value associated with the procedure. Brief deviations from this standard (e.g. overshoots or undershoots during and immediately after turns) up to a maximum of 1 time the RNAV/RNP value should be allowable.
- For a 3D approach operation, the flight crew should use a vertical deviation indicator and, where required by AFM limitations, a flight director or autopilot in vertical navigation mode.
- Deviations below the vertical path should not exceed 75ft at any time, or half-scale deflection where angular deviation is indicated, and not more than 75ft above the vertical profile, or half-scale deflection where angular deviation is indicated, at or below 1,000ft above aerodrome level. The flight crew should execute a missed approach if the vertical deviation exceeds this criterion, unless the flight crew has in sight the visual references required to continue the approach.

- Unless the flight crew has sufficient visual reference to continue the approach operation to a safe landing, an RNP APCH operation should be discontinued if:
  - (1) navigation system failure is annunciated (e.g. warning flag);
  - (2) lateral or vertical deviations exceed the tolerances;
  - (3) loss of the on-board monitoring and alerting system.
- Discontinuing the approach operation may not be necessary for a multi-sensor navigation system that includes demonstrated RNP capability without GNSS in accordance with the AFM.
- Where vertical guidance is lost while the aircraft is still above 1,000ft AGL, the flight crew may decide to continue the approach to LNAV minima, when supported by the navigation system.

## 8.5 Contingency procedures

The flight crew should make the necessary preparation to revert to a conventional arrival procedure where appropriate. The following conditions should be considered:

- failure of the navigation system components including navigation sensors, and a failure effecting flight technical error (e.g. failures of the flight director or autopilot);
- multiple system failures affecting aircraft performance;
- coasting on inertial sensors beyond a specified time limit; and
- RAIM (or equivalent) alert or loss of integrity function.

In the event of loss of PBN capability, the flight crew should notify ATC and invoke contingency procedures and navigate using an alternative means of navigation.

In the event of communication failure, the flight crew should continue with the operation in accordance with published lost communication procedures.

## 8.6 Occurrence reporting

Part ORO is modified to lay down the requirements for the reporting of occurrences or anomalies associated with PBN operations.

A reportable event is understood as anything that adversely affects the safety of the operation and may be caused by actions or events external to the functioning of the aircraft navigation system such as:

- significant navigation errors attributed to incorrect data or a database coding error;
- unexpected deviations in lateral/vertical flight path not caused by flight crew input or erroneous operation of equipment;
- significant misleading information without a failure warning;
- total loss or multiple navigation equipment failure; and
- loss of integrity, e.g. RAIM function, whereas integrity was predicted to be available during pre-flight planning.

The operator should have in place a system for investigating a reportable event to determine if it is due to an improperly coded procedure or a navigation database error and should also initiate corrective actions for such an event.

## APPENDIX B FLIGHT CREW TRAINING REQUIREMENTS

EASA introduced a new set of **Learning Objectives (LOs)** for PBN in Annex I to their recent Decision 2016/008/R. These LOs have incorporated the flight crew training syllabus amendments provided in Appendix 4 to former AMC 20-28 which were used as reference in the past.

The PBN LOs have been introduced to EASA AMC7 FCL.615(b) “*IR — Theoretical knowledge and flight instruction*” in [RD-12]. These LOs, referred as 062 07 “PBN”, substitute the first three chapters of former 062 05 “AREA NAVIGATION SYSTEMS, RNAV/FMS”:

- 062 05 01 “*General philosophy and definitions*”
- 062 05 02 “*Simple 2D RNAV*”
- 062 05 03 “*4D RNAV*”

It is worth noting that EASA RMT.0595 is currently working on further updates of these LOs. Annex II to [RD-12] keeps the original LOs presented in NPA 2014-29, while the new changes have been proposed in NPA 2016-03. The list of PBN LOs found in [RD-12] is copied below:

### **062 07 00 00 PBN**

#### **062 07 01 00 PBN concept (as described in ICAO doc 9613)**

##### **062 07 01 01 PBN principles**

- List the factors used to define RNAV or RNP system performance requirements (accuracy, integrity, continuity and functionality)
- Explain the concept of continuity
- Explain the concept of integrity
- State that, unlike conventional navigation, performance-based navigation is not sensor specific.
- Explain the difference between raw data and computed data

##### **062 07 01 02 PBN components**

- List the components of PBN as NAVAID infrastructure, navigation specification and navigation application
- Identify the components from an example

##### **062 07 01 03 PBN scope**

- State that in oceanic/remote, en-route and terminal phases of flight, PBN is limited to operations with linear lateral performance requirements and time constraints
- State that in the approach phases of flight, PBN accommodates both linear and angular laterally guided operations.

#### **062 07 02 00 Navigation Specifications**

##### **062 07 02 01 RNAV and RNP**

- State the difference between RNAV and RNP in terms of the requirement for on-board performance monitoring and alerting

##### **062 07 02 02 Navigation functional requirements**

- List the basic functional requirements of RNAV and RNP specifications (continuous indication of lateral deviation, distance/bearing to active waypoint, g/s or time to active waypoint, navigation data storage and failure indication)

##### **062 07 02 03 Designation of RNP and RNAV specifications**

- Interpret “X” in RNAV X or RNP X as the lateral navigation accuracy (total system error) in nautical miles, which is expected to be achieved at least 95 per cent of the flight time by the population of aircraft operating within the airspace, route or procedure..
- State that aircraft approved to the more stringent accuracy requirements may not necessarily meet some of the functional requirements of the navigation specification having a less stringent accuracy requirement.
- State that RNAV10 and RNP4 are used in the oceanic/remote phase of flight
- State that RNAV5 is used in the enroute and arrival phase of flight

- State that RNAV2 and RNP2 are also used as navigation specifications
- State that RNP2 is used in the enroute, and oceanic/remote phases of flight
- State that RNAV1 and RNP1 are used in the arrival and departure phases of flight
- State that RNP APCH is used in the approach phase of flight
- State that RNP AR APCH is used in the approach phase of flight
- State that RNP 0.3 navigation specification is used in all phases of flight except for oceanic/remote and final approach, primarily for helicopters

