European Union Aviation Safety Agency

Comment-Response Document 2018-02

Appendix

to ED Decision 2019/011/R

RELATED NPA 2018-02 — RMT.0519— 26.4.2019
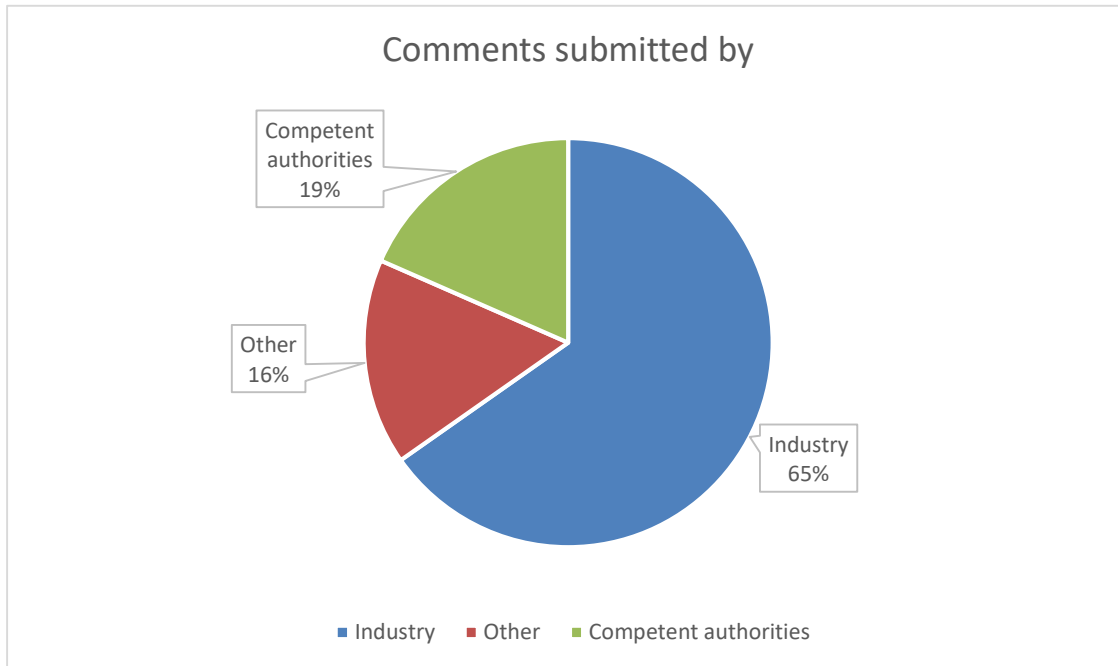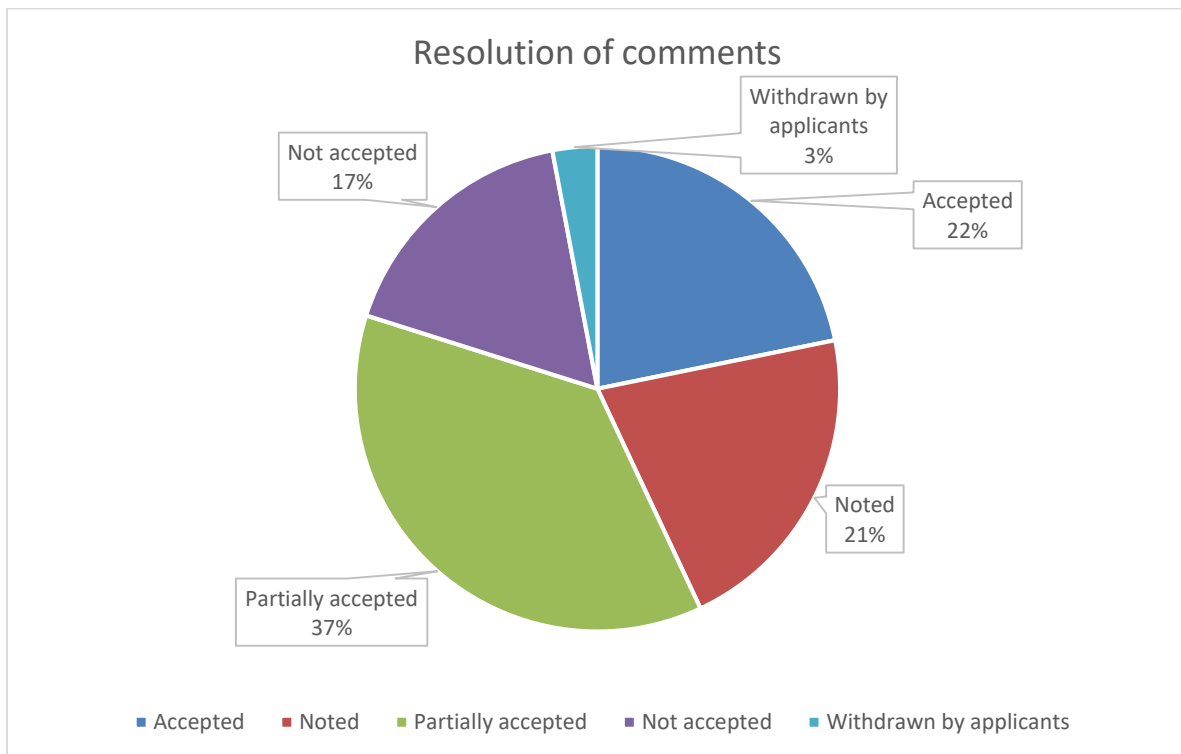
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1. Summary of the outcome of the consultation

The consultation phase started with the publication of the Notice of Proposed Ammendment (NPA) on 22 February 2018 and finished on 31 May 2018, after an extension of approximately one month, upon request of some interested stakeholders. During the aforementioned period, 537 comments were electronically submitted by the interested parties and recorded in EASA Comment-Response Tool (CRT).

Resolution of comments

Withdrawn by applicants
3%

Not accepted
17%

Accepted
22%

Noted
21%

Partially accepted
37%

■ Accepted   ■ Noted   ■ Partially accepted   ■ Not accepted   ■ Withdrawn by applicants

Please refer to Section 2.4 of the Explanatory Note to find out about the main concerns expressed in the comments and how these were addressed by EASA.

2.   Individual comments (and responses)

In responding to comments, a standard terminology has been applied to attest EASA's position. This terminology is as follows:

(a)   **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.

(b)   **Partially accepted** — EASA either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.

(c)   **Noted** — EASA acknowledges the comment but no change to the existing text is considered necessary.

(d)   **Not accepted** — The comment or proposed amendment is not shared by EASA.

CRD table of comments, responses and resulting text

(General Comments)	-

comment	2	comment by: *British Airways Flight Operations*

British Airways is not, self-evidently, an entity which is involved in the certification of aircraft. Nevertheless, as an end user for which PBN forms a core part of the airline's operational capability, we feel able to register a general comment as an interested party.

British Airways Flight Operations supports the rationale behind this NPA, and agrees with the Agency's assessment that there do not appear to be any drawbacks to it.

response	Noted.

Noted.
EASA appreciates the support expressed by British Airways and the fact that no apparent drawbacks have been identified by the aircraft operator.

comment	6	comment by: *Luftfahrt-Bundesamt*

General Comments applicable to the entire document: Example: CS.ACNS.C.PBN.205	It is appreciated to present the AMC/GM directly below the CS. Do we then really need to additionally give a reference to the AMC/GM in the CS itself? For consistency the already existing parts of CS-ACNS should be reorganized in the same manner. The style in which requirements are written looks more like a description than a requirement. That is un-usual and could cause misunderstandings. For example the text *"All equipment contributing to the area navigation function is approved."* should be replaced by *"All equipment contributing to the area navigation function **shall be** approved."*

		It should be noted somewhere that later revisions of ETSOs or EUROCAE/RTCA/SAE standards are also acceptable.

response	Partially accepted.

It should be noted that Book 1 and Book 2 have been combined (compact format) to facilitate the reading of the proposed amendments during the consultation phase, particularly, the analysis of Subpart C. However, when published, the final text separates the certification specifications (CSs) from their corresponding acceptable means of compliance and guidance material, as in the style of the CSs. (Though, this might change in the near future).

As regards the drafting style, please bear in mind that this material, including the CSs, is considered not binding, so the wording cannot resort to terms that denote a mandate, e.g. 'shall'. Hence, the use of present tense, like in the example provided, is preferred.

Finally, it is acknowledged that the text needs to clarify that the ETSO version indicated represents the "minimum requirements" and that any subsequent version of the ETSO identified will also be recognised.

comment	*30* comment by: *Dassault-Aviation*

Dassault-Aviation

Associated CS:
CS ACNS.C.PBN.2145, 2150, 330, 565, 660, 665, 675, 680.

The meaning of terms or their use in the frame of integrity or continuity CS should be clarified (glossary or reference ?). In particular:

- erroneous data (versus incorrect data and misleading data)
- loss of capability (does thi sinclude the loss of integrity?)

response	Not accepted.

It should be noted that the definitions of integrity (system integrity) and continuity (system continuity) were introduced with the initial issue of CS-ACNS and the text of the current amendment is consistent with those definitions. This issue 2 of CS-ACNS also adds a definition of continuity of a function.

This amendment does not consider terms like 'incorrect' or 'misleading', which are commonly associated with integrity requirements. 'Erroneous' is used in the context of integrity requirements, while the notion of 'loss of capability' is employed when addressing continuity issues. Loss of integrity can lead to total of partial loss of data, but these integrity failures are by definition undetected, so loss of capability, meaning unscheduled interruption, is not associated with a loss of integrity.

comment	*78* comment by: *European Helicopter Association (EHA)*

The NPA intent and the proposal to incorporate all the PBN specification requirements in a single certification specification is positive, however for a very

peculiar nav spec such as RNP AR it could be better to maintain\update (e.g AMC 20-26)\develop a specific regulation covering both airworthiness and operational aspects.

It should be noted that, even if out of the scope of this NPA, there is the strong need to remove the SPA for RNP 0.3 all phases of flight operations. The RNP 0.3 nav spec requirements must be considered enough mature and the current obligation for an additional administrative process to obtain a specific approval (SPA) to fly helicopter specific applications based on RNP 0.3 may impair the achievement of the potential benefits related to the use of RNP 0.3.

response	Noted.
	The decision to separate the operational approval requirements form the certification requirements was taken in 2016 and it materialised with the publication of a number of ED Decisions that transposed all PBN operational approval requirements from the AMC-20 material into the AMC/GM to Regulation (EU) No 965/2012. Hence, AMC 20-26 will be cancelled after the relevant airworthiness requirements has also been transposed into CS-ACNS.
	As regards the specific approval to fly RNP 0.3 applications, it should be noted that helicopters may suffer from operational constraints that are expected to be very different from aeroplane constraints due to helicopter capabilities, flight manual limitations and route design. Hence, the way forward may consider the provision of additional operational guidance in support of RNP 0.3 operations, which is beyond the scope of NPA 2018-02.

comment	*100* comment by: *Transport Canada Civil Aviation Standards Branch*
	The document seems to recommend certain ETSO boxes for compliance to certain requirements - often with separate TSOs recommended / noted for compliance to different aspects of the same Nav Spec. That doesn't help to determine which Standalone GPS ETSO Class box (146) or FMS integrated GPS box (C115d) can be used to meet the entire Nav spec. Suggest quote ETSO-146 and ETSO-115d (and the appropriate class) if they will both do. Comments are provided on those areas that are affected, to help with your assessment of this point - but they all relate to this general comment.

response	Noted.
	The reference to a particular ETSO is made only when the EASA has assured that the ETSO authorisation covers the particular requirement. It does not imply that all the criteria of a particular subsection are met. Please see the responses to other comments made with regard to the suitability of certain ETSOs to meet certain requirements. In all cases, the ETSOs referred to represent the minimum standard.

comment	*101* comment by: *Transport Canada Civil Aviation Standards Branch*
	The document seems to assume that everyone will purchase boxes to the latest ETSO C115d or ETSO 146c; - aside from pages 22/23 there is little mention of legacy TSO versions and associated combinations with ETSO C145 for example - or Supplemental Nav GPS ETSO C196 or the legacy TSO C129. Those systems are still in production/for sale and presumably can be used by new applicants, including those seeking to expand Nav Spec capability/cert with their legacy systems. Which guidance should

be used when certifying Nav Spec ops using those systems? Perhaps provide a matrix to legacy advice if the older AMCs address the older boxes and will remain available.

response	Noted.
	Although technically, the older equipment could still support PBN operations, EASA considers the CS-ACNS as a forward looking document. For this reason, the minimum requirements have been raised to the level that is most common today.
	It should also be noted that the publication of CS-ACNS does not invalidate existing approvals and credit will be given to recognise those in cases where an applicant applies for a change to an existing approval.

comment	*102*	comment by: *Transport Canada Civil Aviation Standards Branch*
	Here are no references to legacy TSO C129 or the more recent TSO C196 supplemental GNSS systems . Or legacy TSO C115c and TSO 145 combinations. Is there a separate doc that covers those?	

response	Noted.
	Please see the response to comment 101.

comment	*239*	comment by: *AIRBUS*
	PARAGRAPH / SECTION THE COMMENT IS RELATED TO:	
	General	
	PROPOSED TEXT / COMMENT:	
	'Many AMCs only refer to ETSOs as unique acceptable means of compliance. AMCs have to cover applications not using ETSOs in order to allow other solutions/architectures complying with the CS requieremets. AMCs should also support the analysis of potential non compliances to ETSO.	
	It is proposed that those AMCs first refer to the the relevant paragraph(s) of the ED 75D as acceptable mean of compliance and precise that ETSO(s) CXXX comply(ies) with this(those) paragraph(s).	
	This is a general remark that applies to many AMC and/or GM. In some cases this remark is reiterrated on some AMC/GM (but this reiterration is not systematic).	

response	Partially accepted.
	In many cases, the proposed AMCs encourage stakeholders to install ETSO-authorised equipment, thus providing a presumption of compliance with the ED-75D requirements. It is true that part of these AMCs only provide references to ETSOs as valid means of compliance because this may simplify and facilitate demonstration of compliance, especially for those applicants that are less familiar with the MASPS (ED-75D).
	EASA recognises, however, that not all applicants install ETSO authorised products and has added references to ED-75D where appropriate.

comment	*240*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

General

PROPOSED TEXT / COMMENT:

Could EASA precised in each concerned AMC or though an other mean that : "ETSO CXXXx or any subsequent version".

RATIONALE / REASON / JUSTIFICATION:

In the AMCs ETSO versions are specified. It is undertood that those versions are related to the minimum versions recognised.

response	Accepted.
	It is acknowledged that the text needs to clarify that the ETSO version indicated represents the 'minimum requirements' and that any subsequent version of the ETSO identified will also be recognised.

comment	*251*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

general

PROPOSED TEXT / COMMENT:

It is proposed to replace in the concerned AMCs
"authorisation against ETSO-CXXXx"
by " compliance with ETSO-C1XXXx"

RATIONALE / REASON / JUSTIFICATION:

Several AMCs (such as AMC1 ACNS.C.PBN.205) call for an ETSO autorisation. As per 21.A.303, ETSO autorisation are not mandatory; the compliance with the technical requirements in an ETSO can be managed directly at aircraft level.

response	Not accepted.
	The references to ETSO authorisations greatly reduce the effort to demonstrate compliance with CS-ACNS criteria for most applicants. ETSO authorisation is optional, so applicants will be allowed to choose between the installation of ETSO equipment or, alternatively, demonstration of compliance with the applicable requirements, which are primary based on ED-75D. In this regard, references to ED-75D have been added, where appropriate, in support of those applicants who do not install ETSO equipment.

comment	*252*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

general

PROPOSED TEXT / COMMENT:

It is proposed to write in each concerned AMC "ETSO CXXX or equivalent standard".

RATIONALE / REASON / JUSTIFICATION:
Several AMCs call for an ETSOs. Sometimes industrial standards (typically MOPS) may also be used.
Could EASA clarify each time an ETSO is mentionned that an "equivalent standard" may also be used.

response	Not accepted. It should be noted that the wording proposed is ambiguous as the AMCs need to clearly specify what MOPS could be used. Therefore, EASA does not agree that an ETSO should recognise other equivalent standards than those specified in CS-ETSO. The use of equipment that has been authorised against an ETSO is, however, not a requirement, so applicants can contact EASA to propose what standards wish to use on a case by case basis for the purpose of demonstrating compliance with the CSs.

comment	*282*	comment by: *THALES AVIONICS*

THALES support the objective to simplify the various RNAV /RNP operations material by gathering the airworthiness information in one single document. Moreover Thales also support the addition of RNP operations (RNP 4, RNP 2, Advanced RNP, RNP 0,3, RNP APCH down to LP minima) that were not previously covered by EASA material.

Nevertheless the resulting NPA2018-02 introduces more stringent certification materials without any rationale compared to the current EASA and FAA materials. Moreover the lack of traceability with existing materials in the NPA induces difficulties for industry to perform an exhaustive and accurate comparison.

THALES, amid numerous comments detailed in CRT, would like to express its top major concerns in this synthesis general comment:

. Criticality of several failure conditions has been increased without any safety rationale. It results with significant differences with current EASA material and current FAA AC20-138D change 2. It would imply a significant change of the current developed solutions to meet the prescriptive material, moreover it would be detrimental to innovation, and it would create a non-level playing field with FAA. (e.g. see comments on Table 9 of CS565 and on Table 12 of CS675)

. A Certification specification for automatic cold temperature compensation has been introduced, which is not included in the FAA AC20-138D change 2 material.

Consequently THALES strongly request to not introduce more stringent certification material without any safety rationale and to achieve a full harmonization with equivalent FAA certification material.

response	Partially accepted. With regard to the failure classifications, please see the response to comment 43.

With regard to automatic temperature compensation, please see the response to comment 413.

comment	*289* comment by: *Europe Air Sports*

Europe Air Sports (EAS) and the organisations' member federations and unions thank the Agency for the preparation of this NPA.

Having reviewed the NPA, we have the following comments/questions:

GENERAL COMMENTS

EAS basically supports the purpose of this NPA.
The objectives of the NPA are shared by our organisation, namely

- the update of CS-ACNS ;
- the relationship established between the various PBN specifications ;
- the setting-up of a subpart C « NAV » within ED Decision 2013/031 ;
- the rationalisation of existing texts, including cancellation of some AMC-20s.

Nevertheless, EAS has some concerns about :

- the alignement with ICAO provisions about ADS-B and subsequent FAA criteria to allow global interoperability and global market and

the mandatory PBN functionalities.

response	Noted.
Although the comment is very much appreciated, the proposed amendment to CS-ACNS is not addressing changes to the existing ADS-B requirements nor is it about the mandatory use of PBN navigation specifications and functionalities within particular airspace, but about qualification of aircraft for its use, where required.

comment	*294* comment by: *Europe Air Sports*

NOTE: This comment proposes to create a new paragraph or to modify an existing one in the subpart D of the CS ACNS which is not modified by this NPA.

Subpart D – Surveillance (SUR)
Section 4 – 1090 Extended Squitter ADS-B Out
Paragraph AMC1 ACNS.D.ADSB.025(c)

Add a provision in this paragraph ensuring the alignment with US industry standards in terms of the performance criteria for aircraft positioning : the FAA prescribes that the aircraft position broadcast by ADS-B transmitter is determined by GPS with WAAS while the EU prescribes that it is determined by GPS only.

Please refer to the Final Report on the revision of the SPI Regulation (RMT.0679 – December 2017 – Pages 15 & 16)
In EU, this level of performance in terms of NIC/NAC availability is at our reach with EGNOS.

The advantages that can be expected are the following :

- harmonisation of ADS-B related industry standards between USA and EU ;
- applicability by ANSPs of the separation and spacing minimums prescribed by ICAO in a ADS-B environment ;
- potential replacement of a SSR layer by an ADS-B layer ;

deployment of ADS-B-stand alone coverages.

response	Not accepted.

response

Not accepted.
It should be noted that EU, and in particular Subpart D of CS-ACNS (SUR), does not preclude the use of SBAS to enhance and broadcast (ADS-B) the aircraft position.
As regards the report on the revision of the SPI Regulation, the use of SBAS for the purpose of improving the level of integrity (NIC) and accuracy (NAC) of the position determined on-board the aircraft is presented as a valid option, among others, though noting that the low percentage of aircraft currently equipped would limit the benefits that could be achieved in the short term.
Please refer to the response given to comment 289 with regard to the scope of the changes presented in NPA 2018-02.

comment   *378*   comment by: *EUROCONTROL*

The EUROCONTROL Agency welcomes the publication by EASA of a Notice of Proposed Amendment concerning the 'Provision of airworthiness requirements in support of global performance-based navigation operations', namely NPA 2018-02. It also thanks EASA for the opportunity that has been given to submit comments.

Around 95 comments have been submitted. The way they have been developed varies with NPA content complexity, viz. they are presented straightforwardly sometimes , or under the form of questions, suggestions and even recommendations. This way has been seen as a means to help the EUROCONTROL Agency to undertake a more precise and insightful analysis of its contributions and feedback given when CRD is received.

The EUROCONTROL Agency would like to confirm that it will read with interest the comments on the NPA received from stakeholders and the responses given to them by EASA in its future comment-response document (CRD). Like for NPA 2018-02, EUROCONTROL staff will be given access to CRD 2018-02. It is hoped that CRD 2018-02 will be available before the ED Decision amending CS-ACNS and the related AMC-20 material is communicated.

Still from the general perspective, though at a different level, the EUROCONTROL Agency would like to draw the attention to the fact that the PBN manual always refers to 'Advanced RNP (A-RNP)'. It is believed that this formulation should replace any other formulation such as 'advanced RNP'.

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response	Noted. It should be noted that the comment-response document (CRD) is to be published as an Appendix to the Explanatory Note that is going to be published together with the ED Decision amending CS-ACNS and the AMC-20 related material. As regards which is the right wording for A-RNP, the PBN Manual writes 'Advanced RNP' in upper case letters when the term 'Advanced' is included in titles of documents or Chapters of the Manual. It should be noted that the headers of the Manual for Part C - Implementing RNP Operations - Chapter 4 (Volume II) read 'Implementing advanced RNP (A-RNP)'. Therefore, it is not obvious what the right formulation is.

comment	*387* comment by: *AIRBUS*
	PARAGRAPH / SECTION THE COMMENT IS RELATED TO: General **PROPOSED TEXT / COMMENT:** Could EASA precised in each concerned AMC or though an other mean that ETSO C196a can be used in place of ETSO C145c or C146c, except for approaches down to LPV minima. **RATIONALE / REASON / JUSTIFICATION:** 'It is proposed to precise that ETSO C196a is regonised for PBN operations except for approaches down to LPV minima that require the SBAS (ETSO-C145c or ETSO-C146c). Only AMC1 ACNS.C.PBN.205 regognises ETSO-C196a. In the rest of the document, only TSO C145 or C146 are regognised.
response	Accepted. Please see the response to comment 390.

comment	*429* comment by: *THALES AVIONICS*
	Thales support to propose ETSOs as an AMC. But Thales identifies several concerns associated to the way it is presented in the NPA: 1/ The ETSO authorization is called in the various AMC to CS without detailing the requirements of the MOPS that satisfies the CS. Thus it will be difficult to make the link between deviations or incomplete ETSO authorization versus each specific CS; and it does not offer the possibility to address the specific MOPS without having an ETSO authorization 2/ ETSO reference are not always at the latest issue. 3/ for display requirements, TSO C209 is not considered 4/ the wording 'largely satisfied' used for some ETSO in AMC is not very clear 5/ For ETSO C115d the class that satisfies the CS is not mentioned.

Thales proposal:

1/ Where an ETSO authorization is mentioned as an AMC, to detail the section of the MOPS that satisfies the CS

2/ To have a general statement that when an ETSO is referenced in an AMC, the current issue and following ones satisfy the CS.

3/ To consider TSO C209 for display requirements.

4/ To remove the wording 'largely satisfies', to replace by 'satisfy in combination with …'

5/ To add a general statement that when the class is not mentioned, class A and class B of ETSO C115d satisfy the CS.

response	Partially accepted

Partially accepted
1/ EASA acknowledges that not all applicants install ETSO authorised products and has added references to ED-75D where appropriate.
2/ & 5/ The text will clarify that the ETSO version indicated represents the 'minimum requirements' and that any subsequent version of the ETSO identified will also be recognised.
3/ ETSO-C209 will not be referenced at this time, but will be considered for the next revision. At this moment we are not aware of applications for approval of systems against this standard in our system.
4/ The text will be revised to improve clarity.

comment	*484*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

General

PROPOSED TEXT / COMMENT:

The delay for the review was very short and despite the working sessions between EASA and ASD some major points still need to be clarified and understood.
The review would have benefit from additionnal working sessions to ensure a good understanding of the CS ACNS and a good maturity of its content. The absence of traceability matrix with current AMCs made the review complex and some major points may have been missed.
Several major concerns and comments need further discussions involving certification pilots (from both EASA and industry) before the release of the the final text.

response	Noted.

Noted.
EASA appreciates the huge input given by the industry and, in particular, Airbus during the consultation. The revision of CS-ACNS has focussed on the points of concern and involved pilots in the resolution of the comments submitted, as necessary.

comment	*487*	comment by: *Danish Aviation Association*

Danish Aviation Association (DAA) appreciates the possibility to comment on this NPA.

DAA notes the analysis mentioned in the Impact Assessment and the prefered option no. 1.

DAA has got no specific comments to this NPA.

response	Noted.

EASA appreciates the time dedicated by DAA to review NPA 2018-02.

comment	*537*	comment by: *Airbus Helicopters*

Attachment #1

Alain DUCOLLET
Guidance Navigation ETGGN
Airbus Helicopters

1 – Section 2.1 (page 4)
Comment: CS-AS 002 is 02 is used for cerfication as a certification basis, when the SBAS is used to replace the baro altitude

Suggested resolution: CS-AM 002 to be added at the same level as AMCs

2 – Section 2.3.6 (page 10)

Comment: RNP-AR name should be RNP-AR APCH to comply with PBN spec naming

Suggested resolution: renaming

3 – Section 1 (page 17)

Comment: A PBN compliance list should include the RNP value but also the navigation source as well as some functional capabilities. This is required to allow filtering out of some procedures for which the avionics is not certified. RF leg capability and PBN spec cannot be considered at the same level

Suggested resolution: rephrasing

4 – Section 1 (page 19)

Comment: table 1 is redundant with the one of page 10

Suggested resolution: redundancy should be avoided

5 - CS.ACNS.C.PBN.205 (page 22)

Comment: the wording 'equipment contributing to area navigation' can be misleading : does it means FMS + positioning source, or does it include also radio

navigation equipment which may be required also for area navigation (missed approach, alternate destination approach...)?

Suggested resolution: area navigation equipment definition to be provided

6 – AMC1.ACNS.C.PBN.205 (page 22)

Comment: equipment with a former TSO as TSO C129 GPS could be used during a certification process where compliance to CS-ACSN is claimed. The way to consider such equipment with there limitation is no more covered by the updated CS-ACNS

Suggested resolution: status to be clarified

7 – GM2.ACNS.C.PBN.205 (page 23)

Comment: 'additional navigation systems' could be required : additional equipment may be driven by national authorities AIP, other OPS requirements on alternate destination, missed approach and so on, but sometimes was also defined in AMC : e.g for RNAV5 carriage of conventional navigation source was required. Is there any source which can be used to defin this 'additional equipment carriage'?

Suggested resolution: 'after 'could be required', could be added 'either as defined by a given airspace, or due to operational requirement to perform PBN operation (e.g conventional means required for RNAV operation, conventional approach required for alternate destination..)'

8 – CS.ACNS.C.PBN.210 (page 23)

Comment: 'primary source' : there is a lot of confusion on the meaning of 'primary source' and the other definition as 'supplemental' source and 'supplemental source' . Reminding the definition of primary source would avoid confusion. For GNSS, acceptable conditions (TSO C129, TSO C145, or TSO C145 and SBAS available)

Suggested resolution: add the meaning of primary source

9 – AMC1.ACNS.C.PBN.230 (page 25)

Comment: 'waypoint details' is vague and associated data should be provided

Suggested resolution: to add example of data for 'waypoint details'

10 – AMC1.ACNS.C.PBN.280 (page 30)

Comment: 'comparable to RNP' : should not be applicable to LPV approaches using angular deviation, as the obtained cross track error varies with the distance to the landing point

Suggested resolution:

11 – CS.ACNS.C.PBN.2110 (page 31)

Comment: what is the rational to display the GNSS constellation? If there is no associated action, the display is useless. Requirement to be finalized when multiconstellation capability is available

Suggested resolution: remove the requirement

12 – AMC1.ACNS.C.PBN.2140 (page 36)

Comment: The FTE value compared to RNP is unchanged compared to AMC and AC. Nevertheless if FTE monitoring is to not exceed one dot, meaning for RNP0.3 , 0.15NM, with an error budget of 0,25NM, the 0.15NM are exceeded.

Suggested resolution: clarification expected

13 – Subsection 2

Comment: AC20-138D requires SBAS for RNP0.3 helicopters. There is no such requirement in the CS-ACNS : does it means that the new certification baseline authorizes to claim RNP0.3 en route and terminal with a GNSS w/o SBAS? Does it mean that it will possible to update the previous certification status of aircraft which are certified assuming SBAS?

Suggested resolution: confirmation to be provided
14 – AMC1.ACNS.C.PBN.320 (page 39)

Comment: the full scale deviation has been changed from 1 RNP to 2 RNP. This may impact training for TSE monitoring between aircraft with the 1 RNP design and the one with 2 RNP design. What are the reasons of this change?

Suggested resolution: clarification expected

15 – AMC1.ACNS.C.PBN.320 (page 39)

Comment: the use of angular deviation may induce depending on the FAS lenght that the linear distance at the FAF and before the FAF exceeds the 0.3NM. So in case of RNP0.3 helicopter, the FSD may exceed the RNP value.

Suggested resolution: the sentence (b) (2) is thus not always correct.

16 – GM1.ACNS.C.PBN.420 (page 42)

Comment: on dual pilot aircraft, it is possible to enter a different altimeter setting on both sides. Does this design violate the requirement?

Suggested resolution: requirement to be updated to take into account the design required for dual pilot operation

17 – GM1.ACNS.C.PBN.501 (page 47)

Comment: this subsection being applicable also to 'RNP AR', does it mean that the GNSS altitude based on SBAS can be used for RNP-AR, with straight or curved segment?

Suggested resolution: to add 'LNAV/VNAV minima, RNP-AR minima…'

18 – CS.ACNS.C.PBN.525 (page 48)

Comment: temperature compensation if a must, seems not consistent with approach charts which defines a minimal temperature of use, allowing not to compensate, down to this temperature.

Suggested resolution:

19 – CS.ACNS.C.PBN.530 (page 49)

Comment: what is the possible design in front of 'display the defined vertical path' : there is no VSD on many avionics. If the need remains to display a vertical deviation, sentence should be updated

Suggested resolution: change by 'display vertical deviation from the vertical path'

20 – AMC1.ACNS.C.PBN.535 (page 50)

Comment: 'the pointer still touches a marker' : how to interpret such a requirement?

Suggested resolution: add an example

21 – AMC1.ACNS.C.PBN.535 (page 50)

Comment: 'limit the lenght of the approach' : the approach may be defined within the criteria of ICAO DOC 8168, and with the current defined criteria, with angular deviation, unless saturation is implemented, it is not always possible to not exceed the expected RNP before the FAF.

Suggested resolution: either the lengh limit become a requirement implemented in construction design criteria, or an indication that whatever the leg lenght, in case of FTE exceeding the criteria of the RNP value at FAF a defined to be defined has to be implemented

22 – AMC1.ACNS.C.PBN.555 (page 51)

Comment: the table is redundant with the previous subsection, and defines performance for altitude exceeding the one of a final approach

Suggested resolution: update the altitude limits

23 – AMC1.ACNS.C.PBN.565 (page 55)

Comment: if LP is added in CS ACNS, the hazard classification HAZARDOUS for vertical guidance is not applicable unless this is also relevant for advisory vertical guidance

Suggested resolution: remove the HAZARD for LP, or add a note for interpretation

24 – AMC1.ACNS.C.PBN.565 (page 55)

Comment: HAZARDOUS classification for horizontal and vertical guidance in LNAV and LNVA/VNAV exceeds the current classification of AMC20-27.

Suggested resolution: update the classification

25 – AMC1.ACNS.C.PBN.570 (page 55)

Comment: loss of vertical navigation considered as a MAJOR failure condition :
- is not relevant for LNAV
- exceed current AMC20-27 requirements
- for single FMS a failure rate of 10-4 is typical so below the expected value of 10-5. This could lead to implement a dual system

Suggested resolution: update the classification

26 – AMC1.ACNS.C.PBN.605 (page 57)

Comment: obstacle clearance volume : link to a document defining w/o ambiguity the meaning would clarify the interpretation of the requirement

Suggested resolution: indicate the meaning or a link to a document providing it.
27 – GM1.ACNS.C.PBN.610 (page 58)

Comment: the need of INS, and the rejection of AHRS inertial coasting should be replaced by a positioning drift performance, instead of providing a solution. This drift should be compatible of the extraction requiring not to exceed the 2xRNP, which depends on aircraft speed, climb gradient and approach / missed approach segments lenghts.

Suggested resolution: rephrase the sentence to indicate a drift performance expectation depending on criteria on path lenght and aircraft speeds, rather than a defined equipment

28 – CS.ACNS.C.PBN.615 (page 59)

Comment: coupling to FD or autopilot could be in 2D or 3D : for some aircrafts even with autopilot, only 2D coupling is provided. Indicate if the requirement is also relevant to vertical coupling

Suggested resolution: to add if the vertical coupling is required

29 – CS.ACNS.C.PBN.620 (page 59)

Comment: 'RNP cannot be maintained...' : does it mean that vertical coupling to autopilot is not required, when lateral coupling must remain active?