### **062 07 03 00 Use of PBN**

#### **062 07 03 01 Airspace Planning**

- State that navigation performance is one factor used to determine minimum route spacing

#### **062 07 03 02 Approval**

- State that the airworthiness approval process assures that each item of the area navigation equipment installed is of a type and design appropriate to its intended function and that the installation functions properly under foreseeable operating conditions
- State that some PBN specifications require operational approval

#### **062 07 03 03 Specific RNAV and RNP system functions**

- Recognise the definition of an RF leg
- Recognise the definition of a fixed radius transition
- Recognise the definition of a fly-by turn and a fly-over
- Recognise the definition of a holding pattern
- Recognise the definition of an 'ARINC 424 path terminator'
- Recognise the definition of the following path terminators: IF, TF, CF, DF, FA, CA
- Recognise the definition of an offset flight path

#### **062 07 03 04 Data processes**

- State that the safety of the application is contingent upon the accuracy, resolution and integrity of the data.
- State that the accuracy of the data depends upon the processes applied during the data origination.

### **062 07 04 00 PBN operations**

#### **062 07 04 01 PBN principles**

- Recognise the definition of path definition error
- Recognise the definition of flight technical error
- Recognise the definition of navigation system error
- Recognise the definition of total system error

#### **062 07 04 02 On-board performance monitoring and alerting**

- State that on board performance monitoring and alerting of flight technical error is managed by on board systems or crew procedures.
- State that on board performance monitoring and alerting of navigation system error is a requirement of on-board equipment for RNP.
- State that on board performance monitoring and alerting of path definition error are managed by gross reasonableness checks of navigation data.

#### **062 07 04 03 Abnormal situations**

- State that abnormal and contingency procedures are to be used in case of the loss of PBN capability.

#### **062 07 04 04 Database management**

- State that, unless otherwise specified in operations documentation or AMC, the navigational database must be valid for the current AIRAC cycle.

### **062 07 05 00 Requirements of specific RNAV and RNP specifications**

#### **062 07 05 01 RNAV10**

- State that RNAV 10 requires that aircraft operating in oceanic and remote areas be equipped with at least two independent and serviceable LRNSs comprising an INS, an IRS FMS or a GNSS,
- State that aircraft incorporating dual inertial navigation systems (INS) or inertial reference units (IRU) have a standard time limitation
- State that operators may extend their RNAV10 navigation capability time by updating.

#### **062 07 05 02 RNAV5**

- State that manual data entry is acceptable for RNAV5

#### **062 07 05 03 RNAV/RNP1/2**

- State that pilots must not fly an RNAV/RNP1/2 SID or STAR unless it is retrievable by route name from the on-board navigation database and conforms to the charted route.
- State that the route may subsequently be modified through the insertion (from the database) or deletion of specific waypoints in response to ATC clearances.
- State that the manual entry, or creation of new waypoints by manual entry, of latitude and longitude or place/bearing/distance values is not permitted.

**062 07 05 04 RNP4**

- State that at least two LRNSs, capable of navigating to RNP 4, and listed in the flight manual, must be operational at the entry point of the RNP airspace

**062 07 05 05 RNP APCH**

- State that pilots must not fly an RNP APCH unless it is retrievable by procedure name from the on-board navigation database and conforms to the charted procedure.
- State that an RNP APCH to LNAV minima is a non-precision instrument approach procedure designed for 2D approach operations
- State that an RNP APCH to LNAV/VNAV minima has lateral guidance based on GNSS and vertical guidance based on either SBAS or BaroVNAV
- State that an RNP APCH to LNAV/VNAV minima may only be conducted with vertical guidance certified for the purpose
- Explain why an RNP APCH to LNAV/VNAV minima based on BaroVNAV may only be conducted when the aerodrome temperature is within a promulgated range
- State that the correct altimeter setting is critical for the safe conduct of an RNP APCH using BaroVNAV
- State that an RNP APCH to LNAV/VNAV minima is a 3D operation
- State that an RNP APCH to LPV minima is a 3D operation
- State that RNP APCH to LPV minima requires a FAS datablock

**062 07 05 06 RNP AR APCH**

- State that RNP AR APCH requires authorisation

**062 07 05 07 A-RNP**

- State that Advanced RNP incorporates the navigation specifications RNAV5, RNAV2, RNAV1, RNP2, RNP1 and RNP APCH
- State that Advanced RNP may be associated with other functional elements

**062 07 05 08 PBN Point in Space (PinS) Departure**

- State that a PinS departure is a departure procedure designed for helicopter only
- State that a PinS departure procedure includes either a 'proceed VFR' or a 'proceed visually' instruction from landing location to IDF
- Recognise the differences between 'proceed VFR' and 'proceed visually' instruction.

**062 07 05 09 PBN Point in Space (PinS) Approach**

- State that a PinS approach is an instrument RNP APCH procedure designed for helicopter only and that may be published with LNAV minima or LPV minima
- State that a PinS approach procedure includes either a 'proceed VFR' or a 'proceed visually' instruction from the MAPt to a landing location
- Recognise the differences between 'proceed VFR' and 'proceed visually' instruction.

ESSP and PPL/IR have developed training material based on the above listed EASA LOs to be used as reference to operators, pilots or ATOs. Such material can be found here:

- [EGNOS Training Material](https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=content/training-material) at [https://egnos-user-support.essp-sas.eu/new\\_egnos\\_ops/?q=content/training-material](https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=content/training-material)
- [PPL/IR PBN Manual](https://www.pplir.org/latest-news/1038-pbn-manual-published-2) at <https://www.pplir.org/latest-news/1038-pbn-manual-published-2>

In what regards to skill tests and training, the new EC regulation introduces the following main changes to Part-FCL:

- Content of IR Skill test (Appendix 7):
  - identification of required nav aids for departure, arrival and approach procedures,
  - check that the correct PBN procedure has been loaded in the navigation system and
  - cross-check it with the departure chart<sup>25</sup>.
- Cross-crediting (Appendix 8):
  - Flying at least three IFR departures and approaches exercising PBN privileges, including one RNP APCH approach in the preceding 12 months, will be sufficient to pass Section 6 (Abnormal and Emergency procedures) of the skill test<sup>26</sup>.
- Training (Appendix 9):
  - Specific requirements for single and multi-pilot set that, to establish or maintain PBN privileges, one approach in either Section 4 [3D operations] or Section 5 [2D operations] shall be an RNP APCH. Where an RNP APCH is not practicable, it shall be performed in an appropriately equipped FSTD.
  - Also, references to ILS are replaced by 3D operations.

Additionally, the new EC regulation requires in Part-ORA that the ATO shall use an adequate fleet of training aircraft or FSTDs appropriate equipped for the [PBN] training courses provided.

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<sup>25</sup> This is replicated in the pre-flight, arrival procedures, 3D operations and 2D operations sections.

<sup>26</sup> On an SP class or type of airplane in SP operations or, for multi-engine, other than HP complex airplanes. The same applies for Helicopters PinS procedures in SP operations.

## APPENDIX C CHANGES TO AIR CREW AND AIR OPS REGULATIONS

The following figure provides an overview of the annexes of the AIR-CREW and AIR-OPS Regulations and the Commission Regulation which introduced them from 2011 to 2014, [RD-15] to [RD-19]:

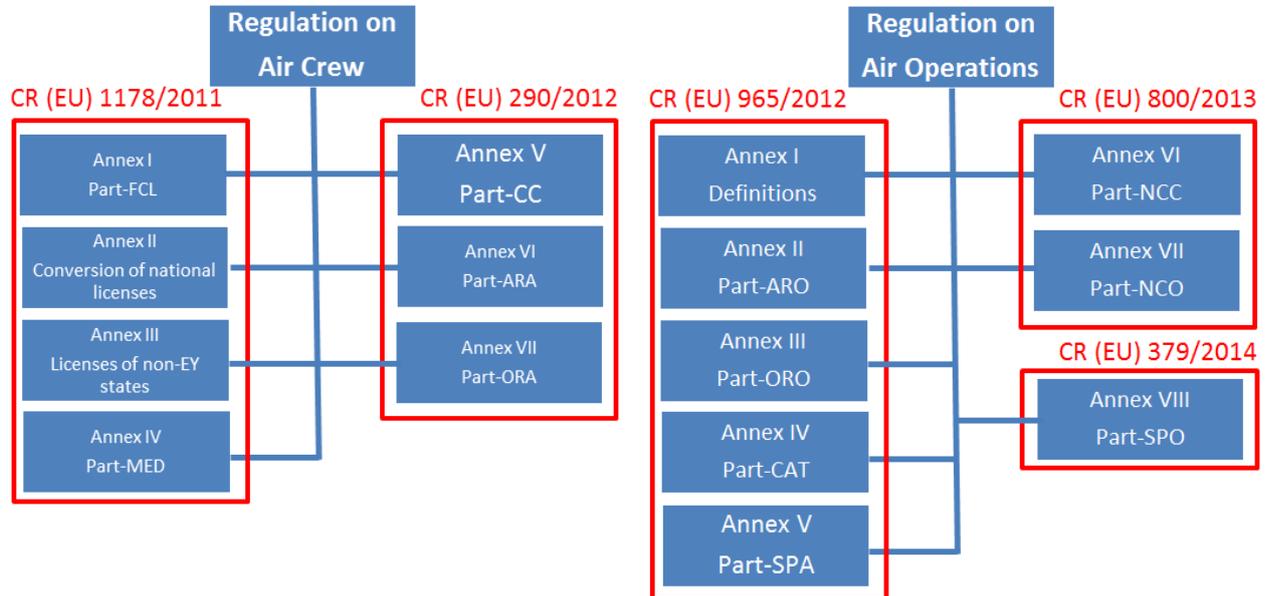


Figure 8-1 Air Crew and Air Operations Regulation Annexes

These annexes have been amended ever since their publication by other Commission Regulations (CR) following the process described in Section 8 above, where EASA NPAs and Opinions were issued prior to the CR and followed by the corresponding Decisions afterwards.

As commented before, the introduction of PBN in Air Crew and Air Ops regulation was set as the main goal of EASA RMTs 0256 and 0257. The proposed changes were first introduced in NPA 2013-25 [RD-13] and consolidated in Opinion 03/2015 [RD-14] on March 2015.

The corresponding Commission Regulations amendments to Air Crew [RD-11] and Air Ops [RD-9] were published on April and July 2016 respectively, followed by the resultant EASA Decisions [RD-12] and [RD-10] containing the amendments to existing AMC and GM.

The main changes introduced to Air-Crew are:

- PBN elements are added for the **initial qualification of the IR pilots from the 25<sup>th</sup> of August 2020 onwards**. Existing **IR holders** are mandated to update their TK on PBN while PS shall be demonstrated in courses or at the first periodic check after that date;
- **Approved Training Organisations (ATOs)** shall introduce PBN privileges to their courses by 25 August 2020 also and notify the competent authority;
- **Part FCL rules** on training and checking are adapted to reflect the changed requirements in Theoretical Knowledge (TK) and Practical Skills (PS) in order to cover PBN;

The following table provide details on the specific articles or requirements that are introduced or modified in the existing Air-Crew regulation and the corresponding changes to EASA AMC and GM as well as a brief description of them.

Table 3– Introduced changes to Air Crew regulation and related EASA AMC & GM.