Suggested resolution: clarification expected

30 – AMC1.ACNS.C.PBN.676 (page 66)

Comment: the paragraph relates to 'vertical performance', when the table mention also horizontal failures

Suggested resolution: remove horizontal reference

31 – AMC1.ACNS.C.PBN.676 (page 66)

Comment: there is no value for loss of vertical guidance?

Suggested resolution: to confirm that this is not a missing requirement

32 – CS.ACNS.C.PBN.725 (page 67)

Comment: 'aircraft track (or track angle error)' : this is two different informations, so the 'or' seems not appropriate

Suggested resolution: wording update

33 – CS.ACNS.C.PBN.801 (page 68)

Comment: there are RNP-AR procedures w/o RF legs : RF legs mandatory for RNP-AR certification is more stringent than AMC20-26. This could prevent to perform RNP-AR w/o RF when the HC is able to manage only straight segment for RNP-AR. When it was an option it was possible
Suggested resolution:

34 – CS.ACNS.C.PBN.815 (page 69)

Comment: is the requirement not relevant also to CS27 aircraft in addition to CS23?

Suggested resolution: clarification

35 – Appendix B (page 82)

Comment: bullet c is ambiguous : following power interruptions, alignment of inertial sensor is unavoidable

Suggested resolution: change the wording

36 – Appendix B (page 82)

Comment: bullet a : is it really 'PBN operation' or 'RNP-AR' operation. Does it mean that if an IRS is used for LNAV this is also applicable? A performance requirement instead of a precise value should be indicated, or at least this possibility to avoid stringent requirement for smaller aircrafts

Suggested resolution:

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response | **1 – Section 2.1**
Accepted.
As with the AMC 20-XX material, the CM will be cancelled. Note, however, that this part of the NPA will not be published as part of the CS.
2 – Section 2.3.6 (page 10)

Not accepted.
RNP AR encompasses both approach and departure operations. The introduction of aircraft qualification requirements for RNP AR departures is justified in Section 2.3.3. Please also see the response to comment 107.
3 – Section 1 (page 17)

Not accepted.
The navigation source for the RNP operations covered by the CS-ACNS is GNSS, supported by an inertial system where specified and need not be specifically mentioned.
RF, FRT and parallel offset are optional for some navigation specifications as indicated in Table 1 and should consequently be mentioned where applicable.
The capability to perform RF legs is optional with some Navigation Specifications. Yet it is of key importance for the flight crew to know whether the aircraft has been certified to perform these manoeuvres or not, since some procedures do require the functionality. Hence the need to specifically state compliance.
4 – Section 1 (page 19)

Noted.
It should be noted that Section 2 presents the amendments proposed in Section 3, so it is logical that some parts of CS-ACNS are presented in the explanatory sections of the NPA.
5 - CS.ACNS.C.PBN.205 (page 22)

Partially accepted.
EASA only refers to positioning sources that are recognised for RNP operations, but this does not imply that other sources need not be approved when installed in an aircraft.
For reasons of consistency, the term area navigation system has been replaced with RNP system, in line with the definition of the system in ED-75D.
6 – AMC1.ACNS.C.PBN.205 (page 22)

Noted.
CS-ACNS is intended to be a forward looking document. The C129 ETSO/TSO no longer exist and we have only received very few applications that utilise these units lately. Applications utilising a C129a unit will be dealt with through a CRI. Also, please note that the CS-ACNS does not invalidate any existing approvals.
Please also see the response to comment 101.
7 – GM2.ACNS.C.PBN.205 (page 23)

Not accepted.
EASA considers the text to be sufficiently clear. Moreover, EASA disagrees that RNAV specifications require the use of conventional navigation means.

8 – CS.ACNS.C.PBN.210 (page 23)

Not accepted.

EASA considers the notion of 'primary source of navigation' sufficiently clear, and the term consistent with the use of similar wording in the PBN Manual.

9 – AMC1.ACNS.C.PBN.230 (page 25)

Partially accepted.

The text has been modified to provide more clarity. An example is not being provided since EASA considers that unnecessary.

10 – AMC1.ACNS.C.PBN.280 (page 30)

Not accepted.

Subsection 2 contains CS and AMC addressing lateral navigation in general. LPV is not covered here, but in Subsection 3.

11 – CS.ACNS.C.PBN.2110 (page 31)

Accepted.

The requirement to provide an indication of the constellations in use has been deleted. Please see the response to comment 177.

12 – AMC1.ACNS.C.PBN.2140 (page 36)

Partially accepted.

Part of the AMC wording has been deleted in response to comment 183. Please see the response to that comment.

13 – Subsection 2

Accepted.

An AMC has been added to require an SBAS GNSS position source for RNP 0.3 operations.

14 – AMC1.ACNS.C.PBN.320 (page 39)

Noted.

EASA considers that the full scale deflection should be commensurate with the RNP value, but does not consider that this necessarily implies a scaling of 1 x RNP. Other solutions have been approved since publication of AMCs 20-26/20-27/20-28 that provided scaling other than 1x RNP and were found acceptable. The text of the AMC reflects this.

15 – AMC1.ACNS.C.PBN.320 (page 39)

Not accepted.

EASA considers the text to be sufficiently clear. In addition, EASA considers compliance with RNP 0.3 navigation specification out of scope of Subsection 3.

16 – GM1.ACNS.C.PBN.420 (page 42)

Accepted.

Please see the response to comment 333.

17 – GM1.ACNS.C.PBN.501 (page 47)

Not accepted.

Firstly, 'RNP AR minima' are charted as LNAV/VNAV minima. We like to additionally point at the need to comply with the requirements of Subsection 6 for RNP AR.

18 – CS.ACNS.C.PBN.525 (page 48)

Nopted.
Please see the response to comment 413.

19 – CS.ACNS.C.PBN.530 (page 49)

Partially accepted.
The wording has been revised for improved clarification. Please also see the response to comment 336.

20 – AMC1.ACNS.C.PBN.535 (page 50)

Not accepted.
EASA considers the text to be sufficiently clear. The text has however been moved from the AMC to the GM.

21 – AMC1.ACNS.C.PBN.535 (page 50)

Accepted.
The text has been changed to better express the intent of the requirement.

22 – AMC1.ACNS.C.PBN.555 (page 51)

Not accepted.
The contents of the table refer to the region altitude and are consistent with the vertical paths performance limits set out in EUROCAE ED-75D.

23 – AMC1.ACNS.C.PBN.565 (page 55)

Partially accepted.
Please see the response to comment 43.

24 – AMC1.ACNS.C.PBN.565 (page 55)

Partially accepted.
Please see the response to comment 43.

25 – AMC1.ACNS.C.PBN.570 (page 55)

Partially accepted.
Please see the response to comment 43.

26 – AMC1.ACNS.C.PBN.605 (page 57)

Not accepted.
EASA considers the term 'obstacle clearance volume' to have been in use for many years and consistent with the ICAO PBN Manual.

27 – GM1.ACNS.C.PBN.610 (page 58)

Not accepted.
Please see the response to comment 371.

28 – CS.ACNS.C.PBN.615 (page 59)

Not accepted.
The text is consistent with the PBN Manual. EASA assumes that coupling will have to be 3D but does not consider it necessary to make this a specific requirement.

29 – CS.ACNS.C.PBN.620 (page 59)

Noted.

In case that the RNP cannot be maintained, the expectation is that in an operational environment, the flight crew will initiate a go-around and climb. This may be supported by an autopilot/flight director but is not a requirement.

30 – AMC1.ACNS.C.PBN.676 (page 66)

Partially accepted.

Please see the response to comment 43.

31 – AMC1.ACNS.C.PBN.676 (page 66)

Partially accepted.

Please see the response to comment 43.

32 – CS.ACNS.C.PBN.725 (page 67)

Not accepted.

The wording is consistent with the PBN Manual.

33 – CS.ACNS.C.PBN.801 (page 68)

Not accepted.

EASA estimates that the number of cases in which the RF functionality is not required during an RNP AR operation would be very limited, hence the RF legs has been added to the certification basis for RNP AR. This is consistent with an agreement reached in the ICAO PBNSG on the subject.

34 – CS.ACNS.C.PBN.815 (page 69)

Not accepted.

The alleviations for non-type rated CS-23 Class 1-3 aircraft are based on an agreement reached with the ICAO PBNSG, supported by a comprehensive set of demonstrations performed by a leading manufacturer of avionics equipment targeted at this market. Such demonstrations have not been performed on CS-27 aircraft and neither has there been agreement in the PBNSG on including CS-27 rotorcraft.

35 – Appendix B (page 82)

Partially accepted.

Although the text refers to 'normal power interruptions' the word 'brief' will be added for clarification. Please see the response to comment 482.

36 – Appendix B (page 82)

Not accepted.

There is no requirement to use an INS/IRU for all PBN operations, except where explicitly stated (e.g. for RNP AR). But where an IRS/IRU is used, it should comply with the requirements of Appendix B.

EXECUTIVE SUMMARY   p. 1-2

| comment | *61* | comment by: *Advanced PBN Solutions* |

In the third paragraph, it states the new sections support global PBN operation, then lists the RNP specifications only. However, in Subpart C and its subsections, guidance and credits are given for RNAV/RNP 10, RNAV 5, RNAV 2 and RNAV 1. To avoid confusion about what is contained in Subpart C, it is suggested to add a statement such as: "....and RNP 0.3. The additions also provide guidance and credits the ICAO RNAV applications i.e. RNAV /RNP10, RNAV 4, RNAV 2 and RNAV 1.

response | Noted.
The consultation procedure applied by EASA does not consider the introduction of amendments to the NPA itself, but amendments to the draft documentation presented in Section 3.
On the other hand, it is important to observe that Subpart C is focused on type certification of navigation systems that are used to fly RNP applications. Therefore, Subpart C does not deliberately address RNAV navigation specifications. The reasons for this approach, as well as the explanation on the certification credit that could be obtained for RNAV specifications, have been reflected with more detail in Subsection 1 of CS-ACNS.

comment | *79*   comment by: *European Helicopter Association (EHA)*

We suggest to include in the text that the NPA is related both to aircraft and rotorcraft

response | Noted.
The consultation procedure applied by EASA does not consider the introduction of amendments to the NPA itself, but amendments to the documentation presented in Section 3 of the NPA.
Please see also the response to comment 297.

comment | *134*   comment by: *Leonardo Helicopters*

General Comments:
The NPA intent and the proposal to incorporate all the PBN specification requirements in a single certification specification is positive, however for a very peculiar nav spec such as RNP AR it could be better to maintain\update (e.g AMC 20-26)\develop a specific regulation covering both airworthiness and operational aspects.
It should be noted that, even if out of the scope of this NPA, there is the strong need to remove the SPA for RNP 0.3 all phases of flight operations. The RNP 0.3 nav spec requirements must be considered enough mature and the current obligation for an additional administrative process to obtain a specific approval (SPA) to fly helicopter specific applications based on RNP 0.3 may impair the achievement of the potential benefits related to the use of RNP 0.3.

response | Noted.
Please see the response to comment 78.

comment | *426*   comment by: *EUROCONTROL*

The EUROCONTROL Agency has one comment.

	The last sentence saying that JAA TGL10 Rev 1 will cease to be recognised by EASA for type certification after the publication of the updated CS-ACNS is questionable. This is misleading without further explanation since the understanding is that PBN IR will require RNAV 1 as a minimum requirement.
response	Partially accepted.
	It is true that there are RNAV specifications that are explicitly required in the Commission Implementing Regulation (EU) 2018/1048 (PBN IR), which implies that aircraft must be suitably qualified to carry out the corresponding flight operations, e.g. to fly RNAV 1 applications. It is also true that approach procedures based on the RNP APCH specification must be implemented at all runway ends, as per the PBN IR. Looking at the requirements depicted in Table 1 of the NPA, it is easy to check that an aircraft certified to conduct RNP APCH operations also complies with the basic certification requirements that apply to the RNP 1 specification, which are basically those contained in Subsection 2. CS-ACNS has been further developed to explain that aircraft that comply with the requirements of Subsection 2 automatically comply with all the criteria of the RNAV 1 specification, provided that the navigation applications are predicated on GNSS.

2. In summary — why and what   p. 4-11

comment	*3* comment by: *British Airways Flight Operations*
	Comment to para 2.3.3.(b): British Airways strongly supports the Agency's reasoning in this paragraph, and, therefore, its decision to deviate from ICAO guidance.
response	Noted.
	The expressed support is highly appreciated.

comment	*31* comment by: *Dassault-Aviation*
	Dassault-Aviation
	Page 10 § 2.3.6
	Comment:
	(Table 1) PBN specifications - Mandatory and optional airworthiness requirements. Table 1
	title is not clear: It is understood that for certification of a PBN capability (1st column), it is required / optional to provide a status to the associated line subsections. It is expected that associated required subsection functionality is not however "required" to answer the PBN capability. Examples:
	• For certification of RNP APCH, it is required to consider subsection 5 (VNAV in final approach): It is not a required capability. See also p21
	• For certification of RNP AR, it is required to consider subsection 8 (RF legs): It is not a required capability.
	Please clarify.
response	Noted.
	It is assumed that the commentator refers to the following:

- The RNP APCH specification could be used to carry out approaches down to LNAV minima, where vertical guidance is not provided on the final approach segment (FAS);
- RF legs may not be necessary to conduct an RNP AR APCH operation.

These discrepancies between the ICAO PBN Manual and CS-ACNS make EASA's certification basis more demanding. However, applications for RNP-APCH to LNAV only minima without VNAV have become increasingly rare; and the same goes for applications for RNP AR APCH without RF path terminator. Should an applicant wish to apply for RNP APCH without VNAV or RNP AR APCH with RF, the corresponding application will be accommodated through the Certification Review Item (CRI) process.

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comment	*32*	comment by: *Dassault-Aviation*

Dassault-Aviation

P10 §2.3.6

Comment:
(Table 1) PBN specifications - Mandatory and optional airworthiness requirements. Table 1
(Possibly in relation with previous comment)
To claim A-RNP capability, in ICAO PBN Manual (9613) only RF leg functionality is required (Table II-C-4-2): Table 1 adds Parallel Offset and FRT as mandatory capabilities. This is surprising, at least for FRT, as this capability has not been deployed yet: Certification of FRT can therefore only be theoretical, based on test procedures.
Please clarify.

response	Noted.

CS-ACNS will just consider FRT as an optional capability for A-RNP certification in order not to limit the implementation of this navigation specification. Execution of parallel offsets is certainly considered a functional requirement for the A-RNP specification in the ICAO PBN Manual. The table referred to in the comment just intends to provide links to specific appendices or attachments to the PBN Manual, where some functional requirements are explained in detail.

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comment	*33*	comment by: *Dassault-Aviation*

Dassault-Aviation

P11 §2.4

Comment:
(GM1) As stated in The NPA addresses only a subset of navigation specifications (RNP only) from ICAO PBN Manual.
RNP navigation is based on GNSS as a primary means of navigation.
For an applicant who wants to certify a system for RNAV airspaces (e.g., B-RNAV, P-RNAV) based on other means of navigation than GPS (e.g., DME/DME, VOR/DME,...), either as primary means of navigation or as a back-up for the area

navigation system in case the GPS becomes unavailable (loss of SIS or equipment), should current AMC be applied (such as AMC 20-4, TGL10)?
Please clarify.

response	Noted. As explained in Section 2.2 and since this NPA also proposes to cancel the related AMC-20 material and no longer recognise TGL 10 Rev 1, aircraft that need to conduct RNAV 5 or RNAV 1 operations supported by navigation aids other than GNSS should be certified by having recourse to Certification Review Items (CRIs).

comment	*62*	comment by: *Advanced PBN Solutions*

Paragraph 2.1, 4th subparagraph, the statement "...a simplified certification basis...approvals in respect of any of the RNP navigation..." is used. What is meant by "..in respect of any..." is not clear. What is described in Paragraph 2.2, 4th subparagraph, are examples of how an RNP airworthiness type certification also provides an RNAV certification. If this is what is intended, it would be more appropriate for the statement to be "...a simplified certifcation basis...approvals with respect to RNP navigation specifications and functionalities that will also apply to RNAV navigation specifications and functionalities defined by ICAO...."

response	Partially accepted. The text in CS-ACNS has been revised to address the concern expressed in the comment and provide more clarity.

comment	*63*	comment by: *Advanced PBN Solutions*

For Table 1 in paragraph 2.3.6, the following are offered.
1. The use of advisory VNAV should be optional for RNP 4 and RNP 2. For such applications, VNAV is largely a workload relief capability but has use for climb and descents in cruise.
2. For the FRT, it is shown as required for A-RNP. It is specified as optional in the PBN manual.
3. Parallel offset. It is shown as required for RNP 4 and A-RNP. However, there is a difference in the functionalities specified for them. For RNP 4, the functionality is largely that contained in many in-service aircraft today that are not standardized. Some establish a parallel offset for the active flight path excluding the terminal procedures, while others permit specifications for individual segments of the flight path. The intercept angles to and from the offset are left to the vendor/manufacturer. For A-RNP, the functionality is specifically based upon the RNP MASPS ED-75 where offsets are defined by flight path segment or for the active path and must have 30 degree intercepts to and from the offset. Is the basic statement of "Required" for RNP 4 sufficient to know what requirements apply, especially given aircraft in-service have approvals to perform RNP 4 without MASPS compliant parallel offset capability?

response	1. Partially accepted. Please see the response to comment 485. 2. Accepted. EASA has decided to identify FRT as an optional capability for A-RNP type-certification and has amended Table 1 accordingly. 3. Noted. EASA acknowledges that aircraft are currently approved to operate RNP 4 with a variety of means to perform parallel offsets. These approvals will

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continue to be recognised. For new applications, however, the expectation is that parallel offsets will be performed as specified in ED-75D.

comment	76	comment by: *Garmin International*

Section 2.2 Page 6:

NPA 2018-02 section 2.2 includes "The publication of the updated CSs does not invalidate the status of aircraft currently approved for compliance with AMC 20-4A, AMC 20-5, AMC 20-12, AMC 20-26, AMC 20-27A, AMC 20-28 and TGL-10. These approvals will continue to be recognised."

Despite the quoted assurance that "These approvals will continue to be recognised", the NPA section 3 "Proposed amendments and rational in detail" includes no such statement affirming this EASA position.

CS-ACNS significantly changes the format, paragraph numbering, etc. of the AMCs related to PBN. Many past certification efforts have had to show a compliance matrix to the requirements of AMC 20-4A, AMC 20-5, AMC 20-12, AMC 20-26, AMC 20-27A and AMC 20-28 as well as TGL 10. It will be a non-trivial effort for industry to update these compliance matrices for existing approved installations or even installation of previously approved equipment in a new aircraft type.

AC 20-138D Chg 2 Chapter 1 paragraph 1-1.i includes: "This AC revision is not intended to modify, change or cancel equipment design or airworthiness approvals previously in existence. However, new installation approvals (TC, ATC, STC or ASTC) should follow the guidance in this AC."

CS-ACNS should include a similar statement indicating that cancellation of the previous AMCs "is not intended to modify, change or cancel equipment design or airworthiness approvals previously in existence."

Furthermore, CS-ACNS should include an allowance that even new installation approvals should be able to use a previous AMC compliance matrix data for installation of previously approved equipment in a new aircraft type.

response	Accepted.

It should also be noted that the publication of CS-ACNS does not invalidate existing approvals and CS-ACNS has added explanations on how credit could be granted for future applications.

comment	77	comment by: *Garmin International*

Section 2.3.3 and 2.3.4 - Page 7 - 9:

NPA 2018-02 sections 2.3.3 and 2.3.4 list example deviations from the ICAO PBN Manual and AC 20-138D Changes 1 and 2, respectively. However, there is no detailed list of deviations, several of which are noted in other Garmin comments where NPA 2018-02 raises the certification requirements without providing justification.

Furthermore, NPA 2018-02 provides no traceability to show that the existing AMC 20-4A, AMC 20-5, AMC 20-12, AMC 20-26, AMC 20-27A and AMC 20-28 as well as TGL 10 have been accurately transposed into CS-ACNS and that all deviations have been accounted.

Existing CS-ACNS Subpart D includes Appendix D "Differences between CS ACNS.D.ELS and JAA TGL 13 Rev1" and Appendix E "Differences between CS ACNS.D.EHS and EASA AMC 20-13". Similarly, AMC 20-26 includes Appendix 6 "AMC 20-26/PBN Manual/AC90-101 Comparison".

CS-ACNS Subpart C should include a detailed list of differences like what is included in CS-ACNS Subpart D. CS-ACNS Subpart C also should include a detailed comparison tracing the CS-ACNS Subpart C CS requirements to past AMC/TGL guidance like what is included in AMC 20-26 Appendix 6.

response	Not accepted. EASA concurs with the commentator that the provision of matrices would be helpful to a certain extent, but the way Subpart C is structured, together with a significantly wider scope of requirements, cannot be compared to other existing references (AMCs); therefore, we conclude that such an effort is not worthwhile.

comment	*80*	comment by: *European Helicopter Association (EHA)*
response	No comment was entered.	

comment	*81*	comment by: *European Helicopter Association (EHA)*
	<u>With reference to para 2.1. "Why we need to change the rules — issue/rationale" we suggest to delete the statement "in accordance with the emerging routes and procedures". A safe PBN implementation is more than routes and procedures.</u>	
response	Not accepted. The consultation procedure applied by EASA does not evisage the introduction of amendments to the NPA itself, but amendments to the documentation presented in Section 3. The referred to paragraph intends to indicate that, according to EU law, aircraft must be suitably equipped to fly instrument routes and procedures, including those predicated on PBN specifications.	

comment	*82*	comment by: *European Helicopter Association (EHA)*
	With reference to para 2.2. "What we want to achieve — objectives", it has to be considered that for a very peculiar nav spec such as RNP AR it could be better to maintain\update (e.g AMC 20-26)\develop a specific regulation covering both airworthiness and operational aspects.	
response	Noted. Please see the response to first part of comment 78.	

comment	*83*	comment by: *European Helicopter Association (EHA)*

With reference to the examples mentioned on para 2.2. "What we want to achieve — objectives", the intent is positive but the statement could be considered misleading or could ingenerate discussions e.g how could the example cover the A RNP or RNP APCH specifications and the different RNP APCH applications (LNAV, LP, LPV, LNAV\VNAV) ? we suggest not to include the examples. It could be better to include a table or a clear statement for each navigation specification: e.g RNP4 type certification provides RNAV 10 type certification, RNP2 provides RNAV 5 etc

response	Partially accepted.

EASA does not consider that the examples provided could be misleading, although the proposal contained in the NPA to amend CS-ACNS failed to explain how to benefit from RNAV certification. Hence, the information provided in Subpart C has been expanded, so as to explain the criteria to automatically obtain credit for RNAV 10, RNAV 5, RNAV 2 and RNAV 1 certification.

comment	*84*	comment by: *European Helicopter Association (EHA)*

With reference to the mentioned EUROCONTROL PRISME database on para 2.2. "What we want to achieve — objectives", it should be noted that, with regards to helicopters, the data retrieved from the PRISME database are not reliable. The large majority of European IFR helicopter fleet (95% and < 20 years old) are GNSS equipped

response	Noted.

Latest data from EUROCONTROL PRISME database shows a rate of 90 % of aircraft flying IFR are GNSS equipped (information is based on the content of flight plans). All types of aircraft (including helicopters) are considered globally and the rate may vary from one sub-category to the other.

comment	*85*	comment by: *European Helicopter Association (EHA)*

with reference to para 2.3.2. "Cancellation of PBN-related AMC-20 material", the mentioned AMCs and other reference material such as the TGL 10 are advisory material included in the PBN manual. There is the need to update the reference section of each Navigation Specification in the PBN manual Volume II according to the EASA proposal

response	Noted.

The update of the PBN manual is within the remit of ICAO PBNSG to which EASA is contributing.

comment	*86*	comment by: *European Helicopter Association (EHA)*

With regards to para 2.3.3. "Compatibility with the ICAO PBN Manual", please refer to our comment on Para 2.3.2. "Cancellation of PBN-related AMC-20 material"

response	Noted.

Please see the response to comment 85.

comment	87	comment by: *European Helicopter Association (EHA)*
	With reference to para 2.3.3. "Compatibility with the ICAO PBN Manual", please note that at the current date RNP AR departure are not included in the 4th edition of the PBN manual. The airborne community officially doesn't have any information\detailed requirements or references for RNP AR departure	
response	Noted. EASA acknowledges that ICAO information on RNP AR Departure Procedures is not available to a wider audience yet. The dilemma for EASA is that there is demand from operators and States for such procedures, and ignoring the developments could hinder the development and utilisation of these. On the other hand, awaiting publication of the ICAO specifications would provide more transparency. Considering the agreement within ICAO on the aircraft eligibility criteria for RNP AR DPs, EASA opted for a more proactive approach and decided to include those criteria in the CS-ACNS. PBN manual is being updated by the ICAO PBNSG group to include RNP AR Departure.	

comment	88	comment by: *European Helicopter Association (EHA)*
	With reference to para 2.3.3. "Compatibility with the ICAO PBN Manual" point (b), could an helicopter approved\certified for RNP 0.3 all phases of flight (including RNP 0.3 in MA) be also considered approved for RNP AR with the same nav spec (RNP 0.3) in MA?	
response	Noted. RNP AR certification requires some functionalities that are not required for RNP 0.3 certification, e.g. RF leg is. Additionally, there are specific requirements in Subsections 6 and 8 that are not applicable for certification against RNP 0.3 and RNP APCH (see Table 1 of CS-ACNS).	

comment	91	comment by: *European Helicopter Association (EHA)*
	reference to para 2.3.4. "Compatibility with FAA Advisory Circular AC 20-138D17 including Changes 1 and 2": even if there are differences between the AC and AMC, we think that an harmonization and common requirements are needed. However, concerning RNP AR SPA there is the risk to duplicate on both side of the Atlantic the requirements ingenerating additional and no clear administrative process (…additional cost for the operators) to obtain the RNP AR approval.	
response	Noted. The SPA for RNP AR operations go beyond the scope of this document. The differences highlighted in Section 2.3.4 have to do with the requirements for the qualification of the aircraft and also apply to the current certification requirements, i.e. AMC 20-26.	

comment	92	comment by: *European Helicopter Association (EHA)*
	With reference to para 2.3.4. "Compatibility with FAA Advisory Circular AC 20-138D17 including Changes 1 and 2", we think that EASA could heavily contribute to	

harmonize the regulatory and operational environment in Europe, avoiding to put more emphasis on the qualification of the aircraft.

response	Noted. Since EASA is the competent authority for type certification of aircraft in the European Union, unwanted behaviours after failure conditions can be mitigated through common airworthiness requirements, especially when it comes to RNP AR operations, which are particularly demanding in relation to performance. Thus, the process of operational approval managed by the national competent authorities of the Member States is simplified.

comment	*103* comment by: *Transport Canada Civil Aviation Standards Branch*
	Similar, but some are not exactly the same. RNAV 10 requires dual equippage. RNP 2 Continental does not so your "applicable to the same type of ops caveat" will need to be clearly stated (perhaps tablulate the recognition of cert by overlap of spec). There is an ICAO PBN Manual statement on this (ICAO PBN Manual page I-(V) (PDF page 13)) :'Because specific performance requirements are defined for each navigation specification, an aircraft approved for a particular navigation specification is not automatically approved for any other navigation specification. Similarly, an aircraft approved for an RNP or RNAV specification having a stringent accuracy requirement (e.g. RNP 0.3 specification) is not automatically approved for a navigation specification having a less stringent accuracy requirement (e.g. RNP 4).' A good idea all the same and tabulating the areas where the specs do cover each other would be a very worthwhile (and time saving) activity. I note your rebuttal to the statement on page 8.
response	Partially accepted. Subpart C has been revised in order to include explanations that address the concern expressed in the comment.

comment	*104* comment by: *Transport Canada Civil Aviation Standards Branch*
	It is important to note the type of GPS fitted during any survey. Many TSO C129 boxes are still out there and these (along with TSO C196) are supplementary GPS Nav systems requiring other Nav systems eg VOR or DME to be fitted. This is significant when considering the retirement of any ground Nav Aids and the move to a focus on GPS based Ops.
response	Noted. Latest data from EUROCONTROL PRISME database shows a rate of 90 % of aircraft flying IFR are GNSS equipped (information is based on the content of flight plans). Further analysis shows that the rate of aircraft, which are LPV capable, is around 10 % globally (representing 3 % of the flights), with large variations between the different segments: from 0.9 % for CAT to more than 30 % for business aviation. Therefore, the remaining population of GNSS equipped aircraft are fitted with ETSO-C129 or ETSO-C196. CS-ACNS is a forward looking document, although certification credit obtained on the basis of a previous ETSO-authorised equipment will be taken into account as far as practicable for new applications.

comment	105	comment by: *Transport Canada Civil Aviation Standards Branch*

Page 7 Section 2.3.3

The ICAO text is "RNP AR APCH" rec use same for consistency

response	Noted.

It should certainly read RNP AR APCH. This unfortunate oversight seems not to repeat in other parts of the text.

comment	106	comment by: *Transport Canada Civil Aviation Standards Branch*

I note that your CS equates RNP to RNAV - page 5 - not RNP to RNP. So the ICAO argument is true for RNP 4 and RNP 0.3 because RNP 4 requires dual equipage and RNP 0.3 does not. You may wish to tweak your argument (on page 5 - see earlier comment)- and also address the RNP to RNP mapping not just RNP to RNAV in any table of overlapping compliance.

response	Partially accepted.

Subpart C has been revised in order to include explanations that address the concern expressed in the comment.

comment	107	comment by: *Transport Canada Civil Aviation Standards Branch*

The ICAO PBN Manual uses the Term:RNP AR APCH - is there a reason we don't state APCH in the table?

I note on page 17 : (k) RNP AR (for approach and/or departures); The ICAO PBN manual links RNP Departures to A-RNP (PAGE 11-C-4-3). Where is the link to RNP AR? Page 20 of this doc does not mention departures in relation to RNP AR.

response	Noted.

As explained in Section 2.3.3, CS-ACNS also introduces new requirements for RNP AR departures that are likely to be incorporated into the next revision of the ICAO PBN Manual.

comment	135	comment by: *Leonardo Helicopters*

Page 4

we suggest to delete the statement *in accordance with the emerging routes and procedures.*
A safe PBN implementation is more than routes and procedures…..

response	Not accepted.

Please see the response to comment 81.

comment	136	comment by: *Leonardo Helicopters*

Page 5

Consider that for a very peculiar nav spec such as RNP AR it could be better to maintain\update (e.g AMC 20-26)\develop a specific regulation covering both airworthiness and operational aspects.

The intent is positive but the examples\statement could be considered misleading or could ingenerate discussions e.g how the example could cover the A RNP or RNP APCH specifications and the different RNP APCH applications (LNAV, LP, LPV, LNAV\VNAV) ?
I suggest to do not include the examples. It could be better to include a table or a clear statement for each navigation specification: e.g RNP4 type certification provides RNAV 10 type certification, RNP2 provides RNAV 5 etc

response	Partially accepted. Please see the responses to comments 83 and 78.

comment	**137**	comment by: *Leonardo Helicopters*

Page 6

It should be noted that with regard helicopters the data retrieved from the PRISME database are not reliable. The large majority of European IFR helicopter fleet (95% and < 20 years old) are GNSS equipped.

The mentioned AMCs and other reference material such as the TGL 10 are advisory material included in the PBN manual. There is the need to update the reference section of each Navigation Specification in the PBN manual Volume II according to the EASA proposal.

response	Noted. See the responses to comments 84 and 85.

comment	**138**	comment by: *Leonardo Helicopters*

Page 7

See previous comment

response	Noted. See the response to comment 137.

comment	**139**	comment by: *Leonardo Helicopters*

Page 8

At the current date RNP AR departure are not included in the 4th edition of the PBN manual. The airborne community officially does not have any information\detailed requirements or references for RNP AR departure

An helicopter approved\certified for RNP 0.3 all phases of flight (including RNP 0.3 in MA) could also be considered approved for RNP AR with the same nav spec (RNP 0.3) in MA?

| response | Noted. Please see the responses to comments 87 and 88. |

| comment | *140* | comment by: *FAA AIR* |

Section 2.2 states: "*The additional CS-ACNS material shall be used for new applications for type certification of area navigation systems for PBN applications and, deliberately, does not specifically address RNAV navigation specifications. Today's navigation systems are commonly designed to meet RNP applications, and hence provide on-board performance monitoring and alerting. Moreover, a careful review of the aircraft applicability requirements in the ICAO PBN Manual, the RTCA DO-229E MOPS for SBAS/GNSS receivers, the EUROCAE ED-75D MASPS for area navigation systems, FAA AC 20-138D and the EASA/JAA AMC/TGL material revealed that the requirements for aircraft qualification are similar across a significant number of PBN specifications. As a consequence, EASA considered that it is appropriate for an aircraft that will be type-certified in accordance with CS-ACNS for RNP X to also be recognised as having been type-certified for RNAV Y (where Y ≥ X), provided that both specifications are applicable to the same type of operations.*"

COMMENT: *Substantive* This section of the NPA rationalizes using the public RNP system requirements from EUROCAE and RTCA as the baseline for airworthiness assurance for global PBN operations, along with recognizing FAA AC 20-138D as another source for PBN airworthiness guidance. However, throughout the NPA, the document uses the term "area navigation system" when, in fact, the requirements are RNP system requirements. Thus, use of the term "area navigation system" (RNAV) is inpprorpiate; and the use of the term will ikely continue to foster regultor and operator confusion between RNAV system requirements and RNP system requirements.

RECOMMENDATION: Globally replace "area navigation system" with "RNP system" to further distinction between RNAV specifications and RNP specifications.

RATIONALE: Clarity and avoid continuing confusion between RNAV and RNP.

| response | Accepted. The term RNP system has been used throughout the document. |

| comment | *141* | comment by: *Leonardo Helicopters* |

Page 9

Yes, there are differences between the AC and AMC however an harmonization and common requirements are needed. For RNP AR SPA is required however there is the risk to duplicate on both side of the Atlantic the requirements in generating additional and not clear administrative process (… additional cost for the operators) to obtain the RNP AR approval.

EASA could heavily contribute to harmonize the regulatory and operational environment in Europe, avoiding to put more emphasis on the qualification of the aircraft.

response	Noted. Please see the responses to comments 91 and 92.

comment	*142* comment by: *Leonardo Helicopters*
	Page 10
	Regarding the RF capability should be set as "Required" for RNP 0.3 for helicopter otherwise the RF leg could not be used by some local CAA for STAR or DP or Initial/Intermediate segments of APP if it is not required for FMS system on board of H/C. Considering the H/C capability, respect the fix wing, to fly tight RF with small radius the RF capability should be "Required" for RNP 0.3 H/C operations to take maximum advantage from RNP0.3 procedure.
	The RNP APCH approach includes the LNAV minima type that could be flown without Baro-VNAV. Through the "Required" do you mean to force the Baro-VNAV capability for FMS in order to fly RNP APCH with LNAV minima as it's necessary for LNAV/VNAV minima?

response	Not accepted. The RF leg is considered optional in CS-ACNS rather than a minimum requirement for RNP 0.3, which is consistent with the PBN Manual. This approach provides more flexibility to applicants, who may consider apply for this functionality only where RF legs are incorporated into the terminal flight procedures that apply to helicopters. As regards the use of the RNP APCH specifications to fly approaches down to LNAV minima only, EASA can confirm that such applications have become increasingly rare. Should an applicant wish to apply for RNP APCH without VNAV, the certification will be accommodated by means of Certification Review Items (CRIs).

comment	*229*
	NPA 2.3.4 Page 9:
	EASA's CS 23 SSD list indicates that CS-ACNS is one of several "CS requirements that have no direct equivalent FAR requirements" that may need to be addressed during validation of FAA TC/STCs (see https://www.easa.europa.eu/sites/default/files/dfu/CS23%20Published%20SSD%20List.pdf section 2.13, accessed 9 May 2018).
	This EASA position seems unjustified since US applicants will use FAA's AC 20-138D to certify RNAV and RNP capabilities, which should largely satisfy EASA's CS-ACNS Subpart C. However, if this EASA position remains, to simplify validation, EASA should include new appendices identifying differences to FAA ACs that correspond to the CS-ACNS subparts with the expectation that only the differences need to be addressed for validation. e.g., one appendix should identify the differences between Subpart C and AC 20-138D Chg 2, another appendix should identify the differences between Subpart D and AC 20-165B, etc.

response	Not accepted.

The SSD (now SEI) list recognises that there is no FAA equivalent at the CS level. At AC, AMC level, we do recognise equivalency and in many cases accept demonstration to FAA ACs for credit to demonstration to the CS-ACNS requirements.

The notion of including appendices is appreciated. But there are no such appendices in the FAA ACs either and we currently lack the resources to create such lists for all the AMCs and ACs.

comment	*265*	comment by: *ESSP-SAS*

Page 6:
The publication of the updated CSs does not invalidate the status of aircraft currently approved for compliance with AMC 20-4A, AMC 20-5, AMC 20-12, AMC 20-26, AMC 20-27A, AMC 20-28 and TGL-10. <u>These approvals will continue to be recognised</u>

The regulatory text do not present provisions to ensure that AMC 20-XX are still recognised.

response	

Accepted.
In general, existing approvals will be grandfathered and considered as part of the certification basis of the aircraft. Where changes are introduced that have not already been covered by the existing approval, the CS-ACNS will apply. EASA will, however, provide credit for the existing approval to the extent that this is reasonable. Text will has been added to CS-ACNS to state this.

comment	*295*	comment by: *Europe Air Sports*

2.4, page 11, last sentence:

"EASA did not identify any remarkable drawbacks". What does "remarkable" mean in this context? Would "significant" be a better choice?

response	

Noted.
The sentence just intends to convey that no notable or worthy of notice drawbacks could be identified during the impact assessment. Drawbacks were simply unnoticeable when compared to the potential benefits associated with the expansion of the certification basis for PBN and the way CS-ACNS has been structured.

comment	*321*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 9 & 2.3.5

PROPOSED TEXT / COMMENT:

It is proposed to clarify the applicability in the final rule and in CS ACNS.A.GEN.001 as follow :
"- The subpart C of CS ACNS will be applied to certify PBN functionalities on new Type certified aircraft

- If TGL-10 or AMC 20-X or an any other guidance recognised by EASA, has been applied on a type certified aircraft and if the function to be certified is covered by this guidance; then this guidance remains applicable to certify functionalities, changes and evolutions; on this type certified aircraft and on its derivatives (new engine, new wings, conversion to freighter…).
- If a Type certified aircraft has no previous approval against an AMC 20-X or TGL 10 or any other guidance previously recognised by EASA, the CS-ACNS will be applied to certify the new functionality. EASA will however recognize prior certifications on other PBN functionalities and provide credit for this for the compliance to CS ACNS Subpart C (e.g. : compliance to subsections 1&2 will be recognised as covered by past PBN certification exercises...)"

RATIONALE / REASON / JUSTIFICATION:

On page 5 § 2.2 it is written : "The additional CS-ACNS material shall be used for new applications for type certification of area navigation systems for PBN applications and, deliberately, does not specifically address RNAV navigation specifications."
And on page 9 § 2.3.5 it is written : "This proposal does not require recertification of aircraft; however, an applicant wishing to certify additional functionalities on already type-certified aircraft would have to apply on the basis of the proposed CS-ACNS."
Airbus understands that:
- when applying for a brand new Type Certified Aircraft the CS ACNS will be applied
- if an AMC 20-X or if TGL 10 has been applied on a Type Certified aircraft and the function to be certified is covered by this AMC 20-X or TGL 10, then this AMC 20-X or TGL 10 remains applicable for changes, evolutions and derivatives (new engine, new wings, conversion to freighter…)

response	Partially accepted. Please see the response to comment 323.

comment	*322*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 5 & 2.2 - Objectives

PROPOSED TEXT / COMMENT:

It is proposed to clarify the applicability in the final rule and in CS ACNS.A.GEN.001 as follow :
"- The subpart C of CS ACNS will be applied to certify PBN functionalities on new Type certified aircraft
- If TGL-10 or AMC 20-X or an any other guidance recognised by EASA, has been applied on a type certified aircraft and if the function to be certified is covered by this guidance; then this guidance remains applicable to certify functionalities, changes and evolutions; on this type certified aircraft and on its derivatives (new engine, new wings, conversion to freighter…).
- If a Type certified aircraft has no previous approval against an AMC 20-X or TGL 10 or any other guidance previously recognised by EASA, the CS-ACNS will be applied

to certify the new functionality. EASA will however recognize prior certifications on other PBN functionalities and provide credit for this for the compliance to CS ACNS Subpart C (e.g. : compliance to subsections 1&2 will be recognised as covered by past PBN certification exercises...)"

RATIONALE / REASON / JUSTIFICATION:

On page 5 § 2.2 it is written : "The additional CS-ACNS material shall be used for new applications for type certification of area navigation systems for PBN applications and, deliberately, does not specifically address RNAV navigation specifications."
And on page 9 § 2.3.5 it is written : "This proposal does not require recertification of aircraft; however, an applicant wishing to certify additional functionalities on already type-certified aircraft would have to apply on the basis of the proposed CS-ACNS."
Airbus understands that:
- when applying for a brand new Type Certified Aircraft the CS ACNS will be applied
- if an AMC 20-X or if TGL 10 has been applied on a Type Certified aircraft and the function to be certified is covered by this AMC 20-X or TGL 10, then this AMC 20-X or TGL 10 remains applicable for changes, evolutions and derivatives (new engine, new wings, conversion to freighter…)

response	Partially accepted. Please see the response to comment 323.

comment	*337*	comment by: *DGA*
	For transparency and practical reasons, suggestion to add in subsection 1 a table that gives exhaustively "equivalence" between certification of RNP and RNAV capabilities (like in the example page 6).	
response	Partially accepted. EASA agrees to add more information to Subpart C so as to show when certification credit for RNAV 10, RNAV 5, RNAV 2, and RNAV 1 could be automatically obtained.	

comment	*339*	comment by: *DGA*
	At the end of page 5, in order to clarify "equivalence" between certification of RNP and RNAV capabilities, suggestion to add explicitly in CS ACNS specifications (in subsection 1 for example) "an aircraft that will be type-certified in accordance with CS-ACNS for RNP X to also be recognised as having been type-certified for RNAV Y (where Y ≥ X), provided that both specifications are applicable to the same type of operations."	
response	Partially accepted. Please see the response to comment 337.	

comment	*428*	comment by: *EUROCONTROL*

Section 2.2 What we want to achieve - objectives - Page 5-6

The EUROCONTROL Agency has three comments, the first two requiring explanation and clarification of the proposal.

Whilst the move to only RNP Specifications certification can be understood, the loss of TGL 10 as guidance for RNAV 1 certification is confusing. This should be explained right up front.

The document indicates the following: 'RNP 4 airworthiness type certification for remote continental/oceanic operations will also provide RNAV 10 airworthiness type certification'. What about dual INS/IRS capabilities which are applicable for RNAV 10 but not permitted for RNP 4? This needs clarification.

The document indicates the following: 'RNP 2 airworthiness type certification for en-route continental operations will also provide RNAV 5 airworthiness type certification for en-route continental operations'. This effectively takes out the VOR as RNP2 does not allow use of VOR.

Section 2.3.3 Compatibility with the ICAO PBN Manual - Page 7-8

The EUROCONTROL Agency has two comments.

'advanced RNP (A-RNP)'. Please replace by 'Advanced RNP (A-RNP)'.
'RNP approach authorisation required (RNP APCH AR)'. Please follow the PBN Manual title as follows: 'RNP Authorisation Required Approach (RNP AR APCH)' throughout the document.

Section 2.3.5 Relationship with existing EASA regulations and decisions - Page 9-10

The EUROCONTROL Agency has one comment.

The last paragraph of the section indicates that ICAO Assembly resolution 37-11 urges all States to implement RNAV and RNP ATS routes and approach procedures in accordance with the ICAO PBN concept laid down in the Performance-based Navigation (PBN) Manual (Doc 9613).
In fact, ICAO Assembly resolution 37-11 urges the development of State Implementation Plans where States explain to their stakeholders what are their plans concerning the introduction of RNAV and/or RNP.

ICAO Assembly resolution 37-11 did, however, reiterate the APV target laid out in resolution 36-23.

Section 2.3.6 Structure of the proposed PBN Section of Subpart C 'Navigation' - Page 10

The EUROCONTROL Agency has two comments.

Subsection 6: please replace 'RNP approach authorisation required' by 'RNP Authorisation Required Approach'.
Subsection 7: please replace 'advanced-RNP' by 'Advanced RNP'.

Table 1: Mandatory and optional airworthiness requirements - Page 10

The EUROCONTROL Agency has one comment under the form of a justified question.

A-RNP row
Why is FRT required in A-RNP? Only a few aircraft have this functionality and there is no operational concept on how it is going to be used. This will result in fewer aircraft being A-RNP capable.

Table 2: Operations supported by the existing navigation specifications - Page 11

The EUROCONTROL Agency has one comment giving rise to a suggestion.

In column 'En-route oceanic/remote' and at rows 'RNP 2' and 'Advanced RNP (A-RNP)' there should be a reference to a note under the table. The note should indicate that these specifications require high continuity.

response | The consultation procedure applied by EASA does not consider the introduction of amendments to the NPA itself, but amendments to the documentation presented in Section 3.

Section 2.2 What we want to achieve - objectives - Page 5-6
Noted.

As regards the use of TGL 10 as guidance for RNAV 1 certification, please see the response to comment 426.
Additional guidance has been provided in Subsection 2 to explain the criteria to grant certificates for RNAV operations.
There is currently no material for VOR and DME. This may be developed for a future amendment of CS-ACNS.

Section 2.3.3 Compatibility with the ICAO PBN Manual - Page 7-8
Not accepted.
With regard to the justification for the use of 'advanced RNP, please refer to response to comment No 378. According to ICAO Doc. 9905, the right terminology is 'RNP authorisation required approach (RNP AR APCH)', i.e. written in lower case letters. It is acknowledged that page 7 contains an editorial error, i.e. RNP APCH AR, which does not appear in the text of CS-ACNS.

Section 2.3.5 Relationship with existing EASA regulations and decisions - Page 9-10
Noted.
The regional implementation plan for PBN is actually materialised by means of Regulation (EU) 716/2014 and, especially, the recently adopted Regulation (EU) 2018/1048, where the implementation of PBN ATS routes and procedures is required, including an extensive use of approach procedures with vertical guidance (APV) at all instrument runway ends.

Section 2.3.6 Structure of the proposed PBN Section of Subpart C 'Navigation' – Page 10
Partially accepted.

The title of Subsection 6 will be amended accordingly. As for Subsection 7 title, no change is necessary.

Table 1: Mandatory and optional airworthiness requirements - Page 10
Accepted.

CS-ACNS will be amended to set the capability to conduct FRTs as an optional functionality for the A-RNP specification.

Table 2: Operations supported by the existing navigation specifications - Page 11
Not accepted.
The information shown in Table 2 is not expected to provide details on the applicable performance requirements, e.g. continuity. Subpart C explains that the aircraft area navigation system should provide a level of continuity that supports the intended operation. This would apply to remote continental and oceanic operations performed in accordance with the A-RNP or the RNP 2 specifications, which would necessitate a higher continuity.

comment	491	comment by: *AIRBUS HELICOPTERS*

§ 2.2: It is written: *'The main objective of this proposal is to develop CS-ACNS in order to establish standards that permit the airborne community to comply with ...'*

Comment: the wording *'airborne community'* may be replaced by *'CNS systems installers'*.

response

Noted.
The consultation procedure applied by EASA does not consider the introduction of amendments to the NPA itself, but amendments to the documentation presented in Section 3.
It is acknowledged that CS-ACNS is addressed to avionics and aircraft designers, installers, and manufacturers, so the proposed text could have been more precise.

comment	493	comment by: *AIRBUS HELICOPTERS*

§ 2.3.4: it is written *'Consequently, EASA found that it is appropriate to address some of the aspects by putting more emphasis on the qualification of the aircraft.'*

Comment: what is meant by *'qualification of the aircraft'* should be precised.

response

Noted.
In the context of the proposed amendment to CS-ACNS, qualification of aircraft should be understood as the approval of all equipment contributing to PBN capabilities.

comment	494	comment by: *Martin Ryff*

2.4 What are the expectecd benefits and drawbacks of the proposal

Stating, that EASA did not identify any remarkable drawbacks leads to the question of how "remarkable" has been defined and what "non-remarkable" drawbacks have been identified.

response | Noted.
Please see the response to comment 295.

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comment | *495*   comment by: *AIRBUS HELICOPTERS*

§ 2.3.5: it is written *'This proposal does not require recertification of aircraft; however, an applicant wishing to certify additional functionalities on already type-certified aircraft would have to apply on the basis of the proposed CS-ACNS'*

Comment: for already certified aircraft, according to 21.A.101 rules, and as specifically written by EASA in § 5.1 'Design-*related requirements from other aviation domains'* of GM 21.A.101 of EU Regulation n° 748/2012, CS-ACNS may be added to the certification basis only by mutual agreement between the applicant and EASA.

response | Noted.
From a Part 21 point of view, the commentator is correct. In practice however, the current AMCs will cease to exist, the TGL will no longer be recognised and the CS contains requirements for ICAO Navigation Specifications for which EASA did not previously publish CS or AMC guidance. The applicant will, therefore, have the choice between accepting the CS as the certification basis, or to establish a certification basis using Certification Review Items that will contain criteria similar to those contained in the CS. Experience has shown that the latter is often a much more demanding process to the applicant to manage, than accepting the CS as part of the certification basis.

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comment | *496*   comment by: *AIRBUS HELICOPTERS*

§ 2.3.6 Table 1

Comment: the wording 'Mandatory/Required' is unusual in a CS and is confusing. Indeed required specifications are not defined at the CS level but at the certification basis level.

response | Noted
Table 1 is reproduced in Subsection 1 of CS-ACNS as a way to describe visually the applicability of the airworthiness requirements for the different RNP specifications.

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comment | *497*   comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

Paragraph 2.3.3 b) : DGAC France does not concur with the EASA statement (disagreement with the IACO policy).

In addition, previously, some aircrafts were certified for RNP APCH without having the capability to perform RNAV/RNP En-route and/or arrival operations, for example :

RNAV1 requires the capability to fly path terminator which are not used for RNP APCH.
RNP 4 requires 2 RNAV systems whereas 1 RNAV system could be sufficient for RNP1.

Therefore, the ICAO statement was to highlight that a the required accuracy value (RNP value) was one requirement of a PBN navigation specification between others (i.e. functionalities such as path terminator capability, continuity of service,...).

So DGAC France recommends that EASA takes into account retrofits matters. It can be easy to install and certify "old" General Aviation aircraft for RNP APCH (LPV) only, but make them comply with RNAV 1 and/or RNP 1 could be very expensive leading the necessity to change the CDI into an EHSI. The possibility to certify GA aircraft only for one nav spec without requiring compliance with other nav spec should be kept.

If in the next few years all the GA aircraft should be RNP APCH capable, it may not be true for RNAV 1 /RNP 1 which will be developped mainly on the major airports.

response	Noted.

EASA concurs with the idea that ICAO statement refers to the fact that the navigation accuracy is just one of the many requirements that define a navigation specification. Subpart C considers the future needs in terms of aircraft equipage. With the adoption of Regulation (EU) 2018/1048 all instrument runway ends will be served with

- RNP approaches down to the three lines of minima.
- RNAV 1 or RNP 1 applicable to all SIDs/STARs, wherever these routes are established

Therefore, EASA expects applicants to apply for RNP APCH certification. Compliance with those requirements ensure that aircraft are capable of flying the above SIDs and STARs, which simplifies the process for both the applicants and EASA.
In any case, certification for a limited number of PBN capabilities, e.g. RNP APCH down LPV minima alone, will remain possible through certification review items (CRIs).

comment	*509*	comment by: *General Aviation Manufacturers Association*

Page 6: NPA 2.2 - Applicability of this CS ACNS to new functions on already certified aircraft: GAMA is concerned that the revision to CS-ACNS will not invalidate previous certifications achieved under the cancelled AMCs. We recommend an additional statement clarifying the intent e.g. "the revision of this document is not intended to modify, change or cancel equipment design or previous airworthiness approvals." or similar statement.

Further we are concerned that the proposed revision to CS-ACNS may restrict the introduction of new functionality (e.g., temperature compensation) to an existing equipment approval that previously had final approach barometric VNAV certified under the now cancelled AMC 20-27A. Further clarification would be appreciated.

Page 7-9: NPA 2018-02 sections 2.3.3 and 2.3.4 - Absence of traceability of means of compliance between previous AMC and the proposed text e.g. between the existing AMC 20-4A, AMC 20-5, AMC 20-12, AMC 20-26, AMC 20-27A and AMC 20-28 as well

as TGL 10 have been accurately translated into the requirements defined in CS-ACNS; this assumes there are no deviations or differences as previously outlined in the current revision of CS-ACNS e.g. Appendices D and E etc. Further how does this relate to the revised SSD list recently published in EASA-FAA TIP Rev 6.0.

response | Partially accepted.
With regards to continued recognition of existing approvals, please see the response to comment 323
With regards to the SSD, please see the response to comment 229.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart A — General | CS ACNS.A.GEN.001 Applicability   p. 13

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comment | *323*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 13 CS ACNS.A.GEN.001

PROPOSED TEXT / COMMENT:

It is proposed to clarify the applicability in CS ACNS.A.GEN.001 as follow :
"- The subpart C of CS ACNS will be applied to certify PBN functionalities on new Type certified   aircraft
- If TGL-10 or AMC 20-X or an any other guidance recognised by EASA, has been applied on a type certified aircraft and if the function to be certified is covered by this guidance; then this guidance remains applicable to certify functionalities, changes and evolutions; on this type certified aircraft and on its derivatives (new engine,   new   wings,   conversion   to   freighter…).
- If a Type certified aircraft has no previous approval against an AMC 20-X or TGL 10 or any other guidance previously recognised by EASA, the CS-ACNS will be applied to certify the new functionality. EASA will however recognize prior certifications on other PBN functionalities and provide credit for this for the compliance to CS ACNS Subpart C (e.g. : compliance to subsections 1&2 will be recognised as covered by past PBN certification exercises...)"

RATIONALE / REASON / JUSTIFICATION:

See comments (321-322) related to Page 5 (§2.2) and Page 9 (§2.3.5) :

response | Partially accepted.
In general, existing approvals will be grandfathered and considered as part of the certification basis of the aircraft. Where changes are introduced that have not already been covered by the existing approval, the CS-ACNS will apply. EASA will however provide credit for the existing approval to the extent that this is reasonable. Text will be added to CS-ACNS to state this.
For example: An aircraft has been certified for RNP-APCH with barometric VNAV to the criteria of AMC 20-27. The applicant intends to add the capability to fly approach

procedures to LPV minima, but the aircraft has not previously been certified to AMC 20-28. In this case, CS-ACNS will apply.

Text will be added to the CS to clarify the EASA position with regard to recognition of existing approvals.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart A — General | CS ACNS.A.GEN.005 Definitions   p. 14-16

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comment	*143*	comment by: *Leonardo Helicopters*

Page 14

For FMS the Advisory Vertical Guidance is based on GNSS altitude data. It uses, as Approved Baro-VNAV, the GPA (if available) at MAPt wpt of approach stored in NAV DB.

response	Noted. Please see the response to comment 485.

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comment	*144*	comment by: *Leonardo Helicopters*

Page 16

We would suggest a little rewording: means a wide area differential GNSS augmentation system using a regional monitoring network to collect data from core constellations and providing a navigation message to users via satellites in geostationary orbit.

response	Partially accepted. The definition for SBAS has been amended to add precision.

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comment	*154*	comment by: *Garmin International*

CS ACNS.A.GEN.005 Definitions - Field of view - Page 15:

AC 20-138D Chg 2 Chapter 15, paragraph 15-2.b.(2) includes: "Traditionally, 14 CFR part 23 airplanes with "classic" analog instrumentation in the "basic T" arrangement have included the center radio stack within the allowable field of view to satisfy this guidance. There is no intent for this AC to change that long-standing guidance." Similarly, AC 20-138D Chg 2 Appendix 9, paragraph A9-1.r Primary Field of View includes: "The primary field of view definition should be broad enough to include the center radio stack on 14 CFR part 23 airplanes with "classic", analog basic 'T' instrumentation. For rotorcraft, reference the visibility requirements defined in the latest revisions of AC 27-1 and 29-2."

AC 27-1B and AC 29-2C Chg 7 MG 19 paragraph c.(2)(iv) includes: "Arrangement and visibility of primary flight and navigation information. Place the primary flight and navigation information in the pilot's primary field of view. Figure [AC 27 | AC 29] MG

19-1 illustrates the primary field of view. Due to rotorcraft instrument panel design, the display of some information may be located below -15° and will need flight evaluation to confirm that pilots can see the information easily without extensive eye movements"

The Field of View definition should be revised to include the AC 20-138D part 23 accommodation and AC 27-1B and AC 29-2C rotorcraft field of view considerations.

response | Not accepted.
In general, the CS-ACNS has been written in a manner that offers more flexibility with regards to where crucial information is presented, than the previous AMC 20-XX allowed. The maximum field of view allows information to be located below 20 degrees. EASA believes that the current provisions are sufficient.

comment | *238*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

CS ACNS.A.GEN.005 Definitions

PROPOSED TEXT / COMMENT:

Could EASA add the definition of "Track" and "Path" ?

RATIONALE / REASON / JUSTIFICATION:

It is not obvious reading the CS ACNS if there is a difference between "Track" and "Path" or if same defintions as the ED 75D are used ?

response | Accepted.
The new CS-ACNS definitions for "desired path" and for "defined path" are copied from ED-75D Appendix A. The new Definition for "track" has been copied from ICAO Doc. 9569.

comment | *248*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 15 CS ACNS.A.GEN.005 Definitions: Navigation aid

PROPOSED TEXT / COMMENT:

It is suggested to precise the difinition and add at the end "or its bearing".

RATIONALE / REASON / JUSTIFICATION:

This is not only for position determination as it can provide an angle

response | Accepted.
The definition has been amended accordingly.

comment	249	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 15 CS ACNS.A.GEN.005 Definitions: Mean sea laval

PROPOSED TEXT / COMMENT:

Proposed definition :
"Mean sea level (MSL) means a geoid reference for measuring and specifying altitudes in aeronautical information, based on an Earth Gravitational Model."

RATIONALE / REASON / JUSTIFICATION:

For clarification

response

Not accepted.
The definition of MSL is believed to suffice.

comment	334	comment by: *Embraer S.A.*

Embraer believes that the proposed IRU definition might give the wrong impression that there is no integration with other aircraft sensors. However, it is quite common to integrate IRU data with GNSS, in order to reduce position, velocity and tilt errors within the IRU. This capability is quite advantageous for lower RNP approaches.

To change the text from:

Inertial navigation system/inertial reference unit (INS/IRU) means a stand-alone aircraft position sensor relying on accelerometers and gyroscopes to estimate position, direction and velocity.

To:

Inertial navigation system/inertial reference unit (INS/IRU) means a stand-alone aircraft position sensor relying on accelerometers and gyroscopes to estimate position, direction and velocity. GNSS data may be coupled to IRU to provide more accurate navigation information.

response

Partially accepted.
The definition has been amended to remove the notion of stand-alone sensor.

comment	342	comment by: *Embraer S.A.*

Embraer suggests adding the definitions of GNSS, GPS, Galileo and GLONASS.

Satellite navigation is the cornerstone of PBN operations. It would be advisable to have the definitions of GNSS, GPS, Galileo and GLONASS on CS.ACSN.A.GEN.005. It is suggested to adopt the definitions that already exist in FAA AC 20-138D, change 2.

To add the following text in CS.ACSN.A.GEN.005:

Galileo is a European satellite-based radio navigation system being developed that will provide a global positioning service. Galileo will provide two levels of service: an open service for non-critical applications, and a fee-based service for safety-of-life applications. However, the two-level structure hasn't been irrevocably set. The Galileo open service will provide two signals that are interoperable with, but will be independent from, GPS for aviation applications.

Global Navigation Satellite System (GNSS) is a generic term for satellite-based navigation, including GPS, GPS/SBAS, GPS/GBAS, GLONASS, Galileo and any other satellite navigation or augmentation system suitable for aviation use within the Aeronautical Radio Navigation Service (ARNS) frequency band.

Global Positioning System (GPS) is a U.S. satellite-based radio navigation system that provides a global positioning service. The service provided by GPS for civil use is defined in the September 2008 GPS Standard Positioning System Performance Standard, 4th edition available at http://pnt.gov/public/docs/2008/spsps2008.pdf.

GLONASS is a Russian Federation satellite-based radio navigation system providing a global positioning service. GLONASS has 24 operational satellites in their designated orbital slots.

response	Not accepted. The definitions of the different GNSS core constellations does not bring any added value as long as only 'GNSS' is used in CS-ACNS. It should be noted that the term 'GNSS' is now generalised, as previous references to 'GPS' have been replaced by references to 'GNSS'. See also response to comment 144.

comment	*347* comment by: *Embraer S.A.*

The proposed VOR definition could mislead the reader on how the system currently works. The way the proposed definition is written, it may give the impression that it receives signals from satellites.

To change the text from:

VHF omnidirectional range (VOR) means a ground–airborne positioning system based on signals in space transmitted by the VOR ground station to the aircraft VOR receiver to measure its angular position from the ground station.

To:

VHF omnidirectional range (VOR) means a ground–airborne positioning system based on <u>radio waves</u> signals ~~in space~~ transmitted by the VOR ground station to the aircraft VOR receiver to measure its angular position from the ground station.

response	Not accepted. The use of the term signal-in-space is not limited to satellite transmissions. For instance, ICAO references consider that many systems, including ground-based

systems, transmit signals in space, which is the case for ILS, MLS, SSR, etc. See ICAO Annex 10 Volume I and Volume IV.

comment	*444*	comment by: *EUROCONTROL*

CS ACNS.A.GEN.005 Definitions

The EUROCONTROL Agency has nine comments, most of them followed by suggestions of change.

Advisory vertical navigation - Page 14
The definition says that it is not based on a vertical path published on a State's aeronautical chart. However, even when there is no protected vertical path in the design - i.e. on a LNAV procedure, there is still a vertical path published on the chart. The wording needs therefore to be changed to address the case where a protected vertical path is part of the procedure design.

ABAS - Page 14
In the definition, the use of term GNSS seems incorrect. This term implies augmentation of some variety. It should therefore read GPS, unless GLONASS is considered as well. Should this assumption be correct then it is proposed to use instead the expression 'a core satellite constellation'. However, it is realised that, as everything falls under ETSO 115 or ETSO 146, then everything is anyway relative to GPS.

INS/IRU - Page 15
It is understood to be a system, not a sensor. Furthermore, it is not sure that today's systems are still relying on gyroscopes. Adding a reference to 'strap-downs' could be appropriate.

MSL - Page 15
The definition given for MSL is incomplete. The AGL definition, i.e. above ground level, should be added.

Navigation aid - Page 15
This is actually the definition of a radio-navigation aid. INS is a navigation aid but it does not transmit signals. It is important that these differences are clarified.

Navigation specification - Page 15
The words "within a defined airspace" should be deleted since they are unnecessary.

RNAV (X) - Page 16
Complete the end of the definition as follows: '... where 'X' refers to the lateral navigation accuracy in nautical miles during 95% of the flight time.'

RNP (X) - Page 16
Complete the end of the definition as follows: '... where 'X' refers to the lateral navigation accuracy in nautical miles during 95% of the flight time, or the operation type.'

PBN - Page 16

Does the operational condition 'ín designated airspace' cover for free route operations?

The EUROCONTROL Agency has also one proposal concerning definitions:

Throughout the document use is made of terms 'Final Approach Fix (FAF)' and 'Final Approach Point (FAP)' without enough consistency. It would be useful to provide a definition for these terms and explain how one relates to the other.

response	Advisory vertical navigation - Page 14 Partially accepted. The definition of Avisory-VNAV has been updated to take into account that 2D approach procedures, like RNP APCH down to LNAV or LP, are also designed to be protected against obstacles and terrain, and consequently, a vertical path is depicted on the chart to inform about the applicable altitude restrictions. ABAS - Page 14 Partially accepted. The term 'GNSS' will be replaced by 'GNSS core constellation'. The notion of 'GNSS' is retained in order to enable the use of constellations, other than GPS. INS/IRU - Page 15 Partially accepted. The notion of 'sensor' has been substituted by 'system', as requested. See also response to comment 334. MSL - Page 15 Not accepted. Elevations, i.e. gravity-related heights, are measured with respect to the MSL datum. Navigation aid - Page 15 Partially accepted. The concept has been renamed to radio navigation aid, as suggested. However, INS is not defined as a navigation aid in CS-ACNS. The notion of aid implies external support for the purpose of navigation. Navigation specification - Page 15 Not accepted. The definition is consistent with that provided in Commission Implementing Regulation (EU) 2018/1048. RNAV (X) - Page 16 Not accepted. The definition is consistent with that provided in Commission Implementing Regulation (EU) 2018/1048. RNP (X) - Page 16 Not accepted. The definition needs to be consistent with that provided in Commission Implementing Regulation (EU) 2018/1048. A minor amendment has been introduced to stick to the definition in the Regulation. PBN - Page 16 Noted. The definition is consistent with that in the ICAO PBN Manual. PBN could indeed support free route operations. Definitions of 'Final Approach Fix (FAF)' and 'Final Approach Point (FAP)'

Partially accepted.
The text will be revised to ensure consistency of the terms used, but no definition will be provided as these concepts have more to do with flight procedure design.

comment	498	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

"Integrity" and "GNSS" definition are missing.

response	Noted.

Noted.
These definitions are available in the initial issue of CS-ACNS.
As for GNSS definition, please also see the response to comment 342.

comment	500	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

In the "Satellite-based augmentation system (SBAS)" definition, "GNSS" should be replaced by "GPS".

response

Not accepted.
In principle, SBAS can use any GNSS core constellation alone or in combination, hence the definition.

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart A — General | CS ACNS.A.GEN.015 Aircraft documentation   p. 17

comment	266	comment by: *ESSP-SAS*

Current Air Ops regulation (e.g. GM2 CAT.IDE.A.345) allows for other documentation references such as:
"(1) AFM, supplements thereto, and documents directly referenced in the AFM; (2) FCOM or similar document;
(3) Service Bulletin or Service Letter issued by the TC holder or STC holder;
(4) approved design data or data issued in support of a design change approval;
(5) 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; and
(6) written evidence obtained from the State of Design."

response

Not accepted.
The reason why GM2 CAT.IDE.A.345 had to allow for other references to be used is because there was no requirement to contain the information in a standardised manner. CS-ACNS.A.GEN.015 is intended to standardise this information and the manner in which it is documented.

comment	461	comment by: *EUROCONTROL*

AMC1 ACNS.A.GEN.015(a) Aircraft documentation - Page 17

	The EUROCONTROL Agency has two comments.
	In (k) 'RNP AR (for approach and/or departures)', it is proposed to spell out the RNP AR APCH and RNP AR DP navigation specifications and functionalities.
	'Scalability' is missing from the list of PBN functionalities.
response	Not accepted. The next amendment of the PBN manual will contain just one RNP AR specification that covers approach and departure. The definition in the CS-ACNS is consistent with this approach. Discussions in the PBNSG have also resulted in an amendment to the scalability function (in the conventional interpretation of the term) from the advanced RNP specification.