Changes introduced by CR (EU) 2016/539				Modified AMC & GM by EASA Decision 2016/008/R			
Type	Item / Req.	Title	Summary	Type	Item / Req.	Title	Summary
<b>Regulation</b>							
New	Article 4a	PBN IR privileges	• Pilot needs to undertake TK (FCL.615) + Training (FCL.615) + skill test (appendix 7) or proficiency check (Appendix 9)• IR pilots without PBN may only fly on non-PBN routes and APCHs. No PBN items shall be required for the renewal of their IR, until 25 August 2020; after that date, PBN privileges shall be required for every IR.'				
New	Article 10a	ATOs	ATOs to introduce PBN privileges to IR courses compliant with Annex I (Part-FCL) by 25 August 2020 at the latest.				
<b>Annex I - Part FCL</b>							
New	FCL.010	Definitions	Angular & linear operation, LNAV, LPV, PBN, RNP APCH, RNP APCH to LNAV – LNAV/VNAV –LPV, RNP AR APCH, 3D and 2D instrument approach operations and VNAV	Mod.	GM2 FCL.010 Definitions	Lateral and vertical navigation guidance	It refers to the guidance provided either by: (a) a ground-based radio navigation aid; or (b) computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of these.'
Mod.	FCL.600.IR	IR - General	"an IR appropriate to the category of aircraft" replaced by "an IR with privileges appropriate to the applicable airspace requirements"				
Mod.	FCL.605.IR	IR - Privileges	The privileges of a holder of an IR are to fly aircraft under IFR, including PBN operations, with a minimum decision height of no less than 200 feet (60 m)				
				Mod.	AMC7 FCL.615(b) IR	IR Theoretical knowledge and flight instruction: PBN LOs	•Delete '062 05 01', '062 05 02', '062 05 03',": AREA NAVIGATION SYSTEMS AND RNAV OR FMS and • Insert '062 07 00 00' "PBN" when applicable
Mod.	Appendix 7 - IR skill test. Point 1		An applicant for an IR shall have received instruction on the same class or type of aircraft to be used in the test which shall be appropriately equipped for the training and testing purposes				
Mod.	• Appendix 7 - IR skill test Point 11 • Appendix 9 -Training Section B Point 4 and Section C Point 4a	PA replaced by "Angular deviations"	Half scale deflection, azimuth and glide path (e.g. LPV, ILS, MLS, GLS)				
New		2D (LNAV) and 3D (LNAV/VNAV) "linear" lateral deviations	Cross-track error limited to $\pm \frac{1}{2}$ the RNP value.				
New		3D linear vertical deviations (e.g. RNP APCH (LNAV/VNAV) using BaroVNAV)	< 75 feet below the vertical profile at any time, < + 75 feet above the vertical profile at or below 1 000 feet above aerodrome level.				
New	Appendix 7 - IR skill test. Content of test	SECTION 1 - PRE-FLIGHT	d) Identification of required navaids for departure, arrival and approach procedures h) PBN departure (if applicable): -Check correct procedure loaded in the navigation system; - Cross-check navigation system display and the departure chart. k) Instrument departure procedures, including PBN departures, and altimeter setting				
New		SECTION 3a - ARRIVAL PROCEDURES	a) Setting and checking of navigational aids b) Arrival procedures, altimeter checks c) Altitude and speed constraints d) PBN arrival (if applicable): - Check correct procedure loaded in the navigation system; - Cross-check navigation system display and the arrival chart.				
New		SECTION 4 - 3D OPERATIONS(++)	a) Setting and checking navigational aids. Check Vertical Path angle For RNP APCH: - Check correct procedure loaded in the navigation system; - Cross-check navigation system display and the approach chart.				

New		SECTION 5 - 2D OPERATIONS(++)	a) Setting and checking of navigational aids For RNP APCH: - Check correct procedure loaded in the navigation system; - Cross-check the navigation system display and the approach chart. f) Altitude/Distance to MAPT, speed, heading control (stabilised approach), Stop Down Fixes (SDF(s)), if applicable				
New		Notes (++)	<b>To establish or maintain PBN privileges one approach in either Section 4 or Section 5 shall be an RNP APCH. Where an RNP APCH is not practicable, it shall be performed in an appropriately equipped FSTD.</b>				
Mod.	Appendix 8 - Cross-crediting	Footnote to Table in Section A: Revalidating IR privileges: planes	<b>'Provided that within the preceding 12 months the applicant has flown at least three IFR departures and approaches exercising PBN privileges, including one RNP APCH approach ...'</b>				
Mod.	Appendix 8 - Cross-crediting	Footnote to Table in Section B: revalidating IR privileges: helicopters	<b>Provided that within the preceding 12 months at least three IFR departures and approaches exercising PBN privileges, including one RNP APCH approach (could be a Point in Space (PinS) approach), have been performed on a SP type of helicopter in SP operations</b>				
New	Appendix 9 - Training	Point 5 (Single-pilot) and 6 (Multi-pilot) of Section B	'(h/j) To establish or maintain PBN privileges one approach shall be an RNP APCH. Where an RNP APCH is not practicable, it shall be performed in an appropriately equipped FSTD.'				
Mod.	Appendix 9 - Training	point 5 (Single-pilot) of Section B	<ul style="list-style-type: none"> <li>3.B.5* "Non-Precision Approach" replaced by "2D operations"</li> <li>"P" = Trained as PIC or Co-pilot and as Pilot Flying (PF) and Pilot Not Flying (PNF) moved from FTD to FFS.</li> </ul>				
New	Appendix 9 - Training	<ul style="list-style-type: none"> <li>Point 6 (Multi-pilot) of Section B Row 3.9.3</li> <li>Point 12 of Section C (helicopter) row 5.4.2</li> </ul>	Note: "According to the AFM, RNP APCH procedures may require the use of autopilot or Flight director. The procedure to be flown manually shall be chosen taking into account such limitations (for example, choose an ILS for 3.9.3.1 in case of such AFM limitation)."				
Mod.	Appendix 9 - Training	<ul style="list-style-type: none"> <li>Point 6 (Multi-pilot) of Section B Row 3.9.3.4</li> <li>Point 12 of Section C row 5.4.4</li> </ul>	"outer marker (OM)" replaced by "1 000 feet above aerodrome level"				
Mod.	Appendix 9 - Training	Point 6 (Multi-pilot) of Section B Row 5.1	"also after an ILS approach with transition to visual flight" replaced by "on with visual reference established when" ... "DH" replaced by "DA/H following an instrument approach operation"				
Mod.	Appendix 9 - Training	Point 12 of Section C row 5.4.2	Manually, with or without Flight Director				
				Mod.	AMC2 ARA.FCL.300(b)	Examination procedures. Subject 062 table	<b>5 new PBN questions are added (062 07). The number of "Area Navigation Systems and RNAV or FMS" (062 05) questions is reduced by 5 to maintain the total number.</b>
<b>Annex VI - Part ARA</b>							
				Mod.	AMC5 ARA.FSTD.100(a)(1)	Initial evaluation procedure	<b>"FSTD EVALUATION REPORT FOR INITIAL AND RECURRENT EVALUATION" FORM replaces the line referred as "GPS" by three other lines: "RNP APCH LNAV", "RNP APCH LNAV/VNAV", "RNP APCH LPV" and "RNP AR APCH".</b>
<b>Annex VII - Part ORA</b>							
Mod.	ORA.ATO.135	Annex VII, point (a)	a) The ATO shall use an adequate fleet of training aircraft or FSTDs appropriately equipped for the training courses provided				