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart A — General | AMC1 ACNS.A.GEN.015(a) Aircraft documentation   p. 17

comment	*126* comment by: *European Helicopter Association (EHA)*
	With regards to "AMC1 ACNS.A.GEN.015 Aircraft documentation", please note that the current date RNP AR departure are not included in the 4th edition of the PBN manual. The airborne community doesn't have officially any information\detailed requirements or references for RNP AR departure
response	Noted. EASA acknowledges that ICAO information on RNP AR Departure Procedures is not available to a wider audience yet. The dilemma for EASA is that there is demand from operators and States for such procedures, and ignoring the developments could hinder the development and utilisation of these. On the other hand, awaiting publication of the ICAO specifications would provide more transparency. Considering the agreement within ICAO on the aircraft eligibility criteria for RNP AR DPs, EASA opted for a more proactive approach and decided to include those criteria in the CS-ACNS.

comment	*146* comment by: *Leonardo Helicopters*
	At the current date RNP AR departure are not included in the 4th edition of the PBN manual. The airborne community officially doesn't have any information\detailed requirements or references for RNP AR departure
response	Noted. Please see the response to comment 126.

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart B — Communications (COM) | SECTION 1 — VOICE CHANNEL SPACING (VCS)   p. 18

comment	**4**	comment by: *Luftfahrt-Bundesamt*

Chapter	**Comment**
CS.ACNS.B.VCS.030 Continuity	It is appreciated that EASA has recognized the disproportionality problem coming with the fact that many COMM equipment on the market for General Aviation may be not qualified for MAJOR. However, CS-23 level 1 only covers one seat aircraft. That would not help to solve the disproportionality problem. It is recommended to change the text *"… CS-23 Level 1 aircraft,…"* by *"… aircraft eligible to Standard Changes according to Regulation (EC) No 748/2012, Part-21, 21.A.90B (a) 1…"*
CS.ACNS.B.VCS.030 Continuity	New VCS.030 is not in line with CS.ACNS.B.VCS.025 regarding CS-23 Level 1 a/c. CS.ACNS.B.VCS.025 should be modified according to the above.

response	Partially accepted. The reference made in the CS-ACNS was to identify these aircraft as aircraft with a Single Reciprocating Engine (SRE) of 6000 pounds or less. However, in the frame of introduction of risk classes in CS-23 Amdt 5, this categorisation has been revisited. The reference to Standard Changes of (EC) No 748/2012 does not apply, as these changes are already considered approved and the categorisation of the change does not apply.

comment	**296**	comment by: *Europe Air Sports*

CS-ACNS.B.VCS.030 Continuity.

Question: Why do you explicitly mention CS-23 Level 1 aircraft only?
Rationale: Later you propose the inclusion of Level 1, 2, 3.

response	Noted. The intent of this amendment was to clarify the failure hazard classification for CS-23 Level 1 aircraft in response to stakeholders concerns that the existing requirement would be disproportionate for CS-23 Level 1 aircraft. EASA does not believe that the requirements were disproportionate for the other categories of aircraft. Neither has EASA received concerns from stakeholders indicating that they found the requirements disproportionate. Consequently, EASA does not intend to relax the requirement for the other categories of aircraft.

comment	**356**	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:
Page 18 CS ACNS.B.VCS.030

PROPOSED TEXT / COMMENT:

It is proposed to remove this CS requirement and adress the point similarly as other safety aspects are managed in this CS ACNS.
It is also proposed to precise "Radio communication" and "airspace where continuous air-ground voice communication is mandadatory"

Proposed wording for an AMC :
The voice communication system is designed to meet safety objectives related to the classification of "Loss of Voice communication in continental airspace" resulting from a aircraft safety process compliant with CS 25.1309.
Alternatively the voice communication system is designed so that the "Loss of Voice communication in continental airspace" is considered:
- 'MINOR' for CS-23 Level 1 aircraft
- 'MAJOR' for other aircraft

RATIONALE / REASON / JUSTIFICATION:

The voice communication system is designed so that the loss of radio communications is considered a 'MAJOR' failure condition for those aircraft foreseen to operate within an airspace where continuous air–ground voice communication is mandatory, except for CS-23 Level 1 aircraft, where this failure may be classified as 'MINOR'.
Safety classifications of failures are linked to the architectures and mitigations in place. They are the result of a Safety analysis performed for compliance to CS 25.1309 as per AMC 25.1309. A CS ACNS requierement should not impose a classification.
Moreover, "Radio communication" could lead to interpretations as it does not precise the radio communications equipement to be considered.
=> It understood by Airbus as "Voice communication"
Similarly the reference to "airspace" where "continuous air-ground voice communication is mandatory" should be precised.
=> It is understood by Airbus as continental airspace.

response	Partially accepted. Although the proposal is appreciated, the proposal would require a full assessment of the entire CS-ACNS to rephrase the requirements and guidance material in a manner similar to the new Subpart C. We have updated the particular CS, however, to match the new scheme of Subpart C with high level CS requirements and a more prescriptive AMC.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 1 — Applicability — General	p. 19-21

comment	*5*	comment by: *Luftfahrt-Bundesamt*
	CS.ACNS.C.PBN.101 Table 1	Section (a) in context with table 1 may be misleading because the table reading direction is not fully clear. Proposal:

	(a) Table 1 helps to identify the subsection(s) covering the requirements related to the PBN specification intended to be used. One should select the target specification from the left column and then follow the respective line to the right.

response	Partially accepted. Thank you for this proposal, the last sentence of which has been adapted and incorporated into the text.

comment	*17*	comment by: *Luftfahrt-Bundesamt*

CM-AS-002 Clarifications to AMC 20-27 Use of S-BAS for LNAV/VNAV approaches Angular vertical deviations Acceptance of FAA AC 20-129	Should the CM be modified or cancelled?

response	Noted. As is the case for the AMC 20-XX material, the CM will be cancelled.

comment	*64*	comment by: *Advanced PBN Solutions*

	Subpart C Section 1, Subsection 1, Table 1. See previous comment for paragraph 2.3.6, Table 1, with regard to Advisory VNAV, FRT and Parallel offset.
response	Accepted. Please see the response to comment 63.

comment	*65*	comment by: *Advanced PBN Solutions*

	Subpart C, Section 1, Subsection 1. GM1-ACNS.C.PBN.101 Applicability. 3rd subparagraph, item c. For consistency, suggest adding A-RNP. A-RNP is shown in the prior Tables as being applicable for oceanic and remote applications.
response	Accepted. Bullet (c) in GM1-ACNS.C.PBN.101 has been modified accordingly.

comment	*127*	comment by: *European Helicopter Association (EHA)*

	With reference to para "CS ACNS.C.PBN.101 Applicability", point (c), we suggest to use the PBN manual wording "The RNP 0.3 specification is primarily intended for helicopter operations" rather than the statement used in the NPA "The RNP 0.3 specification is applicable to helicopters"

response	Not accepted. EASA confirms that the RNP 0.3 specification is only applicable to helicopters.

comment	*128* comment by: *European Helicopter Association (EHA)*
	With regards to "GM1 ACNS.C.PBN.101 Applicability", it has to be considered that the application of the large majority of the PBN nav specs is not dependent upon the availability of ATS surveillance or Communication

response	Noted. EASA however disagrees with the notion that the large majority of the PBN NAV Specs is not dependent on the availability of ATS Surveillance or Communication. On the contrary, the implementation of PBN specifications always requires a full assessment of all the ATS services.

comment	*129* comment by: *European Helicopter Association (EHA)*
	With regards to "GM1 ACNS.C.PBN.101 Applicability", point (f), we suggest to replace the statement "RNP 0.3 was specifically written to facilitate (low-level) en-route operations with rotorcraft" with "RNP 0.3 is primarily intended for helicopter operations and are applied for continental en route (low level), terminal navigation operations and for the initial, intermediate and missed approach navigation operations". RNP 0.3 all phases of flight for helicopter was developed to grant more flexibility in operations allowing easier access to more locations and providing a consistent path for navigation to and away the approach phase.

response	Not accepted. The proposal is not considered to be consistent with the PBN Manual, Part C, Section 7.1.1.

comment	*147* comment by: *Leonardo Helicopters*
	Page 19 We suggest to use the PBN manual wording: The RNP 0.3 specification is primarily intended for helicopter operations The RNP APCH approach includes the LNAV minima type that could be flown without Baro-VNAV. Through the "Required" do you mean to force the Baro-VNAV for RNP APCH with LNAV minima as necessary for LNAV/VNAV minima?
response	Noted. EASA confirms that the RNP 0.3 specification is only applicable to helicopters. See also response to comment 127. Subsection 5 allows procedures to LNAV/VNAV minima to be flown with either barometric altimetry or GNSS/SBAS altimetry. Applications for RNP APCH to LNAV only minima without VNAV have become increasingly rare. Should an applicant wish

to apply for RNP APCH without VNAV, this will be accommodated through the Certification Review Item (CRI) process.

comment	*149*	comment by: *Leonardo Helicopters*

Page 20

Consider also that the application of the large majority of the PBN nav specs is not dependent upon the availability of ATS surveillance or Communication

We suggest to replace the statement with: *RNP 0.3 is primarlly intended for helicopter operations and are applied for continental en route (low level), terminal navigation operations and for the initial, intermediate and missed approach navigation operations*. RNP 0.3 all phases of flight for helicopter was developed to grant more flexibility in operations allowing easier access to more locations and providing a consistent path for navigation to and away the approach phase .

response	Not accepted.

See the responses to comments 128 and 129.

comment	*151*	comment by: *FAA AIR*

Reference Table 1, column labelled Subsection 5, VNAV in final approach. This table states compliance requires VNAV for operational credit in the final approach segment (FAS) of an RNP APCH operation.

COMMENT: *Substantive.* This conflicts with the standards for an RNP system that supports LNAV-only in the (FAS) of an RNP APCH and also conflicts with specifications for SBAS LP approach operation flown to a minimum descent altitude without verical gudiance for operational credit. This includes conflict with TSO/ETSO-C115d, where Class B equipment need not provide a VNAV function for conduct of the RNP APCH FAS.

RECOMMENDATION: Add a clarifying Note highlighting how the NPA requires VNAV when the applicant desires to gain operational credit for VNAV in the FAS of an RNP APCH; specifically, ops credit for use of the LNAV/VNAV and/or LPV lines of minima.

response	Partially accepted.

EASA appreciates the significant safety benefit brought by vertical guidance on final approach and advocates the installation of navigation equipment supporting such functionality. Recent certification experience has shown that applications for RNP APCH without VNAV have become very rare. However, installation of navigation equipment providing lateral guidance only on final approach is possible through Certification Review Items (CRI). This has been clarified in GM1ACNS.C.PBN.101 Applicability.

comment	*155*	comment by: *Garmin International*

CS ACNS.C.PBN.101 Applicability - Page 19:

Table 1, RNP APCH row, indicates Subsection 5 VNAV in final approach is required. But there are RNP APCH specification that allow for approaches that include LNAV only and LP only minimums, which do not require final approach VNAV. Additionally:

- ETSO-C129() does not require final approach VNAV.
- ETSO-C146b/c Class 1 does not require final approach VNAV.
- VNAV is optional even for ETSO-C115d Class B equipment (see RTCA/DO-283B Table 2-13 entry for section 2.2.2 VNAV Functional and Performance Requirements)

 Suggest revising this table entry to more accurately reflect what is intended.

response	Not accepted. See the response to comment 151.

comment	*156*	comment by: *Garmin International*

GM1 ACNS.C.PBN.101 Applicability - Page 20:

Regarding "Subsection 4 addresses the use of advisory vertical navigation (VNAV) outside the approach part of the flight": Per GM1 ACNS.C.PBN.401, subsection 4 also addresses "Advisory vertical guidance … on approaches without a published vertical path (i.e. approaches to LNAV or LP minima)". Thus, subsection 4 is not just for advisory VNAV "outside the approach part of the flight." Suggest revising this statement accordingly.

response	Partially accepted. EASA has decided not to address in CS-ACNS 'Advisory VNAV' outside approach. Reference is made to comment 485.

comment	*250*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

page 20 GM1 ACNS.C.PBN.101

PROPOSED TEXT / COMMENT:

The "Example application of Table 1" seems not consitsent with the Table 1 : It talks about section 8 which is optional in Table 1 and it does not talk about section 4 which is also optional.
It is proposed to put this paragraph in consistency with the Table 1.

RATIONALE / REASON / JUSTIFICATION:

for consistency

response	Partially accepted.

Although the example remains technically correct, it should be noted that Subsection 4 has been revised and its scope has changed.

comment	*268*	comment by: *ESSP-SAS*

CS ACNS.C.PBN.101 Applicability

ICAO PBN Manual states that RNP0.3 navspec might be used NOT ONLY by helicopters, CS states this navspec "is applicable for helicopters". The text could be misunderstanding, as it could be applied as "only" for helicopters.

response	Not accepted.

Not accepted.
EASA confirms that the RNP 0.3 specification is only applicable to helicopters. EASA applies a more strict application of the RNP 0.3 specification than ICAO does. This is supported by the fact that we have not noticed a need to expand the applicability to fixed wing aircraft.

comment	*297*	comment by: *Europe Air Sports*

Page 19
CS-ACNS.C.PBN.101 Applicability

(c) Question: «helicopters » only or all «rotorcraft» ? Please specify!
Rationale: The terms are not synonymous.

response	Accepted.

Accepted.
The word 'rotorcraft' has been replaced by 'helicopter' to improve clarity.

comment	*324*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 19 CS ACNS.C.PBN.101

PROPOSED TEXT / COMMENT:

It is proposed to precise in CS ACNS.C.PBN.101 and/or in its GM, the sections that are applicable to certify approaches with LP/LPV minima.

RATIONALE / REASON / JUSTIFICATION:

As explained in the executive summary, section 2.1 and section 2.2, this NPA aims at cancelling AMC20-28 about the LPV approaches. Table 1 in req. CS ACNS.C.PBN.101 does not identify the sections that are applicable when considering LPV minima Similarly it is understood that this NPA adresses approaches with LP minima.

response	Partially accepted.

Partially accepted.
Approaches to LP or LPV minima are covered under the RNP APCH specification. However, to avoid confusion, clarification has been added to Subsection 1.

comment	343	comment by: *DGA*

In CS ACNS.C.PBN.101 (b), to be absolutely clear, it is worth explaining that certification specifications for RNAV 10, RNAV 5, RNAV 2 and RNAV 1 are given in subsection 2 apart from monitoring and alerting criteria.

response	Partially Accepted.

Guidance on certification for RNAV operations has been added to Subsection 1. Separate criteria for RNAV applications will however not be provided, except for a few that are obviously not covered by the RNP specs.

comment	386	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 19 CS ACNS.C.PBN.101

PROPOSED TEXT / COMMENT:

As written page 5, EASA will recognise that aircraft certified in accordance with CS-ACNS for RNP X will also be recognised as certified for RNAV Y (where Y ≥ X), however there is no more guidance at all for RNAV operations in th CS ACNS. It is understood applicants do not apply anymore for RNAV operations only however RNAV expectations are needed in particular to adress failures leading to the loss of the   RNPx   capability.
It is propose that EASA adds the expectations for RNAV in table 1 of CS ACNS.C.PBN.101.

RATIONALE / REASON / JUSTIFICATION:

response	Partially accepted.

Wording has been added that clarifies that the applicable requirements for RNAV specifications in order to obtain airworthiness approval.

comment	398	comment by: *THALES AVIONICS*

It is understood that current NPA covers only RNAV/RNP operations with GNSS and does not properly address operations in DME/DME.

Thales proposal:

To add a clarification 'The current issue of CS-ACNS navigation section is limited to RNAV/RNP operations with GNSS and does not address operations in DME/DME (It will be introduced in a future issue)'.

response	Accepted.

Wording has been changed to reflect the intent of the comment.

comment	399	comment by: *THALES AVIONICS*

The airworthiness coverage for RNAV operation is not clearly address in the document. For example what is the expectation for alerts in case of failures leading to the loss of the RNPX capability, …).

Thales proposal:

To introduce an explicit link between the RNAV operations and the corresponding CS in the CS-ACNS document.

Note : Do not forget that subsection 4 is applicable to RNAV 1 (in accordance with TGL10)

response	Accepted. Please see the response to comment 398.

comment	*400*	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.101 : FRT for advance RNP is an option at ICAO PBN level and is presently considered optional for advanced RNP functions in the U.S (refer to Appendix 3 of AC20-138D). For international harmonization purpose, Thales proposes to keep the function optional.

Thales proposal:
To replace 'required' by 'optional' for FRT for A-RNP in table 1.

response	Accepted. EASA agrees to make FRT optional for Advanced RNP and Table 1 has been amended accordingly.

comment	*401*	comment by: *THALES AVIONICS*

GM1 ACNS.C.PBN.101 The applicability of various operations/features needs to be corrected/clarified. Without the clarified it may have an impact on the activities conducted by the industry: for example it should be mentioned that RF legs are only for the terminal operation otherwise the text does not clearly limit the demonstration to one area.

Thales proposal:

. To add the mention that RF legs are only for the terminal operations.

. To add the mention that FRT are only for enroute operations.

. To remove 'high' and 'low' continuity considerations for RNP 2 [not used elsewhere in the document]. To clarify that RNP 2 is limited to enroute operations.

. To clarify that RNP 1 is limited to terminal operations.

. To present all the possible minima covered by RNP APCH operations.

. To clarify that when subsection 5 is required not all the minima are required (for exemple implementation of RNP APCH down to LPV minima may be sufficient).

. To clarify that when subsection 6 is required not all the RNP AR operations are required (for example possibility to implement RNP AR approaches without implementing RNP AR departures).

response	Partially accepted. The comments have been accepted and CS-ACNS has been amended to reflect the intent of the comment; however the clarification on the use of FRT and RF is not considered necessary.

comment	**445**	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.101: the title of the third column of table 1 is 'Subsection 3 LNAV in approach ' whereas in the text below table 1 it is written 'Subsection 3: Supplementary specifications for lateral navigation in final approach'. The word 'final' is missing in table 1 for subsection 3- it should be added (it will be coherent with subsection 5 by the way).

Thales proposal:

In the title of the third column of table 1to replace 'Subsection 3 LNAV in approach' by 'Subsection 3 LNAV in final approach'

response	Accepted. Subsection 1 has been updated accordingly.

comment	**462**	comment by: *EUROCONTROL*

CS ACNS.C.PBN.101 Applicability - Page 19

The EUROCONTROL Agency has a comment under the form of a question:

'(c) The RNP 0.3 specification is applicable to helicopters.': could EASA please confirm that RNP 0.3 is applicable only to rotorcraft?

Repetition of EUROCONTROL comments made before:
Subsection 6 should be adapted as follows: 'RNP Authorisation Required Approach (RNP AR APCH)'
Subsection 7 should be adapted as follows: 'Advanced RNP (A-RNP)'

GM1 ACNS.C.PBN.101 Applicability - Page 20

The EUROCONTROL Agency has one question:

At the end of Para. 1, reference is made to, inter alia: 'compliance with the RNAV 10 navigation specifications'. What about a double IN solution?

The EUROCONTROL Agency has three comments, the first and the second giving rise to suggestions.

'(c) RNP 4 and RNP 2 (high continuity) are applied for oceanic and remote continental navigation operations'. This should include A-RNP which can also be applied for oceanic navigation operations.

Para. 5 indicates that 'Some navigation specifications require compliance with supplemental criteria, e.g. compliance with Subsection 10 for parallel offsets for RNP 4'. It is suggested to include additional examples for oceanic/remote continental requirements of RNP2 and A-RNP.

Para. 8 shows a typo: please remove comma in 'fixed radius transition, and parallel offset'.

response	**CS ACNS.C.PBN.101 Applicability - Page 19** Partially accepted. EASA confirm that the RNP 0.3 specification is for helicopters only. EASA does not agree to change the title of Subsection 6 to RNP AR APCH, since the section also includes criteria for departure procedures. **GM1 ACNS.C.PBN.101 Applicability - Page 20** Partially accepted. With reference to A-RNP, this has been included. With reference to paragraph 5, on solutions other than GNSS to comply with RNAV requirements, EASA is of the opinion that since the vast majority of aircraft are now equipped with GNSS and RNP capable systems, these would be perfectly capable of operating on RNAV procedures without having to define criteria for all of the systems which the standards were initially based upon, except where the PBN Manual specifically contains elements that are not covered by the RNP Nav Specs. EASA considers that Table 1 suffices. With regards to Paragraph 8, the typo has been corrected.

comment	*492*	comment by: *Martin Ryff*

CS ACNS.C.PBN.101 Applicability

Is (c) limited to helicopters (or rotorcraft ?)

response	Noted. Please see the response to comment 297.

comment	*499*	comment by: *AIRBUS HELICOPTERS*

CS ACNS.C.PBN.101 Table 1:

Comment: the wording 'Mandatory/Required' is unusual in a CS and is confusing. Indeed required specifications are not defined at the CS level but at the certification basis level.

response	Partially accepted

The words 'mandatory' or 'required' used here relate to application of the NAV Spec, not the CS. Clarification has been added to the GM.

comment	*502*	comment by: *AIRBUS HELICOPTERS*

CS ACNS.C.PBN.101 Table 1, Subsections titles:

Comment: wording 'Supplementary' should be replaced by 'Complementary'. Indeed, 'supplement' indicates 'additional' whereas 'complement' serves to fill a lack.

response	Not accepted.

The word 'supplementary' has purposely been used to indicate that there are additional requirements that need to be fulfilled. It is not intended to fill gaps.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 2 — Generic specifications for performance-based lateral navigation p. 22-37

comment	*7*	comment by: *Luftfahrt-Bundesamt*

CS.ACNS.C.PBN.205 (b)	*"… detailed in 0"* rest of text missing?

response	Accepted.

The text has been amended to correctly refer to Appendix B.

comment	*8*	comment by: *Luftfahrt-Bundesamt*

AMC1 ACNS.C.PBN.210	*"best available source" is unclear, in case source of highest integrity is different to source of highest accuracy. The selected source should be appropriate to the intended operation.*

response	Partially accepted.

The text has been revised to reflect that the system should revert to the best available source i.e. the source that can provide the best computed position in terms of accuracy and integrity.

comment	*9*	comment by: *Luftfahrt-Bundesamt*

GM1 ACNS.C.PBN.215, (a)	*"…fairly high level of confidence, but not a guarantee,…"* *What does that mean?*

response	Partially accepted. The sentence has been removed in response to other comments.

comment	*10*	comment by: *Luftfahrt-Bundesamt*

CS.ACNS.C.PBN.220 Navigation source selection	Manual selection of navigation sensors should be discouraged. Evaluating accuracy and integrity parameters for such a selection in flight would result in higher crew workload.

response	Not accepted. EASA agrees that workload may be a concern, but this is addressed through other CS-XX requirements (e.g. CS 25.1302).

comment	*11*	comment by: *Luftfahrt-Bundesamt*

AMC1 ACNS.C.PBN.280 (c) Deviation display	Manual entering full scale deflection should be discouraged due to potential workload issues.

response	Not accepted. The Luftfahrt-Bundesamt is exactly pointing at the area of concern. Hence the reason for the requirement on the applicant to perform a human factors assessment. Anyway, it should be noted that the full scale deflection settings have been deleted.

comment	*12*	comment by: *Luftfahrt-Bundesamt*

AMC1 ACNS.C.PBN.2100 Note	The Note is misleading and should be removed because the alleviation may also be necessary for small helicopters.

response	Not accepted. The increase in workload resulting from the absence of a slaved selected course has been assessed for fixed wing general aviation aircraft. This is not the case for small helicopters, where such an assessment has not been made. EASA is, therefore, reluctant to expand the applicability to include small helicopters, hence the note. It should also be noted that few small helicopters are actually operated under IFR. Please also see the response to comment 403.

comment	*19*	comment by: *M.Jo (ATR)*
	In GM1 ACNS.C.PBN.205, replace ED-236C by DO236C	
response	Accepted. The change has been made accordingly.	

comment	*23*	comment by: *Rockwell Collins, Inc.*
	Page 22 System Qualification Criteria AMC1 ACNS.C.PBN.205 list item (b): Area navigation system approval, Bullet (b) ends with: "…are detailed in 0". "0" is a link that points to Appendix B, so text is incorrect. Replace "0" text of link with "Appendix B". (suggestion).	
response	Accepted. The text has been amended to correctly refer to Appendix B.	

comment	*24*	comment by: *Rockwell Collins, Inc.*
	Page 22 GM1 ACNS.C.PBN.205 first line RTCA reference: Area navigation system approval, first sentence has RTCA document referenced as ED-236C. Shouldn't this be DO-236C? Change reference to DO-236C (suggestion)	
response	Accepted. The change has been made accordingly.	

comment	*25*	comment by: *Rockwell Collins, Inc.*
	Page 24 GM1 ACNS.C.PBN215: Position estimation, at first glance appears to follow the CS structure but that is not true. Bullet (a) clearly is about position accuracy but bullet (b) starts with position accuracy but the end result is not a probability measure of accuracy. The last sentence in bullet (b) seems to shift to integrity but is very vague. In addition, the value provided does not seem to be capable of supporting the initial approach and final approach and landing requirements for HAZARDOUS and CATASTROPHIC classifications. Later in the NPA "continuity" is introduced; shouldn't it also be included? Revise bullet (b) to clearly delineate between text related to position accuracy and text related to position integrity. Suggest removing the specified numeric value and do like the rest of the NPA and reference integrity to support the requirements shown in Tables showing area navigation system failure conditions (or just say "to provide a level of integrity that supports the intended operation" as used in other areas of the NPA). (suggestion)	

response	Accepted. Bullet (b) has been removed because it added little value to the intended audience of the document.

comment	*26*	comment by: *Rockwell Collins, Inc.*
	Page 27 GM1 ACNS.C.PBN.245 Path definition and leg transition. References RTCA DO-236B as equivalent of ED-75D. Previously equivalent was DO-236C Change 1. Change DO-236B to DO-236C Change 1. (suggestion)	
response	Accepted. ED-75D is equivalent to DO-236C Change 1, so the text has been amended accordingly.	

comment	*34*	comment by: *Dassault-Aviation*
	Dassault-Aviation P22 CS ACNS.C.PBN.205 Comment: (AMC1) Why isn't VOR/DME considered as a position source? Please clarify.	
response	Noted. VOR/DME is not a standardised position source for RNP specifications (cf. ICAO PBN Manual Doc 9613 Fourth edition).	

comment	*35*	comment by: *Dassault-Aviation*
	Dassault-Aviation P 23 CS ACNS.C.PBN.205 Comment: (GM2) Area navigation system approval As stated, (E)TSO-C146c class Delta 4 is specifically designed to support approach down to LP and LPV minima, and was recognized by AMC 20-28 as an AMC for relevant requirements. This class is very useful for integrating LPV in existing avionics. It is not clear why it should not be recognized as an AMC for relevant requirements, equivalent to AMC 20-28, in this document? (see other comments below, subsections 3 and 5, for what is considered as relevant requirements) ? Please substantiate.	
response	Accepted. The text has been changed to reflect the intent of the comment.	

comment	36	comment by: *Dassault-Aviation*

Dassault-Aviation

P 23 CS ACNS.C.PBN.210

Comment:
(AMC1) Position source
The requirement for when GNSS position is no longer available ("...best next available source...") is new and very directive: any position source/logic meeting the requirements should be acceptable. Could you confirm that ETSO-C115d have this level of requirement?
Please confirm.

response | Partially accepted.
The text has been revised to refer to the source that can provide the best computed position in terms of accuracy and integrity.

comment	37	comment by: *Dassault-Aviation*

Dassault-Aviation

P24 CS ACNS.C.PBN.215

Comment:
(GM1) Position estimation
(a) - (b): It is understood that the aim of those sections is to provide definitions/clarifications for position accuracy vs. position error. The sentence at the begining of (b) "The margin between position accuracy and the required performance should be an indication of the available margin" should be moved to (a) as it is related to the position accuracy.
Please correct.

response | Not accepted.
Although EASA appreciated the suggestion, the text of (b) has been removed without carrying over the sentence to (a).
Please also see the response to comment 25.

comment	38	comment by: *Dassault-Aviation*

Dassault-Aviation

P28 CS ACNS.C.PBN.260

Comment:
(CS)   RNAV   holding
It should be clarified that this CS is dedicated to manual holdings (i.e., HM legs) as some specifications may not apply to HA and HF legs (e.g., holding to an altitude and holding to a fix still retain automatic wpt sequencing).
Please clarify

response	Accepted. The item (a)(1) in CS ACNS.C.PBN.260 has been removed.

comment	*39*	comment by: *Dassault-Aviation*
	Dassault-Aviation P30 CS ACNS.C.PBN.280 Comment: (AMC1) Deviation display For FSD setting, the priority should be manual, (c), first, otherwise a pilot entry will never be taken into account. The wording of the note after (c) is ambiguous: it may be inferred that a manual entry above the database value must not be taken into account. Furthermore the note also appears superfluous as the capability for manual entry is already subject to HF assessment in (c). Please clarify	

response	Partially accepted. The bulletpoints related to the full-scale deflection setting in AMC1 ACNS.C.PBN.280 have been deleted.

comment	*40*	comment by: *Dassault-Aviation*
	Dassault-Aviation P 32 CS ACNS.C.PBN.2120 Comment: (AMC1) Data quality requirements (DQRs) Previously a (FAA / EASA) LOA was considered to be an AMC for those requirements: It is assumed that it is still the case. Please confirm and clarify it in the document.	

response	Noted. The AMC 20-XX contained requirements for airworthiness and operational approval. The LOAs were acceptable as an AMC in relation to the operational approval. CS-ACNS only addresses the airworthiness criteria and the reference to DQRs is consistent with Part DAT, the AMCs thereto and ED-75D.

comment	*41*	comment by: *Dassault-Aviation*
	Dassault-Aviation P 35 CS ACNS.C.PBN.2140 Comment: (AMC1) Lateral navigation accuracy, (Table 2) RNP values (in NM) by navigation specification	

	Why A-RNP in En-route continental can be RNP 1 whereas RNP 1 itself is not speciifed for this flight phase? Is there a specific A-RNP function that requires RNP 1 in En-route continental flight phase? which function? Please clarify.
response	Partially accepted. Please see the response to comment 183.

comment	*42*	comment by: *Dassault-Aviation*
	Dassault-Aviation P 37 CS1 ACNS.C.PBN.2150 Comment: (AMC1) Area navigation system design - continuity Please clarify what is meant by "Loss of the capability of the area navigation system to provide lateral position or guidance" : Is it only the loss of the capability to provide (i.e., display) position or guidance data to all pilots, or does this include also loss of integrity (e.g., "Unable RNP")? Is loss of position integrity considered as loss of position here? Please clarify	
response	Noted. See definition of Continuity of Function in section CS ACNS.A.GEN.005 Definitions.	

comment	*43*	comment by: *Dassault-Aviation*
	Dassault-Aviation P 37 CS1 ACNS.C.PBN.2150 Comment: (AMC1) Area navigation system design - continuity Loss of ANS position or guidance is considered Major, more stringent that in AMC 20-27A where the loss of RNP APCH functions is considered as Minor if the operator can revert to a different navigation system and proceed to a suitable airport (§ 6.5 - (b)) What is the rationale for this modification from AMC 20-27A? Please substantiate.	
response	Partially accepted. With the publication of the PBN IR and the update of CS-ACNS, EASA believed that it would be prudent to reassess the failure classifications (FCs). In response to this and other comments on this topic, EASA has decided to revisit the FCs. Further clarification is provided in Section 2.4 of the Explanatory Note.	

comment	*66*	comment by: *Advanced PBN Solutions*
	AMC1-ACNS.C.PBN.205. In item (b), clarify "..are detailed in 0"	

response	Accepted. The text has been amended to correctly refer to Appendix B.

comment	*67* comment by: *Advanced PBN Solutions*
	GM1 ACNS.C.PBN.215 1. Based on the preceding statement for position estimation. Estimated position accuracy is position estimation performance is just one component of RNP. The statement can be read as being the difference between true position and the estimated position. It could also be interpreted on how accurate the navigation sensor is with regard to the position data it provides i.e. the navigation sensor accuracy. In either case, Flight technical error is also a significant component of RNP. The text seems confusing. Suggest replacing the text after the first sentence with "The position accuracy one component of the errors associated with the RNP value." If more is desired, suggest adding "How requirements of the PBN operation will be met will be determined by how the estimated position accuracy is accounted for in the aircraft lateral navigation performance. 2. This is confusing. The first statement appears to describe available margin as though it is what's available for flight technical error. The second statement addresses the integrity of the estimated position with regard to total system error. Read together, it's difficult to understand what is intended.

response	Partially accepted. EASA concurs that the text is potentially confusing and in addition considers that the information in the GM is not required. Relevant parts of the GM have, therefore, been deleted.

comment	*68* comment by: *Advanced PBN Solutions*
	AMC1 ACNS.C.PBN.230 Items (a)(1) and (a)(2) are not required in most PBN navigation specifications, and are available in many in-service aircraft. Item (c) is not in the PBN manual.

response	Not accepted. With regard to items (a)(1) and (a)(2), EASA concatenated the common requirements from several PBN specifications into a 'basic' PBN package, i.e. Subsection 2. Given that some PBN specifications require those items and that most in-service aircrafts provide this functionality, the referred to items were added to the Subsection 2. Item c of AMC1 ACNS.C.PBN.230 is consistent with ED-75D.

comment	*69* comment by: *Advanced PBN Solutions*
	AMC1 ACNS.C.PBN.245. for clarity in the 4th sentence, suggest "..demonstrate that the aircraft and flight systems allow the flight crew..." since the intent appears to be what other means are necessary if the navigation system does not have the functionality.

response	Accepted. The text has been revised accordingly.

comment	70	comment by: *Advanced PBN Solutions*

AMC1 ACNS.C.PBN.260 Is it intended to required RNP holding to satisfy RNAV holding? While it does state what will satisfy the RNAV holding, it will be read as requiring RNP holding.

response	Accepted.