The main changes introduced to Air-Ops are:

- **SPAs are removed** for all PBN specifications except RNP 0.3 and RNP AR APCH. That includes not only RNP APCH but also RNAV 1, 2, 5 and 10 and RNP 1, 2 and 4;
- **PBN operational aspects** such as navigation database management, displays and monitoring, occurrence reporting, NOTAMs checking and missed approaches **are introduced to Parts CAT, NCC, NCO and SPO.**

The following table provide details on the specific articles or requirements that are introduced or modified in the existing Air-Ops regulation and the corresponding changes to EASA AMC and GM as well as a brief description of them.

Table 4– Introduced changes to Air Ops regulation and related EASA AMC & GM.

Changes introduced by CR (EU) 2016/1199				Modified AMC & GM by EASA Decision 2016/014-021/R			
Type	Item / Req.	Title	Summary	Type	Item / Req.	Title	Summary
<b>Annex I - Definitions</b>							
New	103a	RNP term introduced		New	GM1 Annex I	New definitions	Accuracy, ABAS, RNAV, Availability, Continuity of function, Integrity, Lateral navigation, RAIM, SBAS (EGNOS) and Vertical navigation
<b>Annex II - Part ARO</b>							
New	ARO.OPS.240	Specific approval of RNP AR APCH	Refers to RNP AR APCH from SPA.PBN.105	New	GM1 ARO.OPS.240	Specific approval of RNP AR APCH	TEMPORARY LIMITATION ON RVR
				New	GM2 ARO.OPS.240	Specific approval of RNP AR APCH	References to ICAO PBN Ops Approval Manual
Mod.	Appendix II	Air Ops Specs template	EASA Form 139 issue 1 replaced by issue 2. New wording: "Complex navigation specifications for PBN"	-			
Mod.	Appendix V	Note 6 to FORM 140: "PBN" replaces "RNP"	"Special Operations" form for "Non-commercial operations"	-			
<b>Annex III - Part ORO</b>							
				New	AMC2 ORO.GEN.160	Occurrence reporting	REPORTABLE EVENTS OF PBN OPERATIONS
				Mod.	AMC1 ORO.FC.230	Recurrent training and checking	<ul style="list-style-type: none"> <li>• "precision instrument approach" and "non-precision approach" replaced by "3D approach operation" and "2D approach operation"</li> <li>• New: "at least one of the 3D or 2D approach operations should be an RNP APCH or RNP AR APCH operation;"</li> </ul>
<b>Annexes IV - Part CAT, VI - Part NCC, VII - Part NCO and VIII - Part SPO</b>							
New	CAT.OP.MPA.126 NCC.OP.116 NCO.OP.116 SPO.OP.116	Performance-based navigation	Operator shall ensure that relevant PBN navigation specification is stated in the AFM and the aircraft is operated according to it.	New	<ul style="list-style-type: none"> <li>• AMC1 CAT.OP.MPA.126</li> <li>• AMC1 NCC.OP.116</li> <li>• AMC1 NCO.OP.116</li> <li>• AMC1 SPO.OP.116</li> </ul>	PBN OPERATIONS	For PBN operations not included in SPA, the operator should establish operating procedures (normal, abnormal, contingency, database management, MEL entries), specify flight crew qualification and training, ensure continued airworthiness.
				New	<ul style="list-style-type: none"> <li>• AMC2 CAT.OP.MPA.126</li> <li>• AMC2 NCC.OP.116</li> <li>• AMC2 NCO.OP.116</li> <li>• AMC2 SPO.OP.116</li> </ul>	MONITORING AND VERIFICATION	<ul style="list-style-type: none"> <li>• Pre-flight and general considerations</li> <li>• Departure</li> <li>• Arrival and approach</li> <li>• Altimetry settings (Baro VNAV)</li> <li>• Sensor and lateral navigation accuracy selection</li> </ul>
				New	<ul style="list-style-type: none"> <li>• AMC3 CAT.OP.MPA.126</li> <li>• AMC3 NCC.OP.116</li> <li>• AMC3 NCO.OP.116</li> <li>• AMC3 SPO.OP.117</li> </ul>	MANAGEMENT OF THE NAVIGATION DATABASE	flight crew should neither insert nor modify waypoints by manual entry into a procedure been retrieved from the database
				New	<ul style="list-style-type: none"> <li>• AMC4 CAT.OP.MPA.126</li> <li>• AMC4 NCC.OP.116</li> <li>• AMC4 NCO.OP.116</li> <li>• AMC4 SPO.OP.116</li> </ul>	DISPLAYS AND AUTOMATION	<ul style="list-style-type: none"> <li>• Use a lateral deviation indicator, FD or Autopilot in lateral navigation.</li> <li>• Monitor desired path, a/c position relative to lateral and vertical paths.</li> <li>• Suitable full-scale deflection</li> <li>• Keep deviations within 1/2 time RNAV/RNP value</li> <li>• Vertical deviation indicator, FD or Autopilot for 3D</li> <li>• Below vertical path deviation within 75ft</li> </ul>