A GM has been added to clarify that the AMC is to require RNAV Holding and not RNP Holding.

comment	71	comment by: *Advanced PBN Solutions*

CS ACNS.C.PBN.270 Item (b). This is not consistent with ED-75. The RNP MOPS specify a change in RNP at the point of transition, not before. There are no standards for RNP systems or equipment for this requirement. If this is desired, perhaps the requirement is to have the ability for the flight crew to confirm or set the RNP prior to the point of transition. However, this may not be desired as it would increase workload and risk for error by requiring increase flight crew action.

response	Partially accepted.

Please see the response to comment 259.

comment	72	comment by: *Advanced PBN Solutions*

AMC1 ACNS.C.PBN.285 Suggest including ETSO-C115d since it should satisfy the requirement also.

response	Not accepted.

RTCA DO-283B, which is the basis for ETSO-C115d does not contain display requirements, therefore, ETSO-C115d cannot be an AMC.

comment	73	comment by: *Advanced PBN Solutions*

AMC1 ACNS.C.PBN.290 ETSO-C115d seems to be missing, as it should satisfy the requirement.

CS ACNS.C.PBN.2110 Item (a) is not consistent with industry standards reflected in ETSO-C115d or ED-75D. They require an indication of the sensors in use, and in the case of GNSS, not each possible constellation. The standards have no guidance for this.

response	Partially accepted.

ETSO-C115d only supports the intent, but a reference has been added.
The requirement to provide an indication of the constellations in use has been removed.

comment	74	comment by: *Advanced PBN Solutions*

AMC1 ACNS.C.PBN.2140
TAble 2. Since RNP scalability is required for A-RNP, suggest including the ranges of RNPs similar to RNP AR APCH.

Table 3. Unless specified elsewhere, suggest noting that for RNP AR APCH, demonstrated performance allows for different allocations in performance.
The third and fifth subparagraph following the table, appear to be addressing the same issue.

response | Not accepted.
The table is consistent with Table II-A-1-1 of the PBN Manual. The AMC has, however, been replaced by a reference to applicable ETSOs.

comment | *108*   comment by: *Transport Canada Civil Aviation Standards Branch*

So does position accuracy cover both lateral (horizontal) and vertical accuracy? Page 23 infers that position relates to Horiizontal position.

"CS ACNS.C.PBN.210 Position source (See AMC1 ACNS.C.PBN.210) The area navigation system uses global navigation satellite system (GNSS) as primary source of horizontal position".

Suggest break out the definitions of horizontal and vertical accuracy. Vertical accuracy will be specific to VNAV and LPV related aspects.

response | Not accepted.
The definitions for lateral and vertical accuracy are in separate sections. Subsection 2 addresses lateral accuracy, whereas Subsection 5 provides the criteria for vertical accuracy.

comment | *109*   comment by: *Transport Canada Civil Aviation Standards Branch*

Suggested improvement: ETSO-C145c and ETSO-C146c (operational class 1, 2 or 3) support the following operations: (a) oceanic/remote en route; (b) continental en route; (c) arrival; (d) approach down to LNAV minima; and (e) departure.

ETSO-C145c and ETSO-C146c (operational class 2 or 3) support, in addition, approach down to LNAV/VNAV minima.

ETSO-C145c and ETSO-C146c (operational class 3) support, in addition, approach down to LP and LPV minima.

response | Partially accepted.
GM2 ACNS.C.PBN.205 has been amended in response to this and other suggestions. Please also see the response to comment 35.

comment | *110*   comment by: *Transport Canada Civil Aviation Standards Branch*

Should this include RNP holding in the title "RNAV/RNP holding". Just wonder why we retain the RNAV term given the jump to RNP in the CS ACNS spec table on page 19 and list on page 20.

response | Noted.
There has been much discussion on RNP holding versus RNAV holding, but standards for the former have never been developed. EASA concurs that this may seem

inconsistent with the RNP based nature of CS-ACNS, but choses to retain the reference to RNAV Holding in order not to create the impression that RNP Holding is intended here.
See also response to comment 70.

comment	111	comment by: *Transport Canada Civil Aviation Standards Branch*

Since the figure is identical to that in the ICAO PBN Manual page ll-A-2-2 suggest use the same title for consistency: "Lateral navigation errors (95 per cent)"

response	Partially accepted. Please see the response to comment 183.

comment	130	comment by: *European Helicopter Association (EHA)*

Reference to "Table 2: RNP values (in NM) by navigation specification": please note that at the current date RNP AR departure are not included in the 4th edition of the PBN manual. The airborne community officially doesn't have any information\detailed requirements or references for RNP AR departure

response	Noted. Please see the response to comment 87.

comment	150	comment by: *Leonardo Helicopters*

Page 22

to include ref also to TSO-C145e

response	Not accepted. Unless equivalent ETSO is not available, AMC refer to ETSOs and not to TSOs.

comment	152	comment by: *Leonardo Helicopters*

Page 24

AMC PBN.215
Or ETSO-C145c-e should be added for FMS with position sensors Beta – 3 with GNSS ETSO C145c (or e)

GM PBN.215
(a) and (b) to add "...lateral position..."

(b) to add: "...margin form current cross track error"

response	Partially accepted. With respect to the AMC, the requirement is on the area navigation system, not on an individual navigation source. An ETSO-C145( ) unit would be considered a navigation source. With respect to the GM, the suggested change has been incorporated, although the wording has been simplified due to other comments.

comment	*153*	comment by: *FAA AIR*

Reference the System Qualification Criteria on page 22.

COMMENT: *Substantive.* This section of the NPA lits ETSO-C196a or ETSO-145c as the basis for RNP system qualification. This ignores the eligibility of ETSO-C129(), ETSO-C145(), ETSO-C146() and ETSO-C196. RNP equipment compliant with these older standards are also capable of meeting the performance and functional requirements for PBN operations.

RECOMMENDATION: Add clarifying text highlighting the performance eligibility of ETSO-C129(), ETSO-C145(), ETSO-C146() and ETSO-C196 GNSS equipment supporting the RNP system. The new text should also clarify how the RNP system must also ensure complaince with all functional requirements for the desired PBN navigation specifications.

RATIONALE: Failure to add this clarity communicates the need for a new airworthiness approval basis when no such need exists for GNSS sensors and RNP systems alreaday installed in aircraft with airworthiness approval for a variety of PBN operations.

response	Not accepted.

Although technically, the older equipment could still support PBN operations, EASA considers the CS-ACNS as a forward looking document. For this reason, the minimum requirements have been raised to the level that is most common today.

It should also be noted that the publication of CS-ACNS does not invalidate existing approvals and credit will be given to recognise those in cases where an applicant applies for a change to an existing approval.

comment	*157*	comment by: *FAA AIR*

Reference CS ACNS.C.PBN.240., which states, "*The area navigation system has the capability to extract routes/procedures from the on-board navigation database, including all their characteristics, and to load them into the area navigation system's flight plan*."

COMMENT: *Substantive.* As stated, this requirement is incomplete. A key requirement for the functionality of the inetraction betwen the RNP system and the supporting on-board navigation database is the ability of the RNP system to extract the entirity of an RNP route or procedure from the database.

RECOMMENDATION: Change the sentence to read, "*The area navigation system has the capability to extract routes/procedures from the on-board navigation database in their entirty, including all their characteristics, and to load them into the area navigation system's flight plan*."

RATIONALE: The addition of this text ensures the RNP system integration does not require the pilot to manually construct routes or procedures by linking and stringing together individual fixes from the navigation database to form a route or procedure in the flight plan. This avoids probable human error that can occur when

the pilot must string together individual fixes. This aso consistent with the ICAO PBN Manual's navigation specifications and FAA AC 20-138D.

response	Accepted. The text has been revised to reflect the suggested change.

comment	*158*	comment by: *Garmin International*

AMC1 ACNS.C.PBN.205 Area navigation system approval - Page 22:

Includes references to ETSO-C146 for stand-alone systems and ETSO-C115d, ETSO-C196a, ETSO-C145c, ETSO-2C66b, and ETSO-C106 for FMS systems.

Stand-alone systems:

- While EASA has rescinded ETSO-C129(), there are many installations based on ETSO-C129() Class A1/A2 standalone systems that are able to meet RNP 1 and/or RNP APCH to LNAV minimums.
- Additionally, there are many installations based on ETSO-C146a/b, i.e., versions prior to ETSO-C146c, and NPA 2017-08 proposed ETSO-C146e (which may now be published).

FMS systems:

- Many FMS have GNSS sensors based on ETSO-C129 Class Bx/Cx, ETSO-C196, ETSO-C145a/b, and NPA 2017-08 proposed ETSO-C145e (which may now be published).

Suggested changes:

   CS-ACNS should be written so that it does not preclude use of ETSO-C129().
- CS-ACNS should be written to be flexible in allowing all applicable versions of ETSOs.

FAA AC 20-138D uses the nomenclature "(AR)" which is defined in Appendix 9, paragraph A9-1.b as "**All Revisions (AR)**. An all-inclusive reference for TSOs with multiple versions that remain applicable." e.g., AC 20-138D uses "TSO-C146(AR)" to refer to all revisions of TSO-C146 equipment. CS-ACNS could consider using similar nomenclature.

It is suggested that these concerns could be resolved by including a general explanation in Subsection 1 since the issues with ETSO references can be found throughout Subsection 2 as well as in other Subsections.

response	Partially accepted. Although technically, the older equipment could still support PBN operations, EASA considers the CS-ACNS as a forward looking document. For this reason, the minimum requirements have been raised to the level that is most common today. It should also be noted that the publication of CS-ACNS does not invalidate existing approvals and credit will be given to recognise those in cases where an applicant applies for a change to an existing approval.

The AMC to CS ACNS.C.PBN.205 has been amended to clarify that when a reference is made to a particular ETSO issue then later issues are also acceptable.

| comment | *159* | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.205 Area navigation system approval - Page 22:

Item (b) cross-reference to INS/IRU functionality and Performance should be fixed

Item (d) should be changed to remove "A1" since ETSO-C106 does not have a class A1.

| response |

Partially accepted.
The cross reference to Appendix B has been corrected.
The A1 to ETSO-C106 does not refer to a class, but to the amendment to the ETSO, which was published on the 12th of July 2013: ESTO-C106 A1. The text has been revised to clarify this.

| comment | *160* | comment by: *FAA AIR* |

Reference CS ACNS.C.PBN.255 Magnetic Variation.

COMMENT: *Substantive.* This section is incomplete and does not include sufficient detail to ensure complaince with the latest public standards for application of magnetic variation by an RNP system found in ED-75D/DO-236C.

RECOMMENDATION: Rewrite this section and invoke the requirements of ED-75D/DO-236C by reference or by copying the requiremenst from the MASPS in their entirity.

RATIONALE: Completeness and accuracy of the requirements for application of magnetic variation by the RNP system in support of PBN operations and procedures.

| response |

Not accepted.
Because VOR is not a recognised position source sensor to support RNP operations, only the relevant sections of ED-75D have been copied into CS ACNS.C.PBN.255.

| comment | *161* | comment by: *FAA AIR* |

Reference AMC1 ACNS.C.PBN.280 Deviation Display

COMMENT: The requirements begin by stating, "...*The full-scale deflection of the non-numeric lateral deviation display should be: (a) comparable with the applicable RNP value;*..." This requirement is vague and inconsistent with the manner the NPA identifies other requirements.

RECOMMENDATION: Change the statement to read: "...*The full-scale deflection of the non-numeric lateral deviation display should: (a) provide a scale equal to two times the applicable RNP value (i.e. 2XRNP); and (b) provides a means for the flight crew to confirm the deviation scaling.*"

	RATIONALE: This removes the vagury as currently stated and establishes a standard for all aircraft integrating an RNP system consistent with industry's best practices.
response	Not accepted. EASA concurs that many industry solutions have a full scale deflection of 2 times the applicable RNP value, but recognises that other scaling solutions may also be acceptable, as long as it allows the flight crew to assess the deviation from the path.

comment	*162*	comment by: *FAA AIR*

Reference AMC1 ACNS.C.PBN.280 Deviation display

COMMENT: The requirements state the deviation display scaling should be set in the following priority: "*(a) automatically to a value obtained from the on-board navigation database; or (b) automatically by default logic; or (c) manually by flight crew procedure subject to human factor assessment performed by the applicant.*" As stated, the requirement protends the setting of the deviation display scaling is independent of the RNP system's selection of the current RNP value, when, in fact, the deviation scaling is dependent on the RNP value active in the RNP system. The requirement also ignores the standards in ED-75D/DO-236C for setting the RNP value and the resulting impacts on the aircraft's deviation scaling.

RECOMMENDATION: Add a new section titled, "RNP value" (or similar). This section should then require the installation of RNP system in the aircraft meet the equipment requirements of DO-236C, paragraph 3.7.5.1.1.

RATIONALE: Completeness and consistency with the existing public standards for RNP systems found in ED-75D/DO-236C.

response	Partially accepted. This part of AMC1 ACNS.C.PBN.280 has been deleted as the result of other comments. See also response to comment 39.

comment	*163*	comment by: *FAA AIR*

Reference AMC1 ACNS.C.PBN.2140 Lateral navigation accuracy

COMMENT: Later navigatiuon "accuracy" is <u>not</u> simply TSE. As stated, this section alters the defintion of the lateral navigation accuracy requirements of E-75D/DO-236C and does not reflect an accuracy requirement. For example, in contrast, DO-236C, paragraph 2.1 establishes the RNP accuracy requirements, and states in 2.1.1, "Each aircaft operating in RNP airspace shall have total system error components in the cross-track and along track directions that are less than the RNP 95% o the flying time." Unlike the NPA, this identfies the accuracy performance requirement as being a requirement to keep TSE lss than RNP for 95% of the flying time.

RECOMMENDATION: Define the RNP lateral accuracy requirement first by reference to ED-75D/DO-236C (see comment above). Then define the components of TSE as currently stated in the NPA.

	RATIONALE: Consistency with ED-75D/DO-236C. Updating the text will establish a performance requirement for the installed RNP system instead of simply mistating that accuracy is TSE.
response	Partially accepted. Reference is made to comment 183.

comment	*164*	comment by: *Garmin International*
	AMC1 ACNS.C.PBN.240 Route/procedure extraction and loading - Page 26: While ETSO-C146c requires the database to include the individual waypoints and navigation aids for routes (aka airways), it does not require the ability to extract routes or route segments by ATS route identifier from the database and load them into the flight plan. ETSO-C115 equipment prior to revision d also did not require this capability. CS ACNS.C.PBN.265 and AMC1 ACNS.C.PBN.265 already specify "The area navigation system provides a means to the flight crew to build a user-defined route by: (a) entering unique waypoints extracted from the on-board navigation database". Suggest revising AMC1 ACNS.C.PBN.240 to allow manual entry of waypoints/fixes for routes per CS ACNS.C.PBN.265.	
response	Not accepted. The text is consistent with the PBN Manual and with FAA AC 20-138D. If the suggestion had been followed, this would have allowed for extraction of incomplete procedures.	

comment	*166*	comment by: *Garmin International*
	AMC1 ACNS.C.PBN.245 Path definition and leg transition - Page 27: "Installation of equipment with an ETSO authorisation against ETSO-C146c satisfies the requirements of (a), (b)(1), (c) and (d)." This also applies to ETSO-C146a & b. However, ETSO-C146e as proposed in NPA 2017-08 "satisfies the requirements" since its Appendix 1 amends DO-229E to require all of the leg types.	
response	Partially accepted. The reference to ETSO-C146e will be added. With regard to ETSO-C146a & b, please see the response to comment 158.	

comment	*167*	comment by: *Garmin International*
	GM1 ACNS.C.PBN.255 Magnetic variation - Page 27: Reference to ED-77/DO-201A. It is questionable whether these documents include the most current guidance on application of magnetic variation. Suggest also including a reference to ED-75D/DO-236C.	
response	Accepted.	

The reference to ED-77/DO-201A has been replaced by a reference to ED-75D/DO-236C Change 1.

| comment | *168* | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.260 RNAV holding - Page 28:

Regarding "Installation of equipment with an ETSO authorisation against ETSO-C115d Class A satisfies the requirement to define the holding pattern (section (b))": Per the RTCA/DO-283B Table 2-13 entry for section 2.2.1.2.6 Holding, holding is optional for both ETSO-C115d Class A and B.

Additionally, all revisions of ETSO-C146 equipment have the capability to meet section (a) via DO-229C/D/E sections 2.2.1.2.5.2 TO/FROM Course Selection and 2.2.1.3.11 Holding Patterns / Procedure Turns.

Suggest revising this AMC to be consistent with what the ETSOs specify.

| response | Partially accepted. |

Indeed, equipment with an ETSO authorisation against ETSO-C115d satisfies the requirement provided that the equipment meet the criteria described in DO-283B § 2.2.1.2.6. In addition equipment with an ETSO authorisation against ETSO-C146c also satisfies the requirement.

| comment | *169* | comment by: *Garmin International* |

CS ACNS.C.PBN.270 Navigation Accuracy - Page 29:

As written, these requirements align with "RNP scalability" which is an Advanced RNP Nav Spec. These requirements should be moved to Subsection 7 (A-RNP) and combined with the requirements of CS ACNS.C.PBN.715 (RNP scalability)

See ACNS.C.PBN.2140 which is an appropriate requirement for Navigation Accuracy.

| response | Partially accepted. |

The wording of Cs ACNS.C.PBN.270 has been slightly amended to align with the AMC, which allows default setting of the RNP in accordance with DO-226( ) Section 2.2.2.6.1. The criteria of CS ACNS.C.PBN.715 are more stringent and do not allow default setting of the RNP.

| comment | *170* | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.270 Navigation accuracy paragraph (a) - Page 29:

The material here aligns with "RNP scalability". This material should be moved to Subsection 7 (A-RNP) and used as a means of compliance for ACNS.C.PBN.715 (RNP scalability).

| response | Not accepted. |

EASA disagrees that CS ACNS.C.PBN.270 and AMC1 ACNS.C.PBN.270 are not appropriate for inclusion in Subsection 2: the AMC ACNS.C.PBN.270 requirement

allows for default setting of the RNP in accordance with DO-229( ) section 2.2.2.6.1. The scalability requirement in Subsection 7 is much more demanding.

comment	*171*	comment by: *Garmin International*

AMC1 ACNS.C.PBN.270 Navigation accuracy paragraph (b) - Page 29:

ETSO-C146c would not be an appropriate means of compliance for acquiring and setting RNP values because ETSO-C146c equipment is not required to load, display or set RNP values. ETSO-C146c equipment sets a Horizontal Alert Limit (HAL) and CDI scale based on the applicable flight phase (e.g. Enroute, Terminal, Approach).

response | Not accepted.
EASA believes that the ETSO-C-146c systems comply with paragraph a(4).

comment	*172*	comment by: *Garmin International*

AMC1 ACNS.C.PBN.280 Deviation display - Page 30:

For the first item (a), the meaning of "comparable with the applicable RNP value" needs to be clarified. Specifically, using a full-scale deflection less than or equal to the applicable RNP value should always be allowed.

response | Not accepted.
The current wording is considered clear enough. Please see the response to comment 161.

comment	*173*	comment by: *Garmin International*

AMC1 ACNS.C.PBN.280 Deviation display - Page 30:

For the second item (a), "automatically to a value obtained from the on-board navigation database", this requirement is more appropriate for "RNP scalability" which is an Advanced RNP Nav Spec. This requirement should be moved to Subsection 7 (A-RNP) and combined with the requirements of CS ACNS.C.PBN.715 (RNP scalability) or it should be noted that automatically setting the value from the on-board database is an optional capability.

response | Noted.
This part of AMC1 ACNS.C.PBN.280 has been deleted as the result of other comments. See also response to comment 39.

comment	*174*	comment by: *Garmin International*

AMC2 ACNS.C.PBN.280 Deviation display - Page 30:

Since DO-229 requires display of lateral deviation and makes no exception for on-ground vs airborne display, ETSO-C146c authorization should also (along with ETSO-C115d) be sufficient as a means of compliance.

response | Accepted.

The reference to ETSO-C146c has been added.

| comment | 175 | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.2100 Selected course - Page 31:

A Horizontal Situation Indicator (HSI) should also be referenced as an acceptable means of compliance (moving map should not be the only means).

| response | Partially accepted. |

The requirements of CS ACNS.C.PBN.2100 have been merged with the requirements of CS ACNS.C.PBN.280. EASA believes that the concern expressed by the commentator has been addressed.
Please also see the response to comment 403.

| comment | 176 | comment by: *Garmin International* |

CS ACNS.C.PBN.2105 Display of altitude/speed constraints - Page 31:

The requirement to display altitude and speed constraints is not appropriate as a general requirement since VNAV is optional for most PBN NAV Specs. See also Table 1: PBN specifications – mandatory and optional airworthiness requirements. This requirement should be moved to subsection 5.

| response | Partially accepted. |

With reference to altitude constraints, EASA concurs and has relocated the criteria to Subsection 4.
See also response to comment 359.

| comment | 177 | comment by: *Garmin International* |

CS ACNS.C.PBN.2110 Display of navigation aid frequencies and/or identifiers - Page 31:

It is not clear what is expected for item (a) "display of GNSS constellation(s)".
Additionally:

- No revisions of ETSO-C146 require the capability to meet either item (a) or (c).
- It is also unlikely that ETSO-C115d equipment can meet item (c) since GNSS sensors complying with ARINC 743 have no labels communicating which SBAS provider ID is correcting the GPS satellites.

Consequently, it is unclear how any existing equipment can comply.

Furthermore, there is no associated means of compliance identified.

| response | Accepted. |

The requirement to display the GNSS constellation(s) and the SBAS service provider in use has been removed.

| comment | 178 | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.2135 Navigation accuracy alerting - Page 33:

The material here aligns with "RNP scalability". This material should be moved to Subsection 7 (A-RNP) and revised as necessary.

| response | Not accepted.
EASA disagrees. This function relates to manual entry of RNP values, not to scalability. |

| comment | 183 | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.2140 Lateral navigation accuracy - Page 34-36:

As written, the AMC implies that it is expected that applicants will have to show each installation meets TSE. This is unnecessary for ETSO-C146() equipment given the DO-229() requirements for database resolution (PDE), the uncorrected accuracy of GPS (NSE), and the FTE credit given in Table 3. ETSO-C115d equipment that is using GPS as its source also should not have to calculate TSE. Suggest revising the AMC to indicate that for these situations, the installation will be expected to meet the TSE without further showing.

| response | Accepted.
The AMC has been replaced with text that reflects the intent of the comment. |

| comment | 184 | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.2140 Lateral navigation accuracy - Page 36:

The paragraph starting with "For systems integrating INS/IRU with GNSS" is mostly redundant with the prior paragraph starting with "The flight time duration considered for demonstrating INS/IRU sensor lateral position accuracy performance". Suggest combining/consolidating these two paragraphs.

| response | Partially accepted.
Please see the response to comment 183. |

| comment | 230 | comment by: *Garmin International* |

GM1 ACNS.C.PBN.245 Path definition and leg transition - Page 27:

Reference to DO-236B. DO-236C is current.

| response | Accepted.
In fact, DO-236C Change1 is equivalent to ED-75D. |

| comment | 231 | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.2115 Use of navigation database - Page 32:

Referring to item (d) – VNAV is optional for most PBN NAV Specs. See also Table 1: PBN specifications – mandatory and optional airworthiness requirements. Thus, it is not appropriate to require altitude and/or speed constraints in databases for equipment that does not support the optional VNAV capability.

| response | Partially accepted.
See the response to comment 176. |

| comment | *232* | comment by: *Garmin International* |

CS ACNS.C.PBN.2135 Navigation accuracy alerting - Page 33:

As written, these requirements align with "RNP scalability" which is an Advanced RNP Nav Spec. These requirements should be moved to Subsection 7 (A-RNP).

| response | Not accepted.
Please see the response to comment 178. |

| comment | *234* | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.240 Route/procedure extraction and loading - Page 26:

The additional requirement placed on ETSO-C146c equipment that "the applicant should ensure that both altitude and speed constraints are extracted from the database" is not appropriate as a general requirement since VNAV is optional for most PBN NAV Specs. VNAV is optional even for ETSO-C115d Class B, which "satisfies the requirement". See RTCA/DO-283B Table 2-13 entry for section 2.2.2 VNAV Functional and Performance Requirements. See also Table 1: PBN specifications – mandatory and optional airworthiness requirements. Suggest removing this additional requirement for ETSO-C146c equipment.

| response | Partially accepted.
Please see the response to comment 176. |

| comment | *241* | comment by: *AIRBUS* |

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 36: AMC1 ACNS.C.PBN.2145

PROPOSED TEXT / COMMENT:

It is proposed to write the AMC as follow :

"The area navigation system, including position sensors, displays, etc., is designed to provide a level of integrity that supports the classification of failure conditions resulting from the Safety analysis performed in compliance to CS 25.1309. In absence of robust and complete safety process, the applicant should design it to provide a level of integrity that supports the classification of failure conditions defined in Table 4 below."

RATIONALE / REASON / JUSTIFICATION:

Failure cases and their Safety Classifications are linked to the operations, architectures, mitigations in place and information presented to the crew. The only means to assess classification is through compliance to CS 25.1309 applying as per AMC 25.1309 the FHA/SSA process during certification, using pilots judgment and simulator as necessary.

Safety classifications should not be constraint by AMCs when a robust safety process is in place.

It can be understood to provide suggested classifications/guidelines in specifc cases for which safety analyse cannot be performed.

response | Not accepted.
The AMC is intended to provide generic guidance on failure hazard classifications that would be acceptable to EASA. Since this has been incorporated in the AMC, it does not preclude organisations that have the capability and experience to do so from performing a robust safety analysis and present the resulting failure hazard classifications to EASA.
Please also see the response to comment 43.

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comment | *253*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

page 22 AMC1 ACNS.C.PBN.205

PROPOSED TEXT / COMMENT:

in bullet (b): "are detailed in appendix B"

RATIONALE / REASON / JUSTIFICATION:

"(b) INS/IRU horizontal position source, whose functionality and performance are detailed in 0". There is no section "0" in the document. Airbus assumes it is appendix B

response | Accepted.
The text has been revised to refer to Appendix B.

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comment | *254*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 23 GM3 ACNS.C.PBN.205 Area navigation system approval

PROPOSED TEXT / COMMENT:

It is proposed to replace DO-229D by DO-229E and to add also DO-316 Appendix R as a valid source for additional guidance on "tightly coupled" GNSS/IRUs

RATIONALE / REASON / JUSTIFICATION:

For 'tightly coupled' GNSS/IRUs, RTCA Document DO-229D, Appendix R, provides additional guidance on 'tightly coupled' GNSS/IRUs. DO-229D has been revised (DO-229E is now released). Besides, DO-316 also provides Appendix R and should also be mentionned in the GM.

response	Partially accepted. In GM3 ACNS.C.PBN.205 the reference to DO-229D has been kept as it is considered to suffice, whereas the reference to DO-316 has been added for providing adequate guidance on tightly coupled GNSS/IRU.

comment	*255*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 23 AMC1 ACNS.C.PBN.210 Position source

PROPOSED TEXT / COMMENT:

It is proposed to reword the AMC as follow:
"If other horizontal position sources are available, they may be used to complement the GNSS-computed position provided that the output position continues to meet the required performances.
(…)"

RATIONALE / REASON / JUSTIFICATION:

If other horizontal position sources are available, they may be used to complement the GNSS-computed position provided that these sources do not degrade the GNSS-computed position.
It is understood that hybrid / augmented positions are acceptable. How can an applicant demonstrate that these sources do not degrade the GNSS position ? Objective should remain to demonstrated required navigation performances.

response	Accepted. The text has been revised in accordance with the suggestion.

comment	*256*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 24 AMC1 ACNS.C.PBN.225

PROPOSED TEXT / COMMENT:

AMC should provide other acceptable means to comply with following part of the requirement "to perform a reasonableness check of the radio navigation data" when ETSO-C115d is not used.

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An agency of the European Union

RATIONALE / REASON / JUSTIFICATION:

ETSO-C115d is for Airborne Area Navigation Equipment Flight Management Systems (FMS) Using Multi-Sensor Inputs

Additional AMC should be proposed when ETSO-C115d is not used

response | Accepted.
A reference to ED-75D § 3.7.3.1.1 has been included in AMC1 ACNS.C.PBN.225.

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comment | *257*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 24 GM1 ACNS.C.PBN.215

PROPOSED TEXT / COMMENT:

Move the definition part of item (a) in CS.ACNS.A.GEN.005 and delete the rest of GM1 ACNS.C.PBN.215.

RATIONALE / REASON / JUSTIFICATION:

Item (a):
First part of item (a) is a definition and is proposed to be moved in CS.ACNS.A.GEN.005
It is proposed to remove in (a) the following part that does not provide additional guidance: 'if the position accuracy is less than the RNP value, there should be a fairly high level of confidence, but not a guarantee, that the system can meet the requirements of the intended PBN operation'.

Also it is proposed to remove the entire section (b) that is not used elsewhere in the CS ACNS and therefore does not provide added value 'The margin between position accuracy and the required performance should be an indication of the available margin. The position error is the radius of a circle, centred on the estimated position, such that the probability of the true position lying outside the circle without being detected is less than or equal to 10-5/hour.'

response | Partially accepted.
EASA agrees to remove (b), but considers that (a) is merely providing guidance, rather than providing a definition. However, the second part of (a) has been removed as suggested.

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comment | *258*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 26 AMC1 ACNS.C.PBN.235 Automatic leg sequencing

PROPOSED TEXT / COMMENT:

AMC recognises that equipment with an autorisation against "ETSO-C115d and ETSO-C146c" comply with the requirement.

In addition to the general remarks made on the use of ESTOs in AMCs (e.g. : AMC should recognise not only ETSO but also relevant sections of ED 75D, complaince to ETSO could also be done without ETSOA, ETSO should regognise "other equivalent satndards" and future version of ETSOs...), it is understood that this AMC would refer to ETSO-C115d or to ETSO-C146c.

response	Partially accepted. EASA does not agree that an ETSO should recognise other equivalent standards than those specified in CS-ETSO. The use of equipment that has been authorised against an ETSO is, however, not a requirement. However, references to the applicable sections of ED-75D have been added, where appropriate, in Subpart C.

comment	*259*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 29 CS ACNS.C.PBN.270 Navigation accuracy

PROPOSED TEXT / COMMENT:

It is proposed to change "prior to" by "no later than reaching the leg" and to remove considerations with regard to latency.

"When an aircraft flies an RNP route or procedure and the RNP value changes to a lower value, the area navigation system completes the change no later than reaching the leg with the lower RNP value."

RATIONALE / REASON / JUSTIFICATION:

This CS requires in case of reduction of RNP value to "complete the change prior to reaching the leg with the lower RNP value, considering the latency of the monitoring and alerting function of the area navigation system" , this should be objective oriented and not requiring anticipation of change that may take less than 500 ms

response	Accepted. The text has been revised to reflect the suggestion.

comment	*260*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 29 AMC1 ACNS.C.PBN.270 Navigation accuracy

PROPOSED TEXT / COMMENT:

Proposed   text
"The RNP value associated with a leg or segment should be assigned in the following order of precedence:

(1) Flight crew manually entered RNP value for the leg or segment;

(2) The RNP value coded in the on-board navigation database for the current leg or segment; if implemented
(3) The RNP value coded in the on-board navigation database for the current area; if implemented
(4) A system default RNP value if provided by the area navigation system."

RATIONALE / REASON / JUSTIFICATION:

This AMC should be more generic. Indeed point (3) is not possible with A424 and some other points may not be implemented.

response | Accepted.
EASA concurs with the addition of 'if implemented' to a(2) and a(3) in AMC1 ACNS.C.PBN.270. The text has been revised accordingly.

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comment | *261*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 32 CS ACNS.C.PBN.2125 Extraction and display of navigation data

PROPOSED TEXT / COMMENT:

It is propose to add an AMC to precise the intent of the CS requirement :
- this intent is not to prevent truncating resolution to optimise performance as long as the truncation is commensurate with the procedure.
- This intent is to ensure compatibility between the database and the nav system.
It is also proposed to remove the word 'unique' in "load from the on-board navigation database, by its unique identifier, the procedure(s) to be flown."

RATIONALE / REASON / JUSTIFICATION:

All data are not systematically processed with the full resolution of the database inputs.
As written the requirement is prescriptive and does not allow some optimisations. It is understood that the objective of this CS is to ensure compatibility between database and navigation system and that the goal of the CS is not to prevent from truncating resolution to optimise possible performances.
In addition, the terminology 'unique identifier' in b (2) may be subject to wrong interpretations as in the NDB it is a combination of identifiers (Airport + rwy + approach) that ensures the unicity.

response | Accepted.
A GM has been added to provide the requested clarification.

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comment | *262*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 34 AMC1 ACNS.C.PBN.2140

PROPOSED TEXT / COMMENT:

It is proposed to make consistent this table with the table in AC 20-138D Change 2.

RATIONALE / REASON / JUSTIFICATION:

Table 3 does not define FTE for autopilot or flight director when the targeted RNP value (TSE) is 2 or 4.

response	Partially accepted. Please see comment 183.

comment	*267*	comment by: *ESSP-SAS*

AMC1 ACNS.C.PBN.2130 Alerting associated with degradation of navigation

Former AMC 20-28 (Section 7.1 Required Functions, item 2) also allowed for allocating the indication within the maximum ("normal") field of view subject to EASA agreement for RNP APCH to LPV operations.

response	Accepted. The application has been broadened.

comment	*270*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.2150 : Loss of RNP APCH capability is always classified as MAJOR whereas it is possible to classify it Minor in AMC20-27 if there is a possibility to revert to different navigation system. Moreover it is Minor in AC20-138D change 2 if there is a possibility to revert to different navigation system.

Thales proposal:
Add the following sentence in AMC : 'Loss of the RNP APCH function is considered a minor failure condition if the operator can revert to a different navigation system and proceed to a suitable airport

response	Partially accepted. Please see the response to comment 43.

comment	*271*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.2150 : Loss of RNP 1 capability is always classified as MAJOR whereas it is possible to classify it Minor in AC20-138D change 2 if there is a possibility to revert to different navigation system..

Thales proposal:
Add the following sentence in AMC : 'Loss of the RNP 1 function is considered a minor failure condition if the operator can revert to a different navigation system and proceed to a suitable airport.'

response	Partially accepted. Please see the response to comment 43.

comment	272	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.2150 : Loss of RNP 0,3 capability is always classified as MAJOR whereas it is possible to classify it Minor in AC20-138D change 2 for domestic rotorcraft en-route if there is a possibility to revert to different navigation system.

Thales proposal:
Add the following sentence in AMC : 'Loss of the RNP 0,3 function is considered a minor failure condition if the operator can revert to a different navigation system and proceed to a suitable airport.'

response	Partially accepted. Please see the response to comment 43.

comment	281	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.270 : (A) (3) is not possible to implement as current A424 standard does define the RNP value for the current area.

Thales proposal:

To add 'if defined' to item (a) (2) and (a) (3)

response	Accepted. The text has been revised to reflect the suggested change. Please see also response to comment 260.

comment	283	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.2125 : (b) (2) Approach procedure is not defined by a unique identifier in the navigation database but by a combination of identifier (airport + rwy + approach).

Thales proposal:

Remove the word 'unique' in the sentence of (b) (2)

response	Accepted. The word 'unique' has been deleted from CS ACNS.C.PBN.2125.

comment	285	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.275 : ETSO-C146c is reference, it is not the last issue of the ETSO. Following issue of the ETSO should satisfy the requirement too.

Thales proposal:

To replace 'ETSO-C146c' by 'ETSO-C146c and following issues'

response	Accepted.

A statement has been added to indicate that these are minimum requirements. Please see the response to comment 158

| comment | 288 | comment by: *Leonardo Helicopters* |

Page 25

ref. "requires positive action by the flight crew"
The lateral DIR-TO function is an exception. It doesn't require the pilot ackwologement

ref. "distance to go to any waypoint"
The bearing distance to any waypoint. In FMS the distance to go (DTG) is reserved for the distance from the a/c present position and the waypoint to which the aircraft is flying (the "TO" waypoint)

ref. "except for final approach segment (FAS) data blocks protected by a cyclic redundancy check (CRC) code"
This is not true: the FMS should not allow also the modification of SID, STAR and any approach (not only LPV/LP/GLS approach with FAS DB protected by CRC) procedures retrieved by NAV DB

| response | Not accepted.
Comment 1 - 'positive action' does not mean necessarily 'acknowledgement'.
Comment 2 - the option proposed in the comment is not the only solution to meet the CS requirement.
Comment 3- the FMS does not allow the modification of the database (cf CS ACNS.C.PBN.2115 item (a)), but it allows the aircrew to amend the downloaded procedure within the FMS.

| comment | 298 | comment by: *Europe Air Sports* |

Page 22
AMC1 CNS.C.PBN.205 Area navigation system approval

2nd text block, (b): Question: What "0" is meant? Please clarify.

Rationale: The text will be easier to understand with a clearer reference.

| response | Accepted.
A reference to Appendix B has been made to correct the error.

| comment | 299 | comment by: *Europe Air Sports* |

Page 23
GM2 ACNS.C. PBN.205 Area navigation system approval

Mid-page text block: "The minimum system requirements…": The entire sentence in bold characters please!

	Rationale: In our view first of all the requirements in place for the airspace to be flown dictate the equipment to be available.
response	Not accepted. Although EASA has sympathy with the proposal, the highlighting appears to merely create awareness supporting flight operations, rather than airworthiness. The sentence is intended to state that there may be requirements in addition to PBN that may have to be met and is provided here as a reminder to installers only.

comment	*300*	comment by: *Europe Air Sports*
	Page 24 GM1 ACNS.C.PBN.215 Position estimation (a) "…a fairly high level of confidence…" Question: Is this enough? Rationale: The wording chosen is not convincing, there is too much room for interpretation. Replace it please by "sufficient" at least.	
response	Partially accepted. The sentence has been removed in response to comment 257.	

comment	*301*	comment by: *Europe Air Sports*
	Page 31 AMC1 ACNS.C.PBN.2100 Selected course "Note: The alleviation provided…": Thanks for adding Level 2 and Level 3 aircraft. We propose to add CS-VLA (now included in CS-23) as well. Rationale: For the completeness of the picture.	
response	Not accepted. CS-VLA is intended to be applicable to Day VFR only. Special Conditions have been issued to extend the scope (on a limited scale) to Night VFR and IFR. The CS-ACNS, however, is not intended to address every niche case. Where PBN qualification and RF legs become applicable, these will be dealt with through an amendment to the Special Condition. Please also see the response to comment 403.	

comment	*302*	comment by: *Leonardo Helicopters*
	Page 26 **CS ACNS.C.PBN.245 Path definition and leg transition** (See AMC1 ACNS.C.PBN.245 and GM1 ACNS.C.PBN.245) (a) The area navigation system allows flight crew to define the flight path for the intended route.	

(b)   The area navigation system has the capability to maintain tracks consistent with the following path terminators:
(1)   direct to fix (DF), track to a fix (TF), initial fix (IF), fix to an altitude (FA), and course to a fix (CF) **[comment: Radius to Fix (RF)?]**

(2)   heading to an altitude (VA), heading to a manual termination (VM), and heading to an
intercept (VI);

(3)   course to an altitude (CA), and from a fix to a manual termination (FM).

(c)   The area navigation system has the capability to automatically execute leg transitions and maintain tracks consistent with the path terminators listed above, combined with the capability to execute fly-by turns **[comment Or fly-over if required by procedure or pilot manually required.]**

d)   (d)   Unless otherwise specified in the on-board navigation database, the area navigation system constructs the flight path between waypoints in the same manner as a TF leg.

response	Partially accepted. Radius to a Fix (RF) legs are not a requirement for most navigation specifications and are addressed separately in sections 6, 7 and 8 for RNP AR and Advanced RNP. Fly over turns are not extensively used anymore, not compatible with the RNP concept and not required per ED-75D. Hence is has not been included as a required capability in CS-ACNS. The editorial correction has been made.

comment	*303*	comment by: *Europe Air Sports*

Page 33
AMC1 ACNS.C.PBN.2130 Alerting associated…

"Note: The alleviation provided…": Thanks for adding Level 2 and Level 3 aircraft. We propose to add CS-VLA (now included in CS-23) as well.

Rationale: For the completeness of the picture.

response	Not accepted. CS-VLA is intended to be applicable to Day VFR only. Special Conditions have been issued to extend the scope (on a limited scale) to Night VFR and IFR. The CS-ACNS, however, is not intended to address every niche case. Where PBN qualification and RF legs become applicable, these will be dealt with through an amendment to the Special Condition.

comment	*304*	comment by: *Leonardo Helicopters*

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CS ACNS.C.PBN.260   RNAV holding

(See AMC1 ACNS.C.PBN.260)

(a)   (a) The area navigation system has the capability to initiate, maintain and   discontinue   holding procedures at any point and at all altitudes. When a holding procedure is init iated, the area navigation system:

(1)   changes automatic waypoint sequencing to manual
[Please, could you clarify the meaning of "changes automatic sequencing to manual" during holding? During the holding the FMS suspends the waypoints sequencing of active flight plan]
(2)   permits the flight crew to readily select a desired course to or from the holding waypoint;
[Please could you clarify the "or from"? The holding parameter that FMS allows to be changed for HM is holding inbound course (I suppose "the desired course").]

response	Accepted. Please note that item (a) (1) in CS ACNS.C.PBN.260 has been deleted. See also response to comment 38. As regards item (a) (2), 'or from' has been deleted.

comment	*307* comment by: *Leonardo Helicopters*

Page 29

AMC1 ACNS.C.PBN.270   Navigation accuracy

(a)   The RNP value associated with a leg or segment should be assigned in the following order of precedence:

(1)   Flight crew manually entered RNP value for the leg or segment;

(2)   The RNP value coded in the on-board navigation database for the current leg or segment;
(3)   The RNP value coded in the on-board navigation database for the current area **[The concept of RNP value for current area in NAV DB is unknown. Please could EASA clarify the concept of RNP for current area?]**

response	Noted. The text has been revised to offer more flexibility. See also response to comment 260.

comment	*309* comment by: *Leonardo Helicopters*

Page 30

AMC1 ACNS.C.PBN.280   Deviation display

An acceptable means of compliance is to provide a non-numeric deviation display. The full-scale deflection **[Lateral full-scale deflection]**

of the non-numeric lateral deviation display should be:

(a)   comparable with the applicable RNP value **[For FMS the lateral full-scale deflection is EQUAL to RNP]**
; and

(b)   made available to the flight crew.

The full-scale deflection of the non-numeric deviation display should be set in the following manner and priority: **[The lateral FSD shall be equal to RNP value managed by FMS therefore, to avoid inconsistency on FMS sw, the priority should be the same of AMC1 ACNS.C.PBN.270 Navigation accuracy]**

(a)   automatically to a value obtained from the on-board navigation database; or

(b)   automatically by default logic; or

(c)   manually by flight crew procedure subject to human factor assessment performed by the applicant.

If the manually entered value is lower than the value obtained from the database, then the manually entered value should be applied.

Alternatively, subject to EASA agreement, a moving map display with appropriate map scales, and which provides sufficiently equivalent functionality to a non-numeric lateral deviation display, may be accepted. EASA agreement will be based on a human factor and workload assessment performed by the applicant.

AMC2 ACNS.C.PBN.280   Deviation display

When used to conduct a departure procedure off the runway, the area navigation system should display lateral deviations not later than when reaching 50 feet above the departure runway. Installation of equipment with an ETSO authorization against ETSO-C115d supports this. **[The FMS display the lateral deviation respect to the LPATH leg in "TO" as soon as it is loaded in active flight plan indifferently of any H/C height respect of the runway.]**

response	Not accepted. There is no hard requirement for the full scale deflection to be equal to the RNP, and although some system integrators have chosen to do so, others have applied scales that are larger, or in some cases even smaller than 1 x RNP. Consequently, EASA disagrees to couple the priority setting to those established in AMC1 ACNS.C.PBN.270. The fact that the FMS installed on the Leonardo Helicopters is displaying the deviation from the first leg as soon as it is entered in the active flight plan is noted.

comment	*310* comment by: *Leonardo Helicopters* Page 31 **CS ACNS.C.PBN.2110 Display of navigation aid frequencies and/or identifiers**

The area navigation system has the capability to display on a page which is readily available to the flight crew:

(a)   the GNSS constellation(s)
[Do you mean to display the selected constellation among: GPS NAVSTAR, or Galileo, or GLONASS, or etc. ?]
(c)   except where specified in the FAS data block for approach procedures, the SBAS service provider in use
[Once the LPV/LP approach is loaded the SBAS service provider in use is already kwnon by the first letter of reference path ID displayed in cockpit (E for EGNOS, W for WAAS, etc.)]

response	Noted. These requirements have been removed in response to other comments. Please see the response to comment 177.

comment	*312*	comment by: *Leonardo Helicopters*

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At the current date RNP AR departure are not included in the 4th edition of the PBN manual. The airborne community officially doesn't have any information\detailed requirements or references for RNP AR departure

response	Noted. Please see response to comment 87.

comment	*325*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 22 CS ACNS.C.PBN.205 & AMC1

PROPOSED TEXT / COMMENT:

It is proposed that AMCs first refer to the the relevant paragraph(s) of the ED 75D as acceptable mean of compliance and precise that ETSO(s) CXXX comply(ies) with this(those)   paragraph(s).
Proposed   wording:
"Functionnalities and performances of equipement contributing to the area navigation   function   should   follow   ED   75D   sections   X,   Y,   Z....
Alternativelly   when   ETSO   are   used   by   the   appliquant   :
Where the area navigation system architecture is based on a stand-alone system, the area navigation system should comply with ETSO-C146c operational class 1, 2 or 3 (or   equivalent   standard).
Where the area navigation system architecture is based on a flight management system (FMS) receiving input from various sources of position, the FMS should comply with ETSO-C115d (or equivalent standard) and, depending on the type of sources to determine position, it should comply with the following ETSOs (or equivalent standards) and/or be compliant with the following standards: (a) GNSS

position source against ETSO-C196a or ETSO-C145c operational class 1, 2 or 3;
(b) INS/IRU horizontal position source, whose functionality and performance are detailed in Appendix B
(c) DME/DME horizontal position source based on a DME interrogator compliant with ETSO-2C66b (or equivalent standard);
(d) barometric vertical position source: ETSO-C106 A1.
With reference to CS ACNS.A.GEN.020, any deviations from the ETSOs (or equivalent standard) should be evaluated against the relevant sections of EUROCAE ED-75D Minimum Aviation System Performance Standard (MASPS).

RATIONALE / REASON / JUSTIFICATION:

Except for INS/IRU, this AMC is referencing only the ETSOs. This AMC have to cover applications not using ETSOs in order to allow other solutions/architectures

response	Partially accepted. The references to ETSO authorisations greatly reduce the effort to demonstrate compliance with CS-ACNS criteria for most applicants. EASA recognises however that not all applicants install ESTO authorised products and has added references to ED-75D where appropriate. EASA does not agree to the proposed addition 'or equivalent standard' as in most cases there are no equivalent standards to the ones called out in CS-ETSO.

comment	*326*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 24 CS ACNS.C.PBN.215 Position estimation

PROPOSED TEXT / COMMENT:

It is proposed to precise : "When a GNSS or 'tightly coupled' GPS/inertial position is available, the area navigation system continuously estimates:..."

RATIONALE / REASON / JUSTIFICATION:

"The area navigation system continuously estimates…". It is understood that this requierement applies only when an integrity can be computed. This could be precised in the requirement.

response	Partially accepted. EASA considers that aircraft position is continuously estimated regardless of whether an integrity of the position can be computed; therefore, bullet (a) always applies. Bullet (b) has been revised to add 'when supported by the navigation sensors'.

comment	*330*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 25 AMC1 ACNS.C.PBN.230

PROPOSED TEXT / COMMENT:

ETSO-C146c may not be sufficient to meet displaying information at aircraft level. It is probably sufficient for Class Gamma equipements, but probably not for other Class. Could EASA clarify referencing the relevant sections of the ED-75D ?

RATIONALE / REASON / JUSTIFICATION:

response | Accepted.
Only ETSO-C146c Class Gamma are AMC as a complete area navigation system and ETSO-C146c Class Delta operational Class 4 is not an AMC (cf. GM2 ACNS.C.PBN.205), therefore, Class Gamma has been inserted in AMC1 ACNS.C.PBN.205 for clarification. Specific references to relevant § of ED-75D have been added.

comment | *331*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 30 AMC1 ACNS.C.PBN.280

PROPOSED TEXT / COMMENT:

Propose to remove the following part of the AMC :
"The full-scale deflection of the non-numeric deviation display should be set in the following manner and priority:
(a) automatically to a value obtained from the on-board navigation database; or
(b) automatically by default logic; or

(c) manually by flight crew procedure subject to human factor assessment performed by the applicant. If the manually entered value is lower than the value obtained from the database, then the manually entered value should be applied."
It is also proposed to change 'The area navigation system continuously displays, in each flight crew's optimum field of view, the defined path and the deviation from that path'

to
'For defined paths, the area navigation system continuously displays, in each flight crew's optimum field of view, the path and the deviation from that path'.

RATIONALE / REASON / JUSTIFICATION:

The precision of the full-scale deflection could be misunterpretated and mixed with the change of RNP values. It is proposed to be removed.

response | Partially accepted.

As for the order of priority to set the full scale deflection, this part of AMC1 ACNS.C.PBN.280 has been deleted as the result of other comments. See also the response to comment 39. As regards what should be displayed, the text proposed has been taken into account to adapt the text in the CS.

comment	*345*	comment by: *DGA*

AMC1 ACNS.C.PBN.205: "(b) INS/IRU horizontal position source, whose functionality and performance are detailed in 0" Typographical error on link to "Appendix B — INS/IRU standard performance and functionality"

response	Accepted.

The reference to Appendix B has been inserted.

comment	*348*	comment by: *DGA*

Would it be possible to add some guidance about standards of other equipment contributing to the area navigation function (e.g. antennas, navigation displays) in AMC1 ACNS.C.PBN.205?

response	Partially accepted.

References to ETSOs for antennas will be included where applicable. With regards to displays, please see the response to comment 429.

comment	*349*	comment by: *DGA*

In creteria CS ACNS.C.PBN.245 (c), suggestion to add the capability to execute fly-over turns

response	Not accepted.

Fly over turns are not extensively used anymore, not compatible with the RNP concept and not required per ED-75D. Hence is has not been included as a required capability in the CS-ACNS.

comment	*357*	comment by: *Embraer S.A.*

Embraer suggests correcting typo in the reference to the INS/IRU standard performance and functionality appendix, because there is a typographical error in letter "b" of AMC1 ACNS.C.PBN.205.

To change the text from:

[...] (b) INS/IRU horizontal position source, whose functionality and performance are detailed in 0 [...]

To:

[...] (b) INS/IRU horizontal position source, whose functionality and performance are detailed in Appendix B 0 [...]

response	Accepted.

An agency of the European Union

The reference to Appendix B has been inserted.

comment	*359*	comment by: *Embraer S.A.*

Embraer suggests to harmonize CS ACNS.C.PBN.2105 (Display of altitude/speed constraints) with FAA AC 20-138D and EUROCAE ED-75D.

CS ACNS.C.PBN.2105 asks for the indication of speed constraints in the flight crew's maximum field of view. This is not required according to FAA AC 20-138D and EUROCAE ED-75D. Besides this, there are implementations that display such information out of the maximum field of view, compliant with those aircraft human factors' philosophy.

To change the text from:

CS ACNS.C.PBN.2105 Display of altitude/speed constraints
The area navigation system displays altitude and speed constraints to the flight crew in the maximum field of view.

To:

CS ACNS.C.PBN.2105 Display of altitude/speed constraints
The area navigation system displays altitude ~~and speed constraints~~ to the flight crew in the maximum field of view.

response

Partially accepted.
ED-75D is an RNP system MASPS and does not necessarily address all aircraft level design aspects. EASA considers this information relevant for presentation in the maximum field of view.
However, an AMC has been added to allow for alleviation.

comment	*369*	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.280 : 'the defined path and the deviation from that path' are not always meaningful: for example when flying heading legs where the path is always attached to the aircraft. Thus the 'continuously displays' shall be limited to the scenario where the path is defined and deviation makes sense.

Thales proposal:
To change 'The area navigation system continuously displays, in each flight crew's optimum field of view, the defined path and the deviation from that path'
to
'For defined paths, the area navigation system continuously displays, in each flight crew's optimum field of view, the path and the deviation from that path'.

response

Accepted.
The text has been revised to reflect the intent of the suggestion.

comment	*374*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.260 : Holding requirements are the same for class A and class B in DO283B, thus ETSO C115D class A OR <u>class B</u> shall be part of the AMC.

<u>Thales proposal:</u>

To replace 'Installation of equipment with an ETSO authorisation against ETSO-C115d Class A satisfies the requirement to define the holding pattern (section (b)).'

By

'Installation of equipment with an ETSO authorisation against ETSO-C115d Class A or Class B satisfies the requirement to define the holding pattern (section (b)).'

response	Accepted. See the response to comment 168.

comment	*375*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.205 : typo in (b) : What is the 0 in '[…]detailed in 0' ?

<u>Thales proposal:</u>

To replace '[…]detailed in 0' by a correct reference

response	Accepted. The reference to Appendix B has been inserted.

comment	*376*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.2140 : Table 3 for the 2 last lines of the last column it is written 'Manual Operation' whereas the values are also applicable to 'Autopilot, Flight Director ' (as in AC20-138D change 2)

<u>Thales proposal:</u>

In the 2 last lines of the last column of table 3 replace 'Manual operation' by 'Autopilot, Flight Director or Manual Operation'.

response	Partially accepted. Note that Table 3 has been deleted in response to comment 183.

comment	*388*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 23 AMC1 ACNS.C.PBN.210 Position source

PROPOSED TEXT / COMMENT:

It is proposed to replace

"If position is no longer available from a GNSS position source and if additional sources are available, the position should be computed using the best next available source, i.e. the source that provides the computed position with the highest integrity and accuracy."

by

"If position is no longer available from a GNSS position source and if additional sources are available, the system should revert to the best available source (e.g.: the source that can provide the best computed position in terms of accuracy and integrity)."

RATIONALE / REASON / JUSTIFICATION:

"...the position should be computed using the best next available source, i.e. the source that provides the computed position with the highest integrity and accuracy." : The best next available source is not necessarily the best accuracy and integrity.

response	Accepted.
	The text has been revised in accordance with the suggestion.

comment	*390*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 23 GM2 ACNS.C.PBN.205

PROPOSED TEXT / COMMENT:

GM recognises ETSO-C145c or ETSO-C146c. It should also recognise ETSO-C196a (except for approaches with LPV minima)
It is suggested to reword the AMC in order :
- to make it generic refering to relevant sections of ED 75D
- to complete the list of ETSOs that allow to demonstrate compliance to the CS

RATIONALE / REASON / JUSTIFICATION:

response	Accepted.
	ETSO-C196a is currently identified as possible position source for lateral navigation in AMC1 ACNS.C.PBN.205 (a) and in GM2 ACNS.C.PBN.205.
	Relevant references to specific §'s of ED-75D have been added in AMC's.

comment	*391*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 24 AMC1 ACNS.C.PBN.215

PROPOSED TEXT / COMMENT:

AMC recognises ETSO-C115d or ETSO-C146c.
It should also recognise ETSO C-145c and ETSO-C196a (except for approaches with LP/LPV minima)

It is suggested to reword the AMC in order :
- to make it generic refering to relevant sections of ED 75D
- to complete the list of ETSOs that allow to demonstrate compliance to the CS : ETSO-C145c and ETSO-C196a

RATIONALE / REASON / JUSTIFICATION:

response | Not accepted.
Position estimation is a function of the FMS not of the sensor position source; therefore, ETSO-C145c and ETSO-C196a are not AMC.
See also response to comment 390.

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comment | *392*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 24 CS ACNS.C.PBN.220

PROPOSED TEXT / COMMENT:

"...it has the capability to automatically or manually select the best next available source (e.g. the source that can provide the best computed position in terms of accuracy and integrity)."

RATIONALE / REASON / JUSTIFICATION:

"...it has the capability to automatically or manually select the source(s) that provides (provide) the highest position accuracy and integrity"
The best next available source is not necessarily the best accuracy and integrity. It can be the one that provides best continuity or follow other rules.

response | Accepted.
The text has been revised in accordance with the intent of the suggestion.

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comment | *393*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 25   AMC1 ACNS.C.PBN.230

PROPOSED TEXT / COMMENT:

It is suggested to clarify item (b) as follows :

"The area navigation system should enable modification of any flight plan, or flight plan segment, including procedures that were loaded from the on-board navigation database.
The FAS data blocks protected by a cyclic redundancy check (CRC) code cannot be modified."

RATIONALE / REASON / JUSTIFICATION:

In Airbus implementation, FMS flight plan and beam buit based on CRC protected FAS are 2 different features. This requirement may give the impression that modification of the final approach part of the FMS flight plan shall be prohibited, while the primary objective of the requirement is to avoid any change to the beam build on FAS Datablock.

response	Accepted. The text has been amended as suggested but inserting 'However' at the beginning of the 2nd sentence and replacing 'cannot'by 'can never'.

comment	*394*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 26   CS ACNS.C.PBN.245 Path definition and leg transition

PROPOSED TEXT / COMMENT:

It is proposed to split requirement (c) in two:

-     separate   fly-by   turns   from   the   previous   requirement.
- precise in the AMC that the intent of the first part of (c) is to ensure a smooth transition between legs.

Proposed text :
"The area navigation system has the capability to execute fly-by turns. The area navigation system has the capability to ensure smooth leg transitions consistent with the path terminators listed above"

RATIONALE / REASON / JUSTIFICATION:

It could be understood that the CS requires transitions from any terminator to any other terminator listed above.

In ED 75D only TF-TF transitions are requested. And in A424 some transitions are not autorised
It is therefore understood that the objective of the CS is to ensure smooth leg transitions

response	Partially accepted. The text has been revised to relocate the text in the former bullet (c).

comment	*395*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 31   AMC1 ACNS.C.PBN.2100

PROPOSED TEXT / COMMENT:

Introduce in the CS the moving map display.
"The area navigation system should display in the flight crew's optimum field of view a moving map or a selected course. If a selected course is displayed it is automatically slaved to the system computed path."

RATIONALE / REASON / JUSTIFICATION:

A moving map is really different from the CS as it is written. Moving map display should be moved from the AMC to the CS.

response | Partially accepted.
The requirements of CS ACNS.C.PBN.2100 have been merged with the requirements of CS ACNS.C.PBN.280. EASA believes that the concern expressed by the commentator has been addressed.
Please also see the response to comment 403.

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comment | *396*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 31 CS ACNS.C.PBN.2110 Display of navigation aid frequencies and/or identifiers

PROPOSED TEXT / COMMENT:

Indeed, while item (b) repeats a legacy requirement usually found in area navigation systems, there is no justification to fully mirror these requirements when using GNSS sensors.

RATIONALE / REASON / JUSTIFICATION:

Item 2110 defines a requirement to display data listed in items a, b and c, with lack of clear operational needs and potential negative consequences such as increased crew workload and mistakes.

response | Partially accepted.
Please see the response to comment 177.

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comment | *397*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 31 CS ACNS.C.PBN.2110 Display of navigation aid frequencies and/or identifiers

PROPOSED TEXT / COMMENT:

Item (a) requires display of GNSS constellations. GNSS elements include core constellations such as GPS, Glonass, Galileo and Beidou but also augmentations systems such as SBAS and GBAS. Current discussions, held at ICAO (NSP) Navigation Systems Panel, identify several conditions for approval or prohibition of use of GNSS

elements. These conditions can include the certification of a Service Provider under a tier State authority, the compliance of the GNSS elements to ICAO SARPS (Annex 10), the mandate to use a specific GNSS in an airspace and the compliance to performance requirements defined for a given operation. It is understood that item (a) is limited to core constellations. At this stage, it is unlikely that all core constellations will be either tracked, available on-board or utilized concurrently by airliners. In addition, the conditions under which different core GNSS will be used and the conditions to display core GNSS, based on their availability, their operational use (navigation or surveillance) and the utilization of this information by the crew is not defined yet and will mostly rely on the outcomes of on-going ICAO NSP discussions.

Item (a) must not be requiere until consolidated guidelines are defined by ICAO NSP and Industry Standardization Groups (RTCA/EUROCAE) on the use of multiple GNSS. This requirement needs to be postponed to a future amendment of CS-ACNS.

RATIONALE / REASON / JUSTIFICATION:

Item 2110 defines a requirement to display data listed in items a, b and c, with lack of clear operational needs and potential negative consequences such as increased crew workload and mistakes.

response	Partially accepted. Please see the response to comment 177.

comment	*402* comment by: *THALES AVIONICS*

CS ACNS.C.PBN.215 : Its not always possible to implement continuous integrity in case of loss of GPS.

An indication shall be added to clarify that the requirement is not applicable to reversion case (covered by CS220).

response	Partially accepted. EASA considers that aircraft position is continuously estimated regardless of whether an integrity of the position can be computed; therefore, bullet (a) always applies. Bullet (b) has been revised to add 'when supported by the navigation sensors'. See also response to comment 326.

comment	*403* comment by: *THALES AVIONICS*

CS ACNS.C.PBN.2100 : The terminology 'selected course' is confusing. For example the selected course must not be automatically slaved to the system computed path because the selected course is not issued from the path but from the pilot manual entry on the flight control panel. The 'selected course'has to be replaced to stick with the objective of the specification.

Thales proposal:

To consider AC 20-138D change 2 terminology instead of 'selected course' or to remove (b) from CS ACNS.C.PBN.2100.

response	Partially accepted.
	Although the term 'selected course' has been in use since TGL-10, EASA agrees that the terminology used in FAA's AC 20-138D is clearer.
	Following a review of CS ACNS.C.PBN.2100 and CS ACNS.C.PBN.280 the former requirements and AMC have been merged with the latter.

comment	*409*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 37   AMC1 ACNS.C.PBN.2150

PROPOSED TEXT / COMMENT:

It is suggested to align with AC 20-138D

RATIONALE / REASON / JUSTIFICATION:

The criteria in the AMC is more stringent than the one from FAA AC: for some RNP, the AC says minor if the operator can revert to a different navigation system and proceed to a suitable airport.

response	Partially accepted.
	Please see the response to comment 43.

comment	*427*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 31 CS ACNS.C.PBN.2110 Display of navigation aid frequencies and/or identifiers

PROPOSED TEXT / COMMENT:

Item (c) requirement is even more questionable by requiring to display SBAS service providers in use. First of all, SBAS is defined by ICAO SARPS (Annex 10) and is a fully interoperable system with airborne receiver compliant with RTCA DO-229. Any DO-229 compliant receiver can use any SBAS signal in the world as long as it is compliant with ICAO SARPS (Annex 10). As a consequence, there is no technical reason to switch from one SBAS to another one when flying en-route or in terminal areas (outside LPV operation which requires a FAS datablock specifying the SBAS service provider to be used) as long as performance requirements are adequate for the operation and to avoid useless switching. Indeed, it could be seen as going back to the switching between ground navaids while SBAS is a truly global and interoperable system. SBAS are expanding in the world with existing ones such as WAAS, EGNOS, MSAS, GAGAN and future ones such as ASECNA SBAS, Korean SBAS, Beidou SBAS, Russian SBAS (SDCM) and Australian SBAS. For each SBAS, there is one Service Provider. As a consequence, this requirement would lead to display a dozen of SBAS service providers with a risk of evolutions upon appearance of new SBAS service providers, thus requiring multiple software updates to the area navigation system, difficult to anticipate.

Trying to understand the rationale behind this requirement, the number of SBAS service providers to be displayed on a page is probably linked to a potential need to

select/deselect SBAS per service provider. This would have several negative consequences. First of all, it would create additional crew workload to determine which SBAS to select or deselect with the risk of making errors and the risk of forgetting to reselect a specific SBAS previously deselected. Second of all, the conditions of use or prohibition of GNSS, already described in the above comment for item (a), also apply to item (c) and are not fully defined yet.

Therefore, the conditions under which the SBAS could be used or prohibited need to be consolidated by ICAO NSP and RTCA/EUROCAE. Besides, the origin of this requirement is likely to come from an abnormal event that occurred with MSAS (Japan SBAS). Some SBAS receivers, located in Australia, decided to shut down the GPS function. The malfunction was communicated by Japanese authorities only 15 days after the event and since there is no operational procedure to tell the crew to deselect SBAS, the crews had no clue on the reason why the GPS function was shutting down in the receivers. Finally, to avoid that GPS is erroneously shutdown in case a SBAS abnormally declares that GPS is unreliable, RTCA has published DO-229E, to authorize the reversion of the receiver from SBAS to GPS only in case the SBAS signal seems unreliable (e.g. declaring multiple GPS satellites unhealthy).

This was recognized by ICAO NSP as resolving the issue in particular by the Australian Panel Member. As a consequence, the need for deselection of SBAS per service provider seems irrelevant and impractical while increasing crew workload. If for any safety reason, there is a need to deselect SBAS, it should be the case for all SBAS at once and not per single service provider. Indeed, display and deselection of SBAS per service provider would only serve and encourage political mandates not driven by any safety concern.

Since discussions at ICAO NSP continue, to understand the conditions under which SBAS will be used, it is necessary to postpone such requirement to a future amendment of CS-ACNS and limit it at most to SBAS overall display and not per service provider.

RATIONALE / REASON / JUSTIFICATION:

Item 2110 defines a requirement to display data listed in items a, b and c, with lack of clear operational needs and potential negative consequences such as increased crew workload and mistakes.

response	Partially accepted. See the response to comment 177.

comment	*431* comment by: *THALES AVIONICS*
	CS ACNS.C.PBN.2110 :The intent of (a) shall be clarified : to display the GNSS constellation in use. Moreover if the aircraft is only capable to receive one constellation, a statement in the AFM is sufficient. Thales proposal: To replace (a) with 'the GNSS constellation(s) in use;' And

To add an AMC 'If the aircraft has the capability to use only one GNSS constellation, a statement in the AFM satisfies the CS requirement (a)'

| response | Partially accepted.
See the response to comment 177. |

| comment | *434* | comment by: *THALES AVIONICS* |

CS ACNS.C.PBN.2110 : (c) is confusing because:

- . It gives the feeling that it is requested to not display the SBAS service provider when a FAS datablock for approach is specified.

- . RTCA DO-229D explicitly considers using data from multiple SBAS service providers and display of one SBAS provider is not straight to implement.
-

Thales proposal:

To remove (c) or to clarify the expectation for the SBAS provider to be displayed.

| response | Partially accepted.
See the response to comment 177. |

| comment | *443* | comment by: *M.Jo (ATR)* |

CS ACNS.C.PBN.285 Display of active waypoint
This CS requires to display ETA, whereas existing AMC requires 'ETA or TTG' (in AMC 20-26) and 'TTG' (in AMC 20-27). If ETA is not absolutely requested, it is propose to use AMC 20-26 wording because some avionics are displaying TTG.

| response | Accepted.
The text has been revised to reflect the suggested change in CS ACNS.C.PBN.285 as well as in CS ACNS.C.PBN.1010. |

| comment | *446* | comment by: *THALES AVIONICS* |

GM1 ACNS.C.PBN.215 in (b) : 95 % is more appropriate than 10-5 for accuracy.