Changes introduced by CR (EU) 2016/1199				Modified AMC & GM by EASA Decision 2016/014-021/R			
Type	Item / Req.	Title	Summary	Type	Item / Req.	Title	Summary
							or half scale deflection for angular
				New	<ul style="list-style-type: none"> <li>• AMC5 CAT.OP.MPA.126</li> <li>• AMC5 NCC.OP.116</li> <li>• AMC5 NCO.OP.116</li> <li>• AMC5 SPO.OP.116</li> </ul>	VECTORIZING AND POSITIONING	In complying with ATC instructions, the flight crew should be aware of the implications for the navigation system when executing radar headings, "direct-to", initial or intermediate fixes interceptions. Some of these operations have special conditions (see AMC for more details)
				New	<ul style="list-style-type: none"> <li>• AMC6 CAT.OP.MPA.126</li> <li>• AMC6 NCC.OP.116</li> <li>• AMC6 NCO.OP.116</li> <li>• AMC6 SPO.OP.116</li> </ul>	ALERTING AND ABORT	Discontinue RNP APCH if navigation system failure, excessive lateral/vertical deviation, loss of on-board monitoring and alerting. LNAV is acceptable if vertical guidance is lost with aircraft above 1,00ft AGL.
				New	<ul style="list-style-type: none"> <li>• AMC7 CAT.OP.MPA.126</li> <li>• AMC7 NCC.OP.116</li> <li>• AMC7 NCO.OP.116</li> <li>• AMC7 SPO.OP.116</li> </ul>	CONTINGENCY PROCEDURES	flight crew should make the necessary preparation to revert to a conventional arrival
				New	<ul style="list-style-type: none"> <li>• GM1 CAT.OP.MPA.126</li> <li>• GM1 NCC.OP.116</li> <li>• GM1 NCO.OP.116</li> <li>• GM1 SPO.OP.116</li> </ul>	DESCRIPTION	RNP X and RNAV X designations
Mod.	CAT.OP.MPA.135(a)(1) CAT.OP.MPA.175 (b)	<ul style="list-style-type: none"> <li>• Routes and areas of operation</li> <li>• Flight Preparation</li> </ul>	operator shall ensure that <u>space-based facilities</u> are adequate for the planned operation.	New	AMC1 CAT.OP.MPA.135	RNAV 10	N/A
New	CAT.OP.MPA.175(b)(7) NCC.GEN.106 NCO.GEN.105 SPO.GEN.107	Flight preparation	"any navigational database required for performance-based navigation is suitable and current"	New	<ul style="list-style-type: none"> <li>• AMC1 CAT.OP.MPA.175</li> <li>• AMC1 NCC.GEN.106</li> <li>• AMC1 NCO.GEN.105</li> <li>• AMC1 SPO.GEN.107</li> </ul>	FLIGHT PREPARATION FOR PBN OPERATIONS	<ul style="list-style-type: none"> <li>• RNP APCH procedures selectable from the navigation database and are not prohibited by NOTAM.</li> <li>• If RAIM is required for integrity, its availability should be verified during the pre-flight</li> </ul>
				New	<ul style="list-style-type: none"> <li>• AMC2 CAT.OP.MPA.175</li> <li>• AMC2 NCC.GEN.106</li> <li>• AMC2 NCO.GEN.105</li> <li>• AMC2 SPO.GEN.107</li> </ul>	DATABASE SUITABILITY	<ul style="list-style-type: none"> <li>• database required for PBN operations includes the routes and procedures required for the flight</li> <li>• database validity (current AIRAC cycle)</li> </ul>
Mod.	NCC.OP.145 NCO.OP.135 SPO.OP.140	Flight preparation	'(a) Before commencing a flight, the pilot-in-command shall ascertain that <u>space-based facilities ... (etc)..</u> are adequate for the type of operation under which the flight is to be conducted.'				
New	CAT.OP.MPA.182 NCC.OP.153 NCO.OP.142 SPO.OP.152	Destination aerodromes - instrument approach operations	sufficient means are available to navigate and land at the destination or at any alternate aerodrome in the case of loss of capability	New	<ul style="list-style-type: none"> <li>• AMC1 CAT.OP.MPA.182</li> <li>• AMC1 NCC.OP.153</li> <li>• AMC1 NCO.OP.142</li> <li>• AMC1 SPO.OP.152</li> </ul>	PBN OPERATIONS	The pilot-in-command should (" <u>may</u> " in <u>NCO</u> ) only select an aerodrome as a destination alternate aerodrome if an instrument approach procedure that does not rely on GNSS is available either at that aerodrome or at the destination aerodrome.
				New	<ul style="list-style-type: none"> <li>• GM1 CAT.OP.MPA.182</li> <li>• GM1 NCC.OP.153</li> <li>• GM1 SPO.OP.152</li> </ul>	INTENT OF AMC1	<p>(a) The limitation applies only to destination alternate aerodromes for flights when a destination alternate aerodrome is required. A take-off or en route alternate aerodrome with instrument approach procedures relying on GNSS may be planned without restrictions. A destination aerodrome with all instrument approach procedures relying solely on GNSS may be used without a destination alternate aerodrome if the conditions for a flight without a destination alternate aerodrome are met.</p> <p>(b) The term 'available' means that the procedure can be used in the planning stage and complies with planning minima requirements.</p>
New	CAT.IDE.A.345 CAT.IDE.H.345 NCC.IDE.A.250 NCC.IDE.H.250 NCO.IDE.A.195 NCO.IDE.H.195 SPO.IDE.A.220 SPO.IDE.H.220	Communication and navigation equipment for operations under IFR or under VFR over routes not navigated by reference to	For PBN operations the aircraft shall meet the airworthiness certification requirements for the appropriate navigation specification	New	<ul style="list-style-type: none"> <li>• GM2 CAT.IDE.A.345</li> <li>• GM2 CAT.IDE.H.345</li> <li>• GM1 NCC.IDE.A.250</li> <li>• GM1 NCC.IDE.H.250</li> <li>• GM1 NCO.IDE.A.195</li> <li>• GM1 NCO.IDE.H.195</li> <li>• GM1 SPO.IDE.A.220</li> <li>• GM1 SPO.IDE.H.220</li> </ul>	AIRCRAFT ELIGIBILITY FOR PBN SPECIFICATION NOT REQUIRING SPECIFIC APPROVAL	<p><b>Appropriate references in AFM or other applicable documents (FCOM, TC, STC, AMC, AC, etc).</b></p> <p><b>LPV: AMC 20-28; FAA AC 20-138 and FAA AC 90-107</b></p> <p><b>For aircraft that have a TAWS Class A installed and do not provide Mode-5 protection on an LPV approach, the DH is</b></p>