Thales proposal:

At the end of (b) to replace '10-5/hour' by '95 % of the flight time'

| response | Noted.
Item (b) has been deleted in response to another comment. |

| comment | *447* | comment by: *THALES AVIONICS* |

GM1 ACNS.C.PBN.245 : DO-236B is referenced whereas DO-236C is released.

Thales proposal:

	To replace DO-236B by DO-236C
response	Accepted See the response to comment 230, where a reference to DO-236C Change 1 has been accepted.

comment	*448*	comment by: *THALES AVIONICS*
	CS ACNS.C.PBN.270 the wording '…considering the latency of the monitoring and alerting function of the area navigation system ' is not clear and should not be at CS level (not an objective but an implementation). Thales proposal: To replace (b) by : 'When an aircraft flies an RNP route or procedure and the RNP value changes to a lower value, the area navigation system completes the change no later than reaching the leg with the lower RNP value.'	
response	Accepted. The text has been revised in response to comment 259.	

comment	*460*	comment by: *M.Jo (ATR)*
	CS ACNS.C.PBN.2110 It seems to early requiring something about GNSS constellation. The use of several GNSS constellations is still under discussion and may involve political constraints difficult to guess. It is proposed to postpone this requirement or to write it in another way.	
response	Partially accepted. See the response to comment 177.	

comment	*463*	comment by: *The Boeing Company*
	Page: 22 Paragraph: AMC1 ACNS.C.PBN.205 Area navigation system approval **THE PROPOSED TEXT STATES**: (b) INS/IRU horizontal position source, whose functionality and performance are detailed in 0 **REQUESTED** **CHANGE:** (Fix the reference for finding information on INS/IRU position source guidance.) **JUSTIFICATION:** The reference is incorrect.	
response	Accepted. The text has been amended to correctly refer to Appendix B.	

comment	*464* comment by: *The Boeing Company*

Page: 31
Paragraph: CS ACNS.C.PBN.2110 Display of navigation aid frequencies and/or identifiers

THE PROPOSED TEXT STATES:

"The area navigation system has the capability to display on a page which is readily available to the flight crew:
(a) the GNSS constellation(s);
(b) the frequencies and/or identifiers of the ground positioning navigation aids selected;
(c) except where specified in the FAS data block for approach procedures, the SBAS service provider in use."

WE RECOMMEND REVISING THE TEXT AS FOLLOWS:

"The area navigation system has the capability to display on a page which is readily available to the flight crew:
(a) the status of GNSS updating;
(b) the frequencies/channels and/or identifiers of the ground positioning navigation aids selected;
(c) the SBAS service provider from which guidance is being generated, when vertical guidance on approach is based on SBAS.

Note: This can be accomplished either indirectly by display of the channel and/or identifier associated with the specific LPV FAS data block or directly by display of the SBAS service provider as the source of vertical guidance associated with for the LNAV/VNAV line of minima."

JUSTIFICATION:

In a PBN environment, specific information about which core constellations are being used may not be useful to the pilot. There is no accepted or proposed concept of operation wherein a pilot should take action relative to which GNSS constellations is in use by the GNSS sensor.
Please provide clarity on the statement; "the GNSS constellations(s)." Does this mean, generally, specific core satellite constellations are being tracked by the receiver or used in the position solution? Given various ways the GNSS and inertial may be integrated on an airplane, different sets of satellites could be used by different   equipment.
The FAS data block and related LPV system ensures the correct provider is in use when an identifier is presented. Therefore, the correct LPV approach and channel selection leading to the presentation of an identifier, is sufficient information in order for the pilot to know they are utilizing the desired service provider. When a system utilizes SBAS sourced vertical guidance to conduct the LNAV/VNAV line of minima, the system should identify the SBAS service provider that is generating the vertical guidance.

response	Partially accepted.

See the response to comment 177.

| comment | 465 | comment by: *The Boeing Company* |

Page: 32
Paragraph: GM1 ACNS.C.PBN.2115 Use of navigation database

THE PROPOSED TEXT STATES:
"The on-board navigation database should have a capacity that is consistent with the intended use of the aircraft. The database of a regional aircraft may contain data for a given region only, whereas the database of a long-range aircraft may contain worldwide data."

REQUESTED CHANGE:
"The on-board navigation database should have a capacity that is consistent with the intended use of the aircraft. For example the database of a regional aircraft may contain data for a given region only, whereas the database of a long-range aircraft may contain data for multiple regions of intended operation or worldwide data."

JUSTIFICATION:
As written, the second sentence implies that regional aircraft can only carry regional data and that longer range aircraft must carry world-wide data. It should not be necessary to carry world wide data simply because an aircraft is capable of flying long distances. The aircraft should have the data necessary for the intended areas of operation and that the capacity of the database supports that. The requested change includes an example and allows that long-range aircraft may still carry only data for the intended regions of operation as an alternative to carrying worldwide data.

| response | Accepted.
The text has been revised to reflect the intent of the suggested change. |

| comment | 466 | comment by: *The Boeing Company* |

Page: 35
Paragraph: Table 2: RNP values (in NM) by navigation specification

REQUESTED CHANGE:
The current table has no value listed in the EN-route continental column for RNP 1 navigation specification (the table appears to be copied from ICAO Doc 9613, PBN Manual).

We suggest adding a value of 1 to the en-route continental for the RNP 1 navigation specification.

JUSTIFICATION:
Section GM1 ACNS.C.PBN.101 Applicability, states that RNP is to be used for en-route continental operations, which is consistent with European continental airspace plans, but Table 2 reflects current ICAO PBN Manual navigation specification values. EASA should also consider requesting the PBNSG make a corresponding change in the PBN Manual (5th edition).

response	Not accepted. RNP 1 is not intended for use en-route. Please refer to note 3 to Table II-A-1-1 of the PBN Manual.

comment	*483*	comment by: *EUROCONTROL*

Subsection 2 - Generic specifications for performanvce-based lateral navigation - Page 22-37

The EUROCONTROL Agency makes a comment applying to the entire subsection: the cited ETSO's only refer to GPS, not GNSS. The difference needs to be resolved.

AMC1.ACNS.C.PBN 205 - Page 22

The EUROCONTROL Agency makes two comments:

In Para 2 (a), reference to ETSO-C161a is missing (in turn referring to RTCA-DO253, section 2.1, defining the GNSS outputs to the FMS. Requirement [LAAS-068]). It is reminded that aircraft with this approval are already performing PBN operations today.

Para 2 (b) indicates that the functionality and performance concerning of INS/IRU horizontal position source are detailed in 0. However, this 'o' reference cannot be found. Please confirm.

GM1.ACNS.C.PBN 205 - Page 22

The EUROCONTROL Agency makes two comments under the form of suggestions.

In Para 1 please add 'APCH' after 'for RNP AR'.

For Para 2, last sentence, please consider adapting the current formulation as follows: 'Recognition of ETSO authorisation demonstrates compliance with the CS requirements and generally limits the burden on the applicant.'

GM2 ACNS.C.PBN 205 - Area navigation system approval - Page 23

The EUROCONTROL Agency makes three comments under the form of questions.

It finds that the section lacks sufficient clarity. Please find below some questions to stimulate further reflection:
- are there any standalone 196A receivers? If so, is the only acceptable standalone receiver the one that is SBAS capable (ETSO 146)?
- do all other applications must have an ETSO 115d compliant FMS?
- it is not clear in the way that the text is written that ETSO 145/6 operational class 3 equipment also supports the approaches down to LNAV/VNAV, i.e. Class 3 is in addition to, and not separate from Class 2.

The EUROCONTROL Agency makes a fourth and a fifth comment under the form of suggestions.

- a new section should be added: "Depending on implementation, ETSO-C161a may support all of the mentioned operations, as it permits implementation of a superset of ETSO-C146 and ETSO C196 requirements."

- ETSO-C196 is not mentioned in this section, but should be. Perhaps a typo in the first line, which should read: "ETSO-C196 and ETSO-C146c....".

AMC1 ACNS.C.PBN.215 - Position estimation - Page 24

The EUROCONTROL Agency makes one comment:
ETSO-C161a and possibly ETSO-C196 to be added

AMC1 ACNS.C.PBN.230 - Flight plan management - Page 25

The EUROCONTROL Agency makes a comment under the form of a question:
How does the proposed text under (c) fit with modern FMSs that do not allow the manual creation of waypoints?

AMC1 ACNS.C.PBN.240 - Route/procedure extraction and loading - Page 26

The EUROCONTROL Agency has one comment under the form of a suggestion:
Para 2: '…; however, the applicant should ensure that both altitude and speed constraints are extracted from the database.' Should there not be GM material on how to do this if it is not automatically done?

GM1 ACNS.C.PBN.245 - Path definition and leg transition - Page 27

The EUROCONTROL Agency has one comment giving rise to a reques for verification:
Is the RTCA document that is referred to in this section not DO-236C instead of DO-236B?

CS ACNS.C.PBN.255 (a) - Magnetic variation - Page 27

Typo: it should be capital N for North

AMC1 ACNS.C.PBN.255 - Magnetic variation - Page 27

The EUROCONTROL Agency makes one comment:
ETSO-C161a and possibly ETSO-C196 to be added

AMC1 ACNS.C.PBN.260 - RNAV holding - Page 28

The EUROCONTROL Agency makes a comment under the form of two questions:
Can an ETSO146 box not do this? Is guidance material not required?

CS ACNS.C.PBN.265 - User-defined routes and fixes - Page 28

The EUROCONTROL Agency makes a comment under the form of two questions:
In line with the comment already made about AMC1 ACNS.C.PBN.230 (c) on page 25, what would happen if the FMS does not permit manually created user defined waypoints? How does the applicant comply with CS ACNS.C.PBN.265 (b)?

AMC1 ACNS.C.PBN.275 - Display and entry of navigation data - resolution - Page 29

The EUROCONTROL Agency makes one comment:
ETSO-C161a and ETSO-C196 to be added.

AMC1 ACNS.C.PBN.280 - Deviation display - Page 30

(c) para 1
The EUROCONTROL Agency makes a comment under the form of a question:
Should GM not be provided on the default logic?

AMC1 ACNS.C.PBN.2130 - Alerting associated with degradation of navigation - Page 33

The EUROCONTROL Agency makes one comment:
 ETSO-C161a and ETSO-C196 to be added.

AMC1 ACNS.C.PBN.2140 - Lateral navigation accuracy - Page 34-36

The EUROCONTROL Agency makes two comments, the second one under the form of a question:

First para (page 34)
The formula is not in line with section title since TSE is defined in the text as only the lateral component. For this reason only the lateral components of the PDE, FTE and NSE should be used for the calculation (which is not stated in the text). The formula can be read to assume vectorial representation of these errors, resulting in the total TSE, not only its lateral component, but notably including along-track or vertical components. Please rephrase and clarify.

Last para (page 36)
Should there not be a maximum time stipulated between radio updating?

| response | **AMC1.ACNS.C.PBN 205 - Page 22**
Partially accepted. |

Para 1: EASA has decided not to recognise ETSO-C161a for PBN in this amendment of the CS.

Para 2: The Reference to Appendix B has been updated.

GM1.ACNS.C.PBN 205 - Page 22

Not accepted.

Para 1: The CS-ACNS covers both RNP AR APCH and RNP AR DPs, hence the reference to RNP AR without the addition 'APCH'.

Para 2: ETSO often covers many aspects of the compliance demonstration, but this is not a given.

GM2 ACNS.C.PBN 205 - Area navigation system approval - Page 23

Partially accepted.

With respect to ETSI-C161a, see above.

ETSO-C196 generally provide data to ETSO-C115( ) Flight Management Systems and do not provide navigational capabilities in the same sense as the ETSO-C146 standalone units do.

The Class 3 issue has been corrected.

AMC1 ACNS.C.PBN.215 - Position estimation - Page 24

Not accepted.

AMC1 ACNS.C.PBN.215 contains requirements for the entire system, not for the individual sources. ESTO-C196 is considered a source in this context.

AMC1 ACNS.C.PBN.230 - Flight plan management - Page 25

Not accepted.

ED-75D, on which the CS is based, requires the ability for pilots to create waypoints. Where systems do not, EASA will deal with these cases by means of a deviation from the AMC (i.e. a Certification Review Item).

AMC1 ACNS.C.PBN.240 - Route/procedure extraction and loading - Page 26

Not accepted.

The requirement is for this to be automatically done. It makes little sense adding a GM to explain what to do in case a requirement is not met.

GM1 ACNS.C.PBN.245 - Path definition and leg transition - Page 27

Accepted.

The reference has been corrected.

CS ACNS.C.PBN.255 (a) - Magnetic variation - Page 27

Accepted.

The typo has been corrected.

AMC1 ACNS.C.PBN.255 - Magnetic variation - Page 27

Not accepted.

See the response to comment on AMC1 ACNS.C.PBN.215 above.

AMC1 ACNS.C.PBN.260 - RNAV holding - Page 28

Noted.

Indeed, they can. Reference is made to RTCA Do-229E, section 2.2.1.3.11

CS ACNS.C.PBN.265 - User-defined routes and fixes - Page 28

Noted.

See the response to the comment on AMC1 ACNS.C.PBN.230 (c).

AMC1 ACNS.C.PBN.275 - Display and entry of navigation data - resolution - Page 29

Not accepted.

ETSO-C196 does not allow for entry and display of navigation data. For ESTO-C161a, please see the response above.

AMC1 ACNS.C.PBN.280 - Deviation display - Page 30

Not accepted.

EASA considers the AMC to be sufficiently clear.

AMC1 ACNS.C.PBN.2130 - Alerting associated with degradation of navigation - Page 33

Not accepted.

AMC1 ACNS.C.PBN.2130 contains requirements for the entire system, not for the individual sources. ESTO-C196 is considered a source in this context.

AMC1 ACNS.C.PBN.2140 - Lateral navigation accuracy - Page 34-36

Partially accepted.

Please see the response to comment 183.

comment	489	comment by: *Martin Ryff*

GMC1 ACNS.C.PBN.2115 Use of navigation database

The term of "regional" resp. "long-range aircraft" is not defined to our knowledge. As the type of operation is important, as described in foregoing sentence, we propose to delete the second sentence.

response	Not accepted.

Although there is no formal definition of 'regional aircraft' or 'long range aircraft', the terms have been commonly accepted and used in aviation for decades. Therefore, EASA considers that their use in the GM within the context of the use of databases is acceptable.

comment	503	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

General comment:

DGAC France recommends to add in all the CS-ACNS "or subsequent version" at each ETSO authorisation reference to increase flexibility.

response	Partially accepted.

Some generic text has been added to indicate that references to ETSOs along Subpart C reflect the minimum standard.

comment	504	comment by: *AIRBUS HELICOPTERS*

CS ACNS.C.PBN.205:

- Title should be 'Area navigation system installation approval' because only the installation is approved at CS level.

- Wording *'All equipment contributing to the area navigation function' is approved.'* looks like a statement.' I should be written instead 'must be approved'. Same comment to be applied everywhere else in the CS-ACNS, using 'must' instead of the present form, in order to define a requirement.

response	Not accepted.

Due to legal constraints, the use of the words 'must' and 'shall' in CS and AMC material is not allowed.

Page 119 of 241

An agency of the European Union

comment	*510*	comment by: *General Aviation Manufacturers Association*

Page 26: AMC1 ACNS.C.PBN.240 Route / procedure extraction and loading – the CS requirements are perceived to be too prescriptive and design oriented: Existing means of compliance outline approaches to building and extracting a route or flight plan – the additional requirements placed upon equipment complying to ETSO-C146c are not considered necessary or appropriate as these requirements are covered by CS ACNS.C.PBN.265 and AMC1 ACNS.C.PBN.265 and ETSO-C115d Class B. Suggest deletion of the additional requirements applied to ETSO-C146c compliant equipment.

response	Not accepted.

Please see the response to comment 164.

comment	*514*	comment by: *AIRBUS HELICOPTERS*

CS ACNS.C.PBN.2120 Data Quality Requirements (DQRs)

Comment: in this paragraph, specifications actually address the applicant activities in order to ensure Data Quality and do not define Data Quality Requirements. Title should be modified to 'Data Quality Assurance'.

response	Not accepted.

The requirement specific to DQRs as it requires the applicant to ensure that the equipment manufacturer has established Data Quality Requirements, that these are compatible with the intended function and that these have been shared with the data provider. The title would, therefore, seem appropriate.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 3 — Supplementary specifications for lateral navigation in final approach   p. 38-40

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comment	*44*	comment by: *Dassault-Aviation*

Dassault-Aviation

P38 CS ACNS.C.PBN.310

Comment:
(CS) Approach mode indication
The requirement to readily identify "whether the guidance is linear or angular" (b) in itself does not appears relevant operationally as long as the pilot can identify the selected line of minima (a), especially as for LPV for example the deviations can be hybrid (linear or angular). Furthermore "guidance" is ambiguous: maybe it is meant deviations?
Requirement should be clarified or removed.

response	Not accepted.

Although EASA acknowledges that RNP APCH procedures to LPV minima may contain a linear part, this is transparent to the pilot, who needs to fly the approach in a manner similar to an ILS approach: don't exceed 1 dot deviation.

This is very different from a procedure flown to LNAV/VNAV minima supported by barometric altimetry, whereby the guidance is linear and the pilot is to keep the aircraft within +/- 75 ft. of the path.

The requirement is, therefore ,considered appropriate.

comment	*45*	comment by: *Dassault-Aviation*

Dassault-Aviation

P 39 CS ACNS.C.PBN.320

Comment:
(AMC1) Non-numeric lateral deviation display scaling for approach
 (b) (1) ETSO C145c class D 4 is compliant for RNP APCH to LP or LPV minimums and should be added as an AMC

response

Partially accepted
Class D4 is only applicable to ETSO-C146; it is not relevant for ETSO-C145 which refers only to Class B of RTCA DO-229D. A reference to operational Class 4 has been added in Subsection 3.
Additional guidance pertinent to the use of ETSO-C146 Class D4 has been added to GM2 ACNS.C.PBN.205.

comment	*46*	comment by: *Dassault-Aviation*

Dassault-Aviation

P 39 CS ACNS.C.PBN.325

Comment:
(CS) Display of distance to threshold
The requirement is appropriate for direct approaches (e.g., FAS datablock based LP/LPV) when the lateral guidance is to the LTP/FTP. AMC 20-28 requires the display of distance to LTP/FTP or MAP for LPV approaches: Displaying the distance to the MAP may also be more relevant operationally, so the option should be kept. For flight plan based approaches the lateral guidance is to the TO waypoint (CS ACNS.C.PBN.285), i.e., in the final approach FAF, MAP and any intermediate charted waypoint that may exist: Having the along-flight plan distance to the LTP/FTP or MAP readily available in the cockpit is relevant but requiring to display it continuously in the maximum FOV is excessive.
Requirement should be updated.

response

Partially accepted.
EASA agrees that distance to the MAPt should be added.
EASA however disagrees with the statement that the requirement to continuously display distance in the maximum field of view is excessive, considering that this subsection addresses lateral guidance for operations in final approach.

comment	*75*	comment by: *Advanced PBN Solutions*

AMC1 ACNS.C.PBN.305 This appears to exclude RNP systems. Add ETSO-C115d?

response	Partially accepted.

ETSO-115d Class A has been added as a means of compliance. The functionality is optional for Class B.

comment	*112*	comment by: *Transport Canada Civil Aviation Standards Branch*

Is ETSO C115d missing for the LNAV minima or LNAV/VNAV minima (RNP APCH) approaches ? For those that don't purchase a 146 box and aren't looking to get LP/LPV capability. Table 5 on page 40 has the Failure conditions broken out - presumably to allow for this case?

response	Partially accepted

See the response to comment 75.

comment	*113*	comment by: *Transport Canada Civil Aviation Standards Branch*

Is ETSO C115d missing for the LNAV minima or LNAV/VNAV minima (RNP APCH) approaches ? For those that don't purchase a 146 box and aren't looking to get LP/LPV capability. Table 5 on page 40 has the Failure conditions broken out - presumably to allow for this case?

response	Partially accepted

See the response to comments 75 and 112.

comment	*120*	comment by: *Transport Canada Civil Aviation Standards Branch*

The tables have the same title but cover different Failure Conditions for the Approach Phase. Suggest combine or make titles different. (Lateral and along track) v (Horizontal and Vertical).   Is lateral the same as horizontal? Or is Horizontal - Lateral and along track?

response	Partially accepted.

Please see the response to comment 43.

comment	*185*	comment by: *Garmin International*

CS ACNS.C.PBN.310 Approach mode indication - Page 38:

There is no current requirement for item (b) for a specific display of "linear" or "angular" in the cockpit. Suggest adding an AMC that states: "A cockpit display annunciation for angular or linear is not required if the flight crew can identify the type of guidance based on information supplied in the equipment pilot's guide or airplane flight manual (AFM)".

response	Not accepted.

See the response to comment 44 for the rationale for requirement. The commentator's suggestion would, in EASA's view, leave too much room for

interpretation and subsequent discussion. Note that the requirement applies to the final approach only.

| comment | 186 | comment by: *Garmin International* |

CS ACNS.C.PBN.315 Lateral deviation display - Page 39:

The non-numeric lateral deviation display cannot show "the extended flight path" (it can only show the deviation from that path). Thus, this phrase should be removed from the sentence.

| response | Partially accepted.
Please see the response to comment 379. |

| comment | 187 | comment by: *Garmin International* |

CS ACNS.C.PBN.325 Display of distance to threshold - Page 39:

No AMC or GMC is provided for the CS. This CS should be applicable only to approaches using the LPV line of minima (see AMC 20-28 section 7.1 Item 3; AMC 20-27A has no similar requirement). So ETSO-C146c operational class 3 should be an acceptable means of compliance.

| response | Partially accepted.
The requirement to display distance to the LTP has been limited to RNP approach to LPV minima. |

| comment | 236 | comment by: *FAA AIR* |

Reference SUPPLEMENTARY PERFORMANCE CRITERIA Horizontal Performance
CS ACNS.C.PBN.330 Area Navigation system design - integrity in final approach

COMMENT: *Substantive.* This section says, "The area navigation system, including position sensors, displays, etc., is designed to provide a level of integrity that supports the intended operations." As stated, thsi has nothing to do with "integrity in final approach". Also, this statement exemplifies th eproblem with labeling the requirements in the NPA as requirements for an "area navigation system" throughout the document. An area navigation system does not offer integrity. Only RNP systems offer integrity. In fact, RNP systems offer integrity in all phases of flight, not just "in final approach". Likewise, the remainder of this subsection tries to identify the design assurance requirements for aircraft eligibility for an RNP APCH (see Table 5). This too is mislabled as "integrity in final approach"; when, in fact, an RNP APCH requires integrity throughout the approach procedure, not just during the final approach segment. Thus, this section is confusing and offers no value as written.

RECOMMENDATION: Again, since this NPA is trying to identify requirements for RNP systems, not RNAV systems, change all NPA references to "area navigation system" to "RNP system". Meanwhile, rewrite this entire subsection to properly identify the design assurance requirements for eligibility to conduct an RNP APCH.

RATIONALE: Clarity on what the NPA really intends to offer. Also, RNP systems offer integrity anytime the system is actively using an RNP value -- through all phases of flight. To foster clarity in this subsection, the NPA should address solely the design assurance requirements for eligibility for an RNP APCH, since that is what Table 5 offers in the first place.

response | Partially accepted.
The term area navigation system has been replaced with RNP system throughout the document.
With regards to the design assurance requirements, please see the response to comment 43.

comment | *242*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

page 39 AMC1 ACNS.C.PBN.330

PROPOSED TEXT / COMMENT:

It is proposed to write the AMC as follow :

"The area navigation system, including position sensors, displays, etc., is designed to provide a level of integrity that supports the classification of failure conditions resulting from the Safety analysis performed for compliance to CS 25.1309. In absence of robust and complete safety process, the applicant should design it to provide a level of integrity that supports the classification of failure conditions defined in Table 5 below."

RATIONALE / REASON / JUSTIFICATION:

Failure cases and their Safety Classifications are linked to the operations, architectures, mitigations in place and information presented to the crew. The only means to assess classification is through compliance to CS 25.1309 applying as per AMC 25.1309 the FHA/SSA process during certification, using pilots judgment and simulator as necessary.
Safety classifications should not be constraint by AMCs when a robust safety process is in place.
It can be understood to provide suggested classifications/guidelines in specifc cases for which safety analyse cannot be performed.

response | Partially accepted.
Please see the response to comment 43.

comment | *263*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 38 CS ACNS.C.PBN.305 Final approach intercept

PROPOSED TEXT / COMMENT:

The AMC should first refer to relevant sections of ED-75D and precise that equipements compliant with ETSO-C146c, Class Gamma meet those sections of ED-75D.
The VTF shall not be the single solution to comply with the CS requirement

RATIONALE / REASON / JUSTIFICATION:

AMC 305 is not applicable to Large Aircraft that do not use Class Gamma equipment qualified under ETSO C-146c.
Moreover the ETSO C-146c use the VTF function that is not the only mean to comply with the CS requirement and ED-75D.

response	Partially accepted See the response to comment 75.

comment	*315*	comment by: *Leonardo Helicopters*

Page 38

CS ACNS.C.PBN.310   Approach mode indication

The area navigation system provides unambiguous indications in the flight crew's maximum field of view
that enables the flight crew to readily identify:

(a)   the applicable line of minima for the approach that has been selected **[The DHs/MDHs value of approach with multiple minima are not available on NAV DB for FMS. The selection of one particular DH/MDH among the all multiple minima cannot be done by the pilot. The pilot has to set the DH equal to the desired minima.]**

response	Partially accepted. Proposed CS ACNS.C.PBN.310 did neither ask for the lines of minima to be selectable, nor for the actual values to be displayed. The referred to requirement intends to avoid confusion regarding the type of approach that is being flown and the minima that apply. The text of the requirement has however been revised to better express its intent. In addition, GM providing clarification has been added too.

comment	*316*	comment by: *Leonardo Helicopters*

Page 39

AMC1 ACNS.C.PBN.320   Non-numeric lateral deviation display scaling for approach

(a)   When linear lateral deviation is provided, the full-scale deflection of the non-numeric deviation display should not exceed two times the RNP value

[Should be changed in RNP value: FSD (+/- 2 DOTs) = RNP not two times. This FMS implementation allow to display the lateral FSD = Containment Value (RNP) for 95% of flight time.]

response	Not accepted
	EASA concurs that many industry solutions have a full-scale deflection of 2 times the applicable RNP value, but recognises that other scaling solutions may also be acceptable, as long as it allows the flight crew to assess the deviation from the path.

comment	*360*	comment by: *Embraer S.A.*

Embraer believes that the objective of CS ACNS.C.PBN.325 is already covered in ACNS.C.PBN.285 (Display of active waypoint), based on the necessity to cross-check the active waypoint and the information on the published chart.

For instance, when step-down fixes are coded in the database, some systems may display the distance to this step-down fix. Also, if the procedure codes a MAP that does not match the LTP, the system will also display the distance to the MAP waypoint. If such an implementation as required in ACNS.C.PBN.325, the display may be cluttered with unnecessary information, since the various waypoints could be inferred from the necessary cross-check with the published chart.

To delete proposed requirement CS ACNS.C.PBN.325:

CS ACNS.C.PBN.325 Display of distance to threshold

The area navigation system continuously displays in the flight crew's maximum field of view the along-track distance to the landing threshold point/fictitious threshold point (LTP/FTP) after passing the final approach fix/final approach point.

response	Not accepted.
	Although there may indeed be overlap, requirement to display distance to the LTP is a specific requirement consistent with the PBN Manual. The requirement will, however, be limited to RNP APCH to LPV minima in response to another comment.

comment	*379*	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.315: This CS is too generic asking for a continuous display of extended flight path (could be on any leg, anytime) whereas the intent is the limited scenario of final approach interception (link to CS305).
Moreover this CS is not appropriate for RNP AR operation that may contain RF leg in the final approach (extended flight path a RF leg is not meaningful).

Thales proposal:

To replace 'The area navigation system continuously displays on a non-numeric lateral deviation display, in each flight crew's optimum field of view, the extended flight path and the deviation from that path.'
By

'In support to CS ACNS.C.PBN.305, the area navigation system continuously displays on a non-numeric lateral deviation display, in each flight crew's optimum field of view, the extended final approach segment and the deviation from that extension'

And to create an exception for RNP AR approaches operations.

response	Partially accepted. Upon review, EASA found that the requirement, and the associated AMC focussed on the extended final approach, instead of the computed path of the final approach segment. The CS has been amended to correct this.

comment	*408*	comment by: *THALES AVIONICS*
	CS ACNS.C.PBN.325 :Display of distance to threshold is not appropriate for RNP APCH operation with stepdownfix, or RNP AR APCH operation that contains several waypoint in the final approach. Distance to the threshold has an interest only for RNP APCH with LPV minima operation and distance to the active waypoint is already covered in subsection 2. Thales proposal: To restrict the requirement to RNP APCH down to LPV minima operation**.**	
response	Accepted. The requirement has been limited to procedures to LPV minima.	

comment	*410*	comment by: *AIRBUS*
	PARAGRAPH / SECTION THE COMMENT IS RELATED TO: Page 38 CS ACNS.C.PBN.310 Approach mode indication **PROPOSED TEXT / COMMENT:** Proposed wording : The area navigation system provides unambiguous indications in the flight crew's maximum field of view that enables the flight crew to identify: (a) the applicable line of minima in accordance to aircraft capabilities certified and declared in AFM as per CS ACNS.A.GEN.015 **RATIONALE / REASON / JUSTIFICATION:** "The area navigation system provides unambiguous indications in the flight crew's maximum field of view that enables the flight crew to readily identify: (a) the applicable line of minima for the approach mode that has been selected; ". This requirement seems inapropriate operationaly. Airbus understand that the objective is to avoid misleading indications not aligned with certified capabilities.	
response	Partially accepted. Please see the response to comment 315.	

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comment	*411*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 39   CS ACNS.C.PBN.315 Lateral deviation display

PROPOSED TEXT / COMMENT:

"Out of RNP AR, in support to CS ACNS.C.PBN.305, the area navigation system has the capability to display on a non-numeric lateral deviation display, in each flight crew's optimum field of view, the extended final approach segment and the deviation from that segment."

RATIONALE / REASON / JUSTIFICATION:

The need to continuously display the extended flight path and the deviation from that path is not understood in particular in various situations (RF legs, path not fixed to ground, ….) and the CS should exempt the RNP AR

response	Partially accepted. Please see the response to comment 379.

comment	*412*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 39 CS ACNS.C.PBN.325 Display of distance to threshold

PROPOSED TEXT / COMMENT:

it is suggested to clarify the CS requirement as follows :
"The area navigation system continuously displays in the flight crew's maximum field of view the distance to the next fix along intended flight path."

RATIONALE / REASON / JUSTIFICATION:

response	Partially accepted. Although the suggestion is appreciated, the applicability of the requirement has been limited to RNP APCH to LPV minima. The requirement as proposed is already covered by CS ACNS.C.PBN.285.

comment	*467*	comment by: *The Boeing Company*

Page: 38
Paragraph: CS.ACNS.C.PBN.310 Approach mode indication

THE PROPOSED TEXT STATES:
The area navigation system provides unambiguous indications in the flight crew's maximum field of view that enables the flight crew to readily identify:
(a) the applicable line of minima for the approach that has been selected; and
(b) whether the guidance is angular or linear.

REQUESTED CHANGE:

Delete the requirement and subparagraphs (a) and (b).

JUSTIFICATION:
Most area navigation systems do not include a direct flight crew selection of the selected line of minima; this should not be a minimum requirement. The selection in the area navigation system could also be a source of confusion depending upon the aircraft integration and what modes and level of service are achieved in the related flight guidance/automation systems. For example, selecting LPV, which would be indicated in the area navigation system, but only LNAV level of service being achieved in the guidance system. The flight crew is responsible for setting up the aircraft systems (area navigation, minimum descent altitude/decision altitude, tuning, flight guidance, displays, etc.) all of the relevant data and selections for the desire approach and line of minima. Similarly, whether the guidance is angular or linear may not be the responsibility of the area navigation system. It's also not clear if this requirement is intended to cover the common area navigation system function of flying non-PBN procedures. Those procedures could be conventional procedures flown as overlays (i.e. VOR, NDB, etc.) or conventional procedures that utilize area navigation functions to put the aircraft in a position to fly the final approach segment (i.e. GLS or ILS). Is it expected that the area navigation system also provide a line of minima selection for these too? The line of minima or achieved level of service being flown and whether the guidance is angular or linear are aircraft level indications and not the specific or the sole responsibility of the area navigation system.

response	Partially accepted. Please see the response to comment 315.

comment	*468* comment by: *The Boeing Company*
	Page: 39 Paragraph: CS ACNS.C.PBN.325 Display of distance to threshold **THE PROPOSED TEXT STATES**: "The area navigation system continuously displays in the flight crew's maximum field of view the along-track distance to the landing threshold point/fictitious threshold point (LTP/FTP) after passing the final approach fix/final approach point." **REQUESTED CHANGE**: "The area navigation system continuously displays in the flight crew's maximum field of view the distance to the landing threshold point/fictitious threshold point (LTP/FTP) after passing the final approach fix/final approach point." **JUSTIFICATION**: In LPV mode, the system computes straight line distance from the aircraft to the LTP/FTP. On an LPV approach after the FAF/FAP the actual distance to LTP/FTP and along-track distance are likely similar, but they are not the same.
response	Accepted. The CS has been amended to reflect the intent of the suggested change.

comment	*505*	comment by: *EUROCONTROL*

AMC1 ACNS.C.PBN.305 - Final approach intercept - Page 38

The EUROCONTROL Agency makes two comments, the first one under the form of two questions:
Is this specifically an issue for standalone SBAS receivers? If not, where is ETSO 115? ETSO-C161a to be added.