Changes introduced by CR (EU) 2016/1199				Modified AMC & GM by EASA Decision 2016/014-021/R			
Type	Item / Req.	Title	Summary	Type	Item / Req.	Title	Summary
		visual landmarks					limited to 250ft
				New	<ul style="list-style-type: none"> <li>• GM3 CAT.IDE.A.345</li> <li>• GM3 CAT.IDE.H.345</li> <li>• GM2 NCC.IDE.A.250</li> <li>• GM2 NCC.IDE.H.250</li> <li>• GM2 NCO.IDE.A.195</li> <li>• GM3 NCO.IDE.H.195</li> <li>• GM2 SPO.IDE.A.220</li> <li>• GM2 SPO.IDE.H.220</li> </ul>	GENERAL	Aircraft approved for one RNP or RNAV specification is not automatically approved for others.
Mod.	CAT.IDE.A.355 CAT.IDE.H.355 NCC.IDE.A.260 NCC.IDE.H.260 NCO.IDE.A.205 NCO.IDE.H.205 SPO.IDE.A.230 SPO.IDE.H.230	Management of aeronautical databases	Databases shall be adequate and meet quality requirements. Operator shall ensure timely distribution and report occurrences.				
<b>Annex V - Part SPA</b>							
Mod.	SPA.PBN.100	PBN operations	<b>SPA limited to RNP AR APCH and RNP 0.3. RNP AR APCH is not necessarily airport specific (see CR (EU) for more details)</b>	Mod.	GM1 SPA.PBN.100	PBN operations	GENERAL
Mod.	SPA.PBN.105	PBN operational approval	Airworthiness, training program, safety assessment, operating procedures (MEL, crew, database, normal, abnormal and contingency, reportable events	Mod.	<ul style="list-style-type: none"> <li>• AMC1 SPA.PBN.105(b)</li> <li>• AMC1 SPA.PBN.105(c)</li> <li>• GM1 SPA.PBN.105(c)</li> <li>• AMC1 SPA.PBN.105(d)</li> <li>• AMC2 SPA.PBN.105(d)</li> <li>• AMC3 SPA.PBN.105(d)</li> <li>• AMC1 SPA.PBN.105(e)</li> <li>• AMC1 SPA.PBN.105(f)</li> </ul>	PBN operational approval	<ul style="list-style-type: none"> <li>• FLIGHT CREW TRAINING AND QUALIFICATIONS — GENERAL PROVISIONS</li> <li>• FLIGHT OPERATIONAL SAFETY ASSESSMENT (FOSA)</li> <li>• FLIGHT OPERATIONAL SAFETY ASSESSMENT (FOSA)</li> <li>• OPERATIONAL CONSIDERATIONS FOR RNP AR APCH</li> <li>• FLIGHT CONSIDERATIONS</li> <li>• NAVIGATION DATABASE MANAGEMENT</li> <li>• REPORTABLE EVENTS</li> <li>• RNP MONITORING PROGRAMME</li> </ul>

## APPENDIX D REFERENCE DOCUMENTS AND ACRONYMS

### Appendix D.1 Reference documentation

- [RD-1] EASA Opinion 2016-10 “Performance-Based Navigation (PBN) implementation in the European Air Traffic Management Network (EATMN)”
- [RD-2] ICAO Annex 6, 10<sup>th</sup> edition published on 10<sup>th</sup> of November 2016.
- [RD-3] Performance-Based Navigation (PBN) Manual (Doc 9613). - 4th edition, 2013
- [RD-4] EASA AMC 20-28 - Airworthiness Approval and Operational Criteria for RNAV GNSS approach operation to LPV minima using SBAS
- [RD-5] FAA AC 20-138 Airworthiness Approval of Positioning and Navigation Systems
- [RD-6] FAA AC 90-107 Guidance for Localizer Performance with Vertical Guidance and Localizer Performance without Vertical Guidance Approach Operations in the U.S. National Airspace System
- [RD-7] ICAO PBN Operational Approval Manual, Doc 9997, 2013
- [RD-8] LPV Implementation Guidelines for Airports and Operators developed by ESSP on behalf of GSA, 31 July 2014
- [RD-9] Commission Regulation (EU) 2016/1199 of 22 July 2016 amending Regulation (EU) No 965/2012 as regards operational approval of performance-based navigation, certification and oversight of data services providers and helicopter offshore operations, and correcting that Regulation
- [RD-10] EASA Decision 2016/014-021/R Revision of operational approval criteria for performance-based navigation — Air operations
- [RD-11] Commission Regulation (EU) 2016/539 of 6 April 2016 amending Regulation (EU) No 1178/2011 as regards pilot training, testing and periodic checking for performance-based navigation
- [RD-12] EASA Decision 2016/008/R amending the AMC & GM to Part-FCL and Part-ARA of Commission Regulation (EU) No 1178/2011, as amended, and the AMC & GM to Part-ORO and Part-ARO of Commission Regulation (EU) No 965/2012, as amended
- [RD-13] EASA NPA 2013-25 Revision of operational approval criteria for performance-based navigation
- [RD-14] EASA Opinion 3/2015 Revision of operational approval criteria for Performance-Based Navigation (PBN)
- [RD-15] Commission Regulations (EU) No. 1178/2011 (Part FCL)
- [RD-16] Commission Regulations (EU) No. 290/2012 (Part ARA and ORA)
- [RD-17] Commission Regulations (EU) No. 965/2012 (AIR-OPS)
- [RD-18] Commission Regulations (EU) No. 800/2013 (Parts NCC and NCO)
- [RD-19] Commission Regulation (EU) No 245/2014 (Part SPO)

## Appendix D.2 Acronyms

Acronym	Description	Acronym	Description
AGL	Above Ground Level	CRC	Cyclic Redundancy Check
AMC	Acceptable Means of Compliance	DA(H)	Decision Altitude/Height
AC	Advisory Circular	DOA	Design Organisations Approvals
AIRAC	Aeronautical Information Regulation And Control	DF	Direct to Fix
ARINC	Aeronautical Radio Inc.	EWA	EGNOS Working Agreement
AMM	Aircraft Maintenance Manual	EIR	En-route Instrument Rating
ANSP	Air Navigation Service Provider	EATMN	European Air Traffic Management Network
AIR-OPS	Air Operations	EASA	European Aviation Safety Agency
AOC	Air Operator Certificate	ECAC	European Civil Aviation Conference
ATC	Air Traffic Control	EC	European Commission
ATS	Air Traffic Service	EGNOS	European Geostationary Navigation Overlay Service
ATSP	Air Traffic Service Providers	GSA	European GNSS Agency
AFM	Aircraft Flight Manual	ESSP	European Satellite Services Provider S.A.S.
AOM	Aircraft Operations Manual	ETSOs	European Technical Standard Orders
ATPL	Airline Transport Pilot License	EU	European Union
AML	Applicable Model List	FAA	Federal Aviation Administration
APCH	Approach	FATO	Final Approach and Take Off
APV	Approach with Vertical guidance	FAF	Final Approach Fix
ATOs	Approved Training Organisations	FAS	Final Approach Segment
RNAV	Area Navigation	FA	Fix to Altitude
ORA	Authorities and Organizations Approvals	FRT	Fixed Radius Transition
ARO	Authority Requirements for Air Operations	FNPT	Flight and Navigation Procedures Trainer
ARA	Authority Requirements for Aircrew	FCL	Flight Crew License
CS	Certification Specification	FCOM	Flight Crew Operating Manual
CS-ACNS	Certification Specification - Airborne Communication, Navigation and Surveillance	FD	Flight Display
CS-FSTD (A) (H)	Certification Specifications for Flight Simulation Training Devices (Aircraft/Helicopter)	FG	Flight Guidance
CRD	Comments Review Document	FMS	Flight Management System
CAT	Commercial Air Transport Operations	FSTD	Flight Simulation Training Device
CPL	Commercial Pilot Licence	FTE	Flight Technical Error
CR	Commission Regulation	FFS	Full Flight Simulator
CNS	Communication Navigation and Surveillance	GLS	GBAS Landing System
CDO	Continuous Descent Operations	GA	General Aviation
CDU	Control/Display Unit	GNSS	Global Navigation Satellite System
CFIT	Controlled Flight Into Terrain	GPS	Global Positioning System
CBA	Cost Benefit Analysis	GM	Guidance Material
CDI	Course Deviation Indicator	HAL	Horizontal Alert Limit
CA	Course to Altitude	INS	Inertial Navigation Systems
CF	Course to Fix	IRU	Inertial Reference Units
		IAF	Initial Approach Fix
		IAP	Instrument Approach Procedure
		IFR	Instrument Flight Rules

<b>Acronym</b>	<b>Description</b>	<b>Acronym</b>	<b>Description</b>
ILS	Instrument Landing System	PPL	Private Pilot License
IR	Instrument Rating	PANS OPS	Procedures for Air Navigation Services – Aircraft Operations
IF	Intermediate Fix	RTCA	Radio Technical Commission for Aeronautics
ICAO	International Civil Aviation Organization	RTF	Radiotelephony
IRS	Inertial Reference System	RF	Radios to Fix
LNAV	Lateral Navigation	RAIM	Receiver Autonomous Integrity Monitoring
LO	Learning Objective	RVSM	Reduced Vertical Separation Minima
LOA	Letter Of Authorization	RIA	Regulatory Impact Assessment
LP	Localiser Performance	RNP	Required Navigation Performance
LPV	Localiser Performance with Vertical guidance	RMT	Rule Making Tasks
LRNS	Long-Range Navigation Systems	RWY	Runway
LOI	Loss Of Integrity	RVR	Runway Visual Range
MMEL	Master Minimum Equipment List	SoL	Safety of Life
MLS	Microwave Landing System	SBAS	Satellite Based Augmentation System
MEL	Minimum Equipment List	SB	Service Bulletin
MAPt	Missed Approach Point	SDD	Service Definition Document
MCC	Multi Crew Cooperation	SES	Single European Sky
NSA	National Supervisory Authority	SPO	Specialised Operations
NAVAID	Navigation Aid	SPA	Specific Approval
NPA	Non Precision Approach	STAR	Standard Instrument Arrival
NCC	Non-Commercial Operations with Complex Motor-Powered Aircraft	SID	Standard Instrument Departure
NCO	Non-Commercial Operations with Other-Than-Complex Motor-Powered Aircraft	SOPs	Standard Operating Procedures
NDB	Non-Directional Beacon	SDF	Stop Down Fixes
NPA	Notice of Proposed Amendment	STC	Supplemental Type Certificate
NOTAMs	Notice To Airmen	TGL	Temporary Guidance Leaflet
OCA(H)	Obstacle Clearance Altitude (Height)	ToR	Terms of Reference
OM	Operations Manual	TAWS	Terrain Awareness and Warning System
ORO	Organisation Requirements for Air Operations	TK	Theoretical Knowledge
OEM	Original Equipment Manufacturer	TF	Track to Fix
OM	Outer Marker	TC	Type certificate
PBN	Performance Based Navigation	US	United States
PIC	Pilot In Command	VTF	Vector To Final
PNF	Pilot Not Flying	VAL	Vertical Alert Limit
PTO	Pilot Training Organisation	VNAV	Vertical Navigation
POH	Pilot's Operating Handbook	VOR	VHF Omnidirectional Range
PinS	Point in Space	VFR	Visual Flight Rules
PoC	Point of Contact	VMC	Visual Meteorological Conditions
PS	Practical Skills	WAAS	Wide Area Augmentation System