CS ACNS.C.PBN.310 - Approach mode indication - Page 38

The EUROCONTROL Agency makes one comment under the form of two questions: How does the system provide unambiguous indication of the applicable line of minima? Does the system have to display LNAV, LP, LNAV/VNAV or LPV?

AMC1 ACNS.C.PBN.320 - Non-numeric lateral deviation display scaling for approach - Page 39

<u>Para (a)</u>
The EUROCONTROL Agency makes one comment.
It is understood that maximum deflection should be the RNP, i.e. 1 x RNP. In manual flight, how is FTE to be managed when it is stated that the pilot is to maintain within 1/2 full scale deflection to manage FTE.

| response | **AMC1 ACNS.C.PBN.305 - Final approach intercept - Page 38**
Partially accepted.
ETSO-C115d Class A has been added to the AMC.
With regards to ETSO-C161a, please see the response to comment 483.
CS ACNS.C.PBN.310 - Approach mode indication - Page 38
Noted.
The suggested display would be one possible means of compliance with the CS.
AMC1 ACNS.C.PBN.320 - Non-numeric lateral deviation display scaling for approach - Page 39
Not accepted.
There is no requirement in the CS-ACNS stating that the pilot has to maintain the FTE within ½ of the lateral full scale deflection for a display where linear lateral deviation is provided, neither is there such a requirement in the AMC/GM to the OPS rules.
The operational guidance to monitor half scale deflection relates to displays that provide angular deviations. |
|---|---|

comment	*507*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

CS ACNS.C.PBN.310 Approach mode indication
(a) the applicable line of minima for the approach that has been selected

For DGAC France, the means to achieve this requirement is not clear : In general an approach is selected by its name not by the minima which depend on the operator's capability.

| response | Partially accepted.
Please see the response to comment 315. |
|---|---|

comment	*512*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

"hazardous" classification in Table 5 :

This targeted level is not consistent with what is expected for RNP AR (MAJOR when RNP > or = 0.3) or even CAT 1 ILS.
On large A/C It could imply 2 RNAV systems.
What is the impact of such requirement at MMEL level ? Does EASA consider that with only one RNAV system, it is safer to fly LNAV/VNAV (which are dependant on QNH and Temperature and may have a linear interface) rather than an LPV (which is ILS look alike)?

Moreover with LPV, a consistency check with baroaltimetric source can be considered whereas on LNAV/VNAV, the VNAV function and barometric altimeter depend on the same barometric source making this "consistency check" useless and misleading (pilot could think that this monitoring would allow them to detect any discrepancy in the VNAV profile whereas not since both BaroVNAV and altimeter depend on the same barometric source).

So DGAC France considers that EASA should reclassify this failure condition classification as "Major".

response	Partially accepted. Please see the response to comment 43.

comment	*518*	comment by: *AIRBUS HELICOPTERS*

CS.ACNS.C.PBN.315:

<u>Comment:</u> In order to address each flight crew member, wording should be completed as:

"*The deviation indicators on the non-numerical lateral display should appear in a timely fashion **in each flight crew's optimum field of view** to allow the flight crew to intercept the final approach segment.* "

response	Partially accepted. Please see the response to comment 379.

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 4 — Supplementary specifications for advisory vertical navigation	p. 41-46

comment	*13*	comment by: *Luftfahrt-Bundesamt*

AMC1 ACNS.C.PBN.435	Typo: The aircraft f<u>l</u>ight manual…

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response	Noted Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*14* comment by: *Luftfahrt-Bundesamt*

AMC1 ACNS.C.PBN.440, Table 6	Wording of text below table: "The vertical navigation accuracy (TSEz)…" TSEz is the vertical total system error.

response	Noted. Subsection 4 has been repurposed and the referred to AMC no longer exists. Please refer to the response to comment 485.

comment	*47* comment by: *Dassault-Aviation*

Dassault-Aviation

P 46 CS ACNS.C.PBN.440

Comment:
(AMC1) Vertical accuracy
(e) The vertical path error at final approach fix (FAF) due to the vertical fly-by transition defined in this CS (50ft) is different than the one from AMC1 ACNS.C.PBN.555 (e) Table 8. This latter appears more appropriate as it accounts for ground speed.
What is the rationale to have different requirements in subsection 4 and 5? Furthermore, CS ACNS.C.PBN.425 already specify VNAV path transitions in accordance with ED 75D §3.2.8.5: Why should the FAF transition be treated differently?
It is suggested to remove (e)

response	Noted. Subsection 4 has been repurposed and the referred to AMC no longer exists. Please refer to the response to comment 485.

comment	*48* comment by: *Dassault-Aviation*

Dassault-Aviation

P 46 CS ACNS.C.PBN.440

Comment:

	(AMC1) Vertical accuracy (e) ED-75D § 1.7.2.2 does not provide "guidance", only definition of the errors terms (that are mostly redefined in this section of the CS). Is the reference relevant here? Please correct
response	Noted. Subsection 4 has been repurposed and the referred to AMC no longer exists. Please refer to the response to comment 485.

comment	*89*	comment by: *Transport Canada Civil Aviation Standards Branch*
	In the last paragraph, "fight" should be "flight" (AFM).	
response	Noted Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.	

comment	*90*	comment by: *Transport Canada Civil Aviation Standards Branch*
	Regarding Page 45, para (a) Altimetry system error (ASE): The formula for ASE seems to be missing a 10-3 term. The document states ASE = − 8.8×10−8×H2+6.5×H+50, but But it should be ASE= − 8.8× 10−8×H2+6.5×10−3×H+50	
response	Noted Subsection 4 has been repurposed and, in consequence of this, the error in the formula no longer exists. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.	

comment	*114*	comment by: *Transport Canada Civil Aviation Standards Branch*
	Is ETSO C146 missing?	
response	Noted Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including those AMC1 ACNS.C.PBN.430. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.	

comment	*115*	comment by: *Transport Canada Civil Aviation Standards Branch*
	Suggest remove blank middle column (consistency with Table 7)	
response	Noted Subsection 4 has been repurposed and, in consequence of this, the referred to Table has been deleted.	

New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*116*	comment by: *Transport Canada Civil Aviation Standards Branch*

Is ETSO C115d option missing?

response	Noted

Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including those AMC2 ACNS.C.PBN.440.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*117*	comment by: *Transport Canada Civil Aviation Standards Branch*

Table 6 and Table 7 are the same table. Why repeat?

response	Noted

Subsection 4 has been repurposed and, in consequence of this, Table 6 has been deleted.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*118*	comment by: *Transport Canada Civil Aviation Standards Branch*

The ACNS clauses and AMC clauses for Vertical Accuracy seem to duplicate since they both address Baro VNAV accuracy in the AMC. Do you need PBN 555? 555 does include a Path Error table (8) at FAP on page 53 that does not appear on page 46? I don't know if Pages 45 through 53 can be harmonized to remove overlap? If not then perhaps they need to be consistent on the inclusion of Table 8?

response	Noted

Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.440 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*188*	comment by: *Garmin International*

CS ACNS.C.PBN.435 Vertical navigation (VNAV) mode indication - Page 43:

For all operations outside the final approach segment, it is implied that vertical guidance is advisory. Thus, instead of saying "procedures with no published path", this CS should say "on final approach segments where a published DA/DH is not applicable".

response	Noted

Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.435 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

| comment | *190* | comment by: *Garmin International* |

AMC1 ACNS.C.PBN.435 Vertical navigation (VNAV) mode indication - Page 43:

Change "The aircraft fight manual (AFM)" to "The aircraft flight manual (AFM)"; i.e. correct spelling of "flight".

| response | See the response to comment 188. |

| comment | *191* | comment by: *Garmin International* |

AMC2 ACNS.C.PBN.440 Vertical accuracy - Page 46:

Regarding "When using SBAS/GNSS geometric altitude sources":

It should be clarified that when using SBAS/GNSS geometric altitude sources for advisory vertical guidance, the flight crew must use the primary barometric altimeter as the primary reference for compliance with all altitude restrictions. See FAA AC 20-138D Chg 2 paragraph 4-2.c.(2).

It should be clarified that advisory vertical guidance may be provided via GNSS alone; i.e., without SBAS augmentation. See DO-229E 2.2.3.3.4. See also DO-229E section 2.2.3.4.2 Note that includes "*This advisory [vertical] guidance may be provided even when SBAS corrections or integrity information is not available.*"

| response | See the response to comment 188. |

| comment | *192* | comment by: *Garmin International* |

CS ACNS.C.PBN.445 Advisory vertical navigation (VNAV) in final approach - Page 46:

Regarding item (b), "transition from one source of altitude to another" does not seem to capture the true intent. Suggest instead:
"(b) after the FAF, the area navigation system does not automatically "fail-down" to advisory vertical guidance on approaches with LPV or LNAV/VNAV lines of minima;"

| response | Noted
Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.435.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485. |

| comment | *193* | comment by: *Garmin International* |

CS ACNS.C.PBN.445 Advisory vertical navigation (VNAV) in final approach - Page 46:

Regarding item (c), it is agreed that the ability to deselect advisory vertical guidance is desirable to support training. However, this should not be a requirement since it is not an ETSO-C146() or ETSO-C115() requirement and many currently available

	systems providing advisory VNAV do not support the capability. Suggest moving this item to a "GM" item as a recommendation.
response	See the response to comment 192.

comment	*235* comment by: *Garmin International*

AMC1 ACNS.C.PBN.435 Vertical navigation (VNAV) mode indication - Page 43:

The intent behind this statement is not clear: "The use of typographic characters (e.g. '+' or '/') as the only means to distinguish whether the vertical guidance is advisory or is referenced to in a published procedure is not considered adequate". If the indication can meet the standard of "plain and easy to interpret", use of '+' and '/' in the indication should not be prohibited as part of the scheme.

For example, Garmin equipment utilizes the '+' and '/' characters in the display of SBAS approach service levels (provided on the HSI). These service levels are also used to indicate when the final approach segment vertical guidance is advisory. The following display of SBAS approach service levels have been approved by both EASA & FAA:

- Service Levels with "for credit" vertical guidance: "LPV", "L/VNAV"
- Service Levels where no vertical guidance is provided: "LP", "LNAV"

Service Levels with advisory vertical guidance: "LP +V", "LNAV+V"

response	Not accepted.
Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.
The AMC referred to in the comment has been transposed to GM1 CS.ACNS.C.PBN.570 as the original text was introduced to address a concern that results from lack of standardisation of the indication of service levels and the absence of any intent to standardise these. Where the use of typographical characters may seem logical and appropriate for one manufacturer's specific design, it becomes a concern if other manufacturers use similar indication schemes whereby the same indication may have a different meaning. This is particularly concerning for aircraft categories whereby pilots easily transition from one aircraft to the other. Consequently, EASA considers the criteria of the AMC appropriate.

comment	*237* comment by: *FAA AIR*

Subsection 4 - Supplementary specifications for advisory vertical navigation
CS ACNS.C.PBN.401 Applicability and GM1 ACNS.C.PBN.401 Applicability

COMMENT: *Substantive.* These two statements of applicability contradict one another. The first statements says, "...advosry VNAV may optionally be asscoiated with the following navigation specifications: RNP 1, RNP 0.3, RNP APCH and A-RNP." This is false. An aircraft can offer advisory VNAV during conduct of all PBN operations -- RNAV and RNP. For example, the aircraft can provide advisory vertical

guidance during RNAV 10 (i.e. "RNP 10") en route operations when the pilot needs to descend from the current barometric altitude to a new, lower barometric altitude in response to a new ATC clearance. At the other end of the PBN nav specs, the aircraft can offer advisory vertical guidance duing RNP AR APCH ops as well. That is, the aircraft offers advisory VNAV between all barometric altitude constraints leading up to the final approach fix (FAF) and the final approach segment (FAF). The only part of the RNP AR APCH operation requiring "approved vertical guidance" is the FAS. Thus, advisory VNAV is optional for all phases of flight and the aircraft may provide advisory VNAV during all PBN operations. Likewise, advisory VNAV is optional and not required in any way whatsoever.

In contrast, and contradicting the first statement of applicability, the second statement correctly states advisory vertical guidance may support en route, terminal and approach ops. However, this statement of applicability inappropriately ties advisory VNAV to "approaches without a published vertical path". That is, many approaches include a glidepath angle (GPA) as part of the procedure definition, but don't offer any operational credit for use of "approved verical guidance". The aircraft may provide advisory VNAV during the FAS and use the defined GPA. In contrast, RNP APCH ops offer an opportunity to use "approved vertical guidance" for operational credit (i.e. use of the LNAV/VNAV min or the LPV mins). Thus, the use of "published vertical path" in this manner is confusing.

Additionally, the statements of applicability refer to "advisory vertical guidance" (i.e. advisory VNAV) while the title is "advisory vertical navigation". This too is potentially confusing. The title should match the content of the statements. Also, when the aircraft offers advisory VNAV, the aircraft is not "navigating" vertically.

RECOMMENDATION: Rewrite this entire section. Title the section "advisory vertical guidance". Make it clear to readers that advisory vertical guidance is optional, not required and can support all operational implementations of the PBN nav specs, RNAV and RNP. This section should also strive to distinguish "approved vertical guidance" which provides operational credit (i.e. the vertical guidance offered during ILS, MLS, RNP APCH [LNAV/VNAV and LPV] and RNP AR APCH) from "advisory vertical guidance" (advisry VNAV) which offers no operational credit.

RATIONALE: Clarity and consistency with other materials offering gudiance for advisory VNAV, such as AC 20-138D, Chapter 5, and the forthcoming Attachment B to ICAO Document 9613, The PBN Manual.

response	Noted. Please refer to comment 485.

comment	*269* comment by: *THALES AVIONICS* Requirement CS ACNS.C.PBN.405 is not precise enough as the terminology 'fix' could lead to alrge interpretation whereas the intention is probably to consider 'fix with an altitude constraint'. (fixes without altitude constraint should not be concerned by the requirement) Thales proposal:

	To modify the requirement with the following wording: ' The area navigation system has the capability to define a vertical path to a fix with an associated altitude constraint'
response	Noted. Please refer to comment 485.

comment	*276*	comment by: *THALES AVIONICS*
	CS ACNS.C.PBN.430 is ambiguous and may be understand as a requirement to implement a Vertical Display. It needs to be clarified. Thales proposal : To Change '[…] the defined vertical path and the deviation from that path' by '[…] the deviation from the defined vertical path'	
response	Noted Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.430. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.	

comment	*284*	comment by: *THALES AVIONICS*
	AMC1 ACNS.C.PBN.440 : Error in the ASE formula: should read 6.5x10-3 x H and not 6.5 x H Thales proposal: To replace' 6.5 x H' by '6.5x10-3 x H' ASE formula	
response	Noted Please see the response to comment 90.	

comment	*317*	comment by: *Leonardo Helicopters*
	page 42 **AMC1 ACNS.C.PBN.410 Altitude constraints** The altitude constraints should be defined as follows: (a) an 'AT or ABOVE' altitude constraint; (b) an 'AT or BELOW' altitude constraint; (c) an 'AT' altitude constr aint; or (d) a 'WINDOW' altitude constraint **[For H/C operations Window altitude constraint should be identified as optional respect the 'AT', 'AT or ABOVE and 'AT or BELOW']**	
response	Not accepted.	

It should be noted that Subsection 4 has been repurposed and their requirements are primarily optional. Please see the response to comment 485.

comment	318	comment by: *Leonardo Helicopters*

Page 43

AMC1 ACNS.C.PBN.430   Vertical deviation display

A non-numerical vertical deviation display with a full-scale deflection of not more than ± 500 ft is an acceptable means of compliancc
[+/- 500 ft in E—route VNAV but +/- 150ft in TERMINAL area VNAV operations (e.g. approach, arrival, departure).]

response	Noted.

Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.430 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	327	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 46 AMC2 ACNS.C.PBN.440

PROPOSED TEXT / COMMENT:

AMC should also recognise ETSO C145c
It is suggested to reword the AMC in order :
- to make it generic refering to relevant sections of ED 75D
- to complete the list of ETSOs that allow to demonstrate compliance to the CS

RATIONALE / REASON / JUSTIFICATION:

response	Noted.

Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.440 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	332	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 42 CS ACNS.C.PBN.410 Altitude constraints

PROPOSED TEXT / COMMENT:

Proposed   text
"Where barometric altimetry is used as the source for vertical guidance in approach, the area navigation system has the capability to specify a vertical path between altitude constraints at two fixes in the flight plan."

RATIONALE / REASON / JUSTIFICATION:

It is understood that this requirement is applicable only in descent.

response | Not accepted.
Although EASA appreciates the comment, Subsection 4 has been repurposed to address VNAV outside approach, supporting the criteria of the PBN IR (Commission Implementing Regulation (EU) No 2018/1048), Subpart PBN, AUR.PBN.2005 Routes and procedures, sub (5)(a), which foresees the application of RNP 1, with RF legs and the use of altitude constraints on STARs (and SIDs).

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comment | *333*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 42 GM1 ACNS.C.PBN.420 Pressure settings

PROPOSED TEXT / COMMENT:

It is proposed to precise that "The area navigation system should not use its own altimetry setting"

RATIONALE / REASON / JUSTIFICATION:

The GM could be interpretated as requiring one single altimeter in the cockpit. Whereas it is considered safer to have on board 2 altimeter settings with comparison and alert.

response | Accepted.
The text has been revised for GM1 ACNS.C.PBN.420 and GM1 ACNS.C.PBN.515 in line with the suggestion.
It should be noted that Subsection 4 has been repurposed and reference is made to comment 485.

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comment | *336*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 42 CS ACNS.C.PBN.430 Vertical deviation display

PROPOSED TEXT / COMMENT:

The CS could be understood as requiring a Verical Diplay.
It is proposed to clarify by changing "defined vertical path" to "deviation from the defined vertical path".
Same comment applies on CS ACNS.C.PBN.530.

RATIONALE / REASON / JUSTIFICATION:

For clarification

response | Noted.
Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.430 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

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comment | *340*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 46 AMC1 ACNS.C.PBN.440

PROPOSED TEXT / COMMENT:

Item (e) should refer to ED-75D § 1.5.7.2 and not to ED-75D § 1.7.2.2.

RATIONALE / REASON / JUSTIFICATION:

response | Noted.
Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.440 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

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comment | *355*   comment by: *DGA*

CS ACNS.C.PBN.430: For consistency with requirement CS ACNS.C.PBN.315, suggestion to add "on a non-numeric vertical deviation display".

response | Noted.
Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.430 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

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comment | *358*   comment by: *DGA*

In Table 6 of AMC1 ACNS.C.PBN.440: a blank column remains in the table.

response | Noted
Subsection 4 has been repurposed and, in consequence of this, Table 6 has been deleted.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

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comment | *361*   comment by: *Embraer S.A.*

Embraer believes that the AFM, POH or similar documents may be used to supplement the distinction between approved and advisory vertical guidance.

For instance, if the flight crew is trained to use line of minima containing VNAV (*e.g.*: LNAV/VNAV minima), then they should use specific procedures to engage a specific VNAV submode (*e.g.*: through the approach button). In other types of approach, the flight crew should use other procedures, and as such, that specific VNAV submode previoulsy mentioned would not engage.

Therefore a clear distinction between operational procedures combined with system indication exists. This should be reflected in the acceptable means of compliance for CS ACNS.C.PBN.435.

To change the text from:

The indication should be plain and easy to interpret. The use of typographic characters (e.g. '+' or '/') as the only means to distinguish whether the vertical guidance is advisory or is referenced to in a published procedure is not considered adequate.

To:

The indication should be plain and easy to interpret. The use of typographic characters (e.g. '+' or '/') as the only means to distinguish whether the vertical guidance is advisory or is referenced to in a published procedure is not considered adequate. <u>A combination of operational procedures and system indications can be used to distinguish advisory vertical guidance from a published procedure, nonetheless.</u>

response	Not accepted. The AMC is not expected to provide operational procedures. See also the response to comment 235.

comment	*362* comment by: *Embraer S.A.*

Embraer suggests to harmonize AMC1 ACNS.C.PBN.440 (Vertical Accuracy) with AMC1 ACNS.C.PBN.555 (Vertical accuracy when using barometric altitude sources).

§3.2.8.5 (VNAV path transitions) from EUROCAE ED-75D does not differentiate advisory VNAV from approach with vertical guidance operations. The same text from AMC1 ACNS.C.PBN.555, which is partially derived from ED-75D, § 3.2.8.5, should be in AMC1 ACNS.C.PBN.440.

To change the text from:

[...] e) Vertical path error at final approach fix (FAF) due to the vertical fly-by transition

Error due to the capture of the vertical path starting from the FAF altitude should be limited. This momentary deviation below the published procedure minimum altitude

at the FAF is acceptable provided the deviation is limited to no more than 50 feet (assuming no VNAV equipment error).

Further guidance can be found in ED-75D §1.7.2.2, pertaining to vertical components of navigation error terms.

To:

[...] e) Vertical path error at final approach fix (FAF) due to the vertical fly-by transition

Error due to the capture of the vertical path starting from the FAF altitude should be limited. This momentary deviation below the published procedure minimum altitude at the FAF is acceptable, provided the ~~deviation is limited to no more than 50 feet (assuming no VNAV equipment error)~~ *does not exceed the values provided in Table 7 below (assuming no VNAV equipment error).*

Table 7: Maximum vertical path error at final approach fix (FAF)

Ground speed (kt)	*Height loss (ft)*
150	*23*
200	*40*
250	*63*
300	*91*
350	*124*

Further guidance can be found in ED-75D, §3.2.8.5.

Further guidance can be found in ED-75D §1.7.2.2, pertaining to vertical components of navigation error terms.

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response | Noted.
Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.440 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

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comment | *377*   comment by: *THALES AVIONICS*

CS ACNS.C.PBN.435 : The objective of the requirement is not clear. The terminology 'published path' is not understood by Thales. The system knows if something is coded or not in the navigation database but it may differs from what is officially published on charts (data provider may have introduced in the NDB non published angles).
Thus 'published path' needs to be defined in accordance with the objective of the requirement and at aircraft system level (type of approach, type of minima, ….) otherwise it is not possible to implement it.

Thales proposal:

To define at aircraft system level what is a 'published path' and/or to detail objective of the specification.

response	Noted. Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.435 and its corresponding AMC. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*430* comment by: *FAA AIR*
	Reference: The section of the NPA titled, "Subsection 4 – SUPPLEMENTARY FUNCTIONAL CRITERIA and SUPPLEMENTARY PERFORMANCE CRITERIA" COMMENTS: *Substantive.* The supplementary criteria in this subsection provides functional and performance criteria that represents a subset of the requirements an aircraft's installed RNP system (i.e. an FMS) must meet when there's a request for airworthiness approval for barometric VNAV (baro-VNAV), specifically baro-VNAV for operational credit as approved vertical guidance for the final approach segment of an RNP APCH. However, the NPA appears to require all advisory vertical guidance (advisory VNAV) to meet the functional and performance requirements for baro-VNAV without directly stating so. Conflating baro-VNAV and advisory VNAV is wholly inappropriate and unjustified. Advisory VNAV is an optional function, offers no operational credit and solely serves to aid the pilot in compliance with the barometric altitudes that make up their ATC clearance (procedural barometric altitudes, as well as barometric altitudes assigned by ATC). In addition, many different means can offer advisory VNAV. For example, "altitude controllers" in some aircraft compute a simple geometric vertical path between two barometric altitudes; and other solutions for advisory VNAV include systems using geometric altitude from the aircraft's GNSS. Requiring all solutions for advisory VNAV meet the content of this subsection would mean all future applicants desiring recognition of advisory VNAV solutions must provide a solution through application of baro-VNAV airworthiness. This effectively stifles innovation and creates an unnecessary cost and burden on the applicant considering advisory VNAV is of no operational credit. Meanwhile, this subsection of the NPA also raises the bar for the advisory VNAV guidance by inadvertently requiring compliance with ETSO-C115d, with regard to manner an RNP system handles the barometric altitude constraints of RNP procedures. Again, this goes too far as a simple, effective presentation of advisory VNAV need not meet all the RNP system's requirements. Overall, rather than promote presentation of advisory VNAV guidance, this subsection will stifle some applicants from offering any advisory VNAV. This subsection also conflicts with the content of the draft Attachment B to ICAO PBN Manual, Document 9613, Version 5, Advisory Vertical Guidance, which does not require baro-VNAV performance for an aircraft to provide advisory VNAV; and it also conflicts with AC 20-138D, Chapter 4, Advisory Vertical Guidance. If EASA desires to raise the minimum standard for advisory VNAV, then that effort needs justification. Lest, advisory VNAV will not be available in many future aircraft do the cost of demonstrating de facto baro-VNAV airworthiness.

RECOMMENDATION: Delete this subsection in its entirety and replace the subsection with a facsimile the draft Attachment B to the ICAO PBN Manual, Document 9613, Version 5.

RATIONALE: The NPA should offers a means for more aircraft to provide advisory VNAV guidance to aid pilots in compliance with procedural barometric altitudes and enabling continuous descent final approach (CDFA) operations when an instrument procedure does not offer approved vertical guidance for operational credit. Instead, as currently written, the NPA requires all advisory VNAV meet the performance and functional requirements of baro-VNAV and ETSO-C115d. This means an applicant must go to great expense simply to offer as an option advisory VNAV for no operational credit. This means fewer aircraft will offer advisory VNAV despite the obvious benefits to the pilot.

response	Noted. Please see the response to comment 485.

comment	*451*	comment by: *M.Jo (ATR)*

CS ACNS.C.PBN.435 Vertical navigation (VNAV) mode indication
Concept of advisory VNAV is not very clear. If there is no published path, why using VNAV guidance on a theorical profile would be cause of incident. In contrary, the system will guide vertically the aircraft in order to join the lower part of the vertical profile which is published.
So, the need for displaying a distinction between VNAV and ADVISORY VNAV is still not clear to me.

Also, on aircraft having vertical profile displayed on a VSD. Is it considered as a mean of awareness to identify whether aircraft is flying on a calculated path or a published path (depending if flying parts with altitude constraints)?

response	Noted. Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.435 and its corresponding AMC. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*454*	comment by: *M.Jo (ATR)*

Figure 3: vertical error
☐ How to define the PDE in advisory VNAV? Because by definition the "desired path" is undefined. So the defined path is equal to the desired path. Is it correct

response	Noted. Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including Figure 3. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*469*	comment by: *The Boeing Company*

Page: 43

Paragraph: CS.ACNS.C.PBN.435 Vertical navigation (VNAV) mode indication, AMC1 ACNS.C.PBN.435 Vertical navigation (VNAV) mode indication

THE   PROPOSED   TEXT   STATES:

"Where vertical guidance is provided on procedures with no published path, the area navigation system provides, in the flight crew's optimum field of view, an unambiguous indication that the vertical guidance is advisory."

"The indication should be plain and easy to interpret. The use of typographic characters (e.g. '+' or '/') as the only means to distinguish whether the vertical guidance is advisory or is referenced to in a published procedure is not considered adequate."

REQUESTED CHANGE:

"Where vertical guidance is provided on procedures with no published path, the area navigation system should provide, in the flight crew's optimum field of view, an unambiguous indication that the vertical guidance is advisory."

JUSTIFICATION:

This is currently not a minimum requirement. Training for the aircraft or area navigation system will inform the flight crew what type of vertical guidance is provided and therefore, what minimums the crew can achieve. Crew training also provides the knowledge that area navigation system vertical guidance, outside of the specific cases it is "approved" for credit. In some cases, the area navigation system is not aware of the difference. In all cases, the crew is required to understand how to use the vertical guidance information provided. All vertical guidance information outside of approved guidance for final approach is advisory. The flight crew must take responsibility for understanding that they are responsible for how to fly the aircraft and meeting constraints. For the cases where vertical information is allowed to be used for credit, this information is used by the flight crew in selecting the minimums. Requiring a distinct indication in the optimum field of view doesn't change the requirement on the flight crew to understand how to apply the information.

response | Noted.
Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.435 and its corresponding AMC.
New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment | *485*   comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 41 CS ACNS.C.PBN.401 Applicability

PROPOSED TEXT / COMMENT:

The Operational concept related to Advisory VNAV in CS ACNS.C.PBN.401, GM1 ACNS.C.PBN.401, CS ACNS.C.PBN.435, AMC1 ACNS.C.PBN.435 and CS

ACNS.C.PBN.445 is not clear and not mature enough. Even the definition of "approaches with published vertical path" as "approaches to LNAV or LP minima" is not understood by Airbus.

This new concept has strong operational impacts and represents a major risk of safety regression from today's operations.

Airbus considers that related CS requirements, AMC and GM must not be included at this stage in the CS ACNS.
It is necessary to first involve in the discussion certification pilots (from both EASA and industry).

response	Partially accepted. Following discussions in the PBNSG and with stakeholders, EASA has agreed to amend the criteria for Advisory VNAV as well as to revise the definition. Subsection 4 has been repurposed and now addresses vertical navigation outside the final approach. For instance, the requirements of CS ACNS.C.PBN.410, CS ACNS.C.PBN.420 and associated AMC and GM have been retained. Compliance with Subsection 4 is optional, as reflected in Table 1 of CS ACNS.C.PBN.101. The remainder of the initially proposed Subsection 4 has been deleted and new Advisory VNAV requirements have been developed and included in Subsection 5. The advisory VNAV capability is optional and the criteria apply to the final approach segment only. Reference is made to Section 2.4 of the Explanatory note that accompanies the ED Decision.

comment	*506*	comment by: *EUROCONTROL*

AMC1 ACNS.C.PBN.440 Vertical accuracy - Page 44-46

The EUROCONTROL Agency makes three comments, each of them under the form of a question.

Table 6
In column 'Flight along specified vertical descent profile' are the figures + or - 160/210/260 ft 99.7% of the flight time?

Figure 3
Could the vertical errors be below the path?

Section (a)
The reference to CS.XX.1325 is unclear. Where can it be found?

response	Noted. Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including the elements referred to in the comment. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*513*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

DGAC France considers that the use of the word "Advisory" in this subsection 4 is ambiguous.

Whereas this VNAV function does not depend on ground infrastructure, what makes, in accordance with the definition, the VNAV be an advisory function, is the way the instrument flight procedure is built.

It is not the instrument flight procedure which should make VNAV function be an advisory function or not, it is its inherent performance. As the baroVNAV function does not depend on ground facilities, its performance could be established without considering the way the procedure is protected against obstacles.

If the VNAV function has an adequate performance to fly LNAV/VNAV, it should be eligible to fly LNAV or non precision approach procedure without any additionnal limitations. With a VNAV function certified for LNAV/VNAV, and adequate operational procedures (i.e check the consistency between the coded VPA, and the published vertical profile, check nav database currency) the flight will be better protected from the obstacles in the Final Approach Segment if the pilot uses the VNAV function rather than flying CDFA with the help of barometric altitude and distance to threshold.
To highlight that this VNAV function is advisory would not bring any pertinent information to the crew except potential misunderstanding or confusion.

response	Noted. Subsection 4 has been repurposed and new Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*517*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

GM1 ACNS.C.PBN.401 :
DGAC France considers this GM1 as ambigous and the use of the words "operational credit" as inapropriate.
A non precision approach procedure flown with the help of a VNAV function makes the operation be a 3D operation which could be interpretated as an ops credit. Moreover, most of the time the BaroVNAV function used to fly LNAV/VNAV is exactly the same embedded function used to fly LNAV or other non-precision approach procedures. Therefore is there a real need to develop additional airworthiness criteria for that purpose ?
The case which could justify that subsection could eventually be the use of SBAS VNAV on a non precision approach procedure.

response	Noted. See the response to comment 513, please.

comment	*520*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

CS ACNS.C.PBN.435
Could EASA clarify what is a procedure **with no published path**?

response	Noted. Subsection 4 has been repurposed and, in consequence of this, several requirements have been deleted, including CS ACNS.C.PBN.435 and its corresponding AMC. New Advisory VNAV requirements have been developed and included in Subsection 5. Reference is made to comment 485.

comment	*521* comment by: *DGAC Deputy Head of aircraft and operations rulemaking department* AMC1 ACNS.C.PBN.435 Vertical navigation (VNAV) mode indication : This AMC seems to adress a particular avionics system. Is it adequate?
response	Noted. See the response to comment 520, please.

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 5 — Supplementary specifications for vertical navigation in final approach   p. 47-55

comment	*49* comment by: *Dassault-Aviation* Dassault-Aviation P 48 CS ACNS.C.PBN.520 Comment: (AMC1) Glide path intercept Fly-by technique requirement from CS ACNS.C.PBN.425 in subsection 3 is a CS whereas the same fly-by technique from CS ACNS.C.PBN.520 here is an AMC: Is there a reason for this difference in classification? Please clarify (and update?)
response	Noted. Reference is made to comment 485.

comment	*50* comment by: *Dassault-Aviation* Dassault-Aviation P 50 CS ACNS.C.PBN.535 Comment: (AMC1) Resolution and full-scale deflection of the vertical deviation display ETSO C145c class D 4 is compliant for RNP APCH to LPV minimums and should be added as an AMC
response	Not accepted See the response to comment 35 and 45.

comment	*51*	comment by: *Dassault-Aviation*

Dassault-Aviation

P52 CS ACNS.C.PBN.555

Comment:
(AMC1) Vertical accuracy when using barometric altitude sources
(e) The vertical path error at final approach fix (FAF) due to the vertical fly-by transition defined in this CS is different than the one from AMC1 ACNS.C.PBN.440 (e). What is the rationale?
Also, when compared to ED 75D §3.2.8.5 Table 3-8, Table 8 values from this AMC are adapted for a transition to a vertical path angle change of 3°, but a larger change would result in greater height loss for a 0.03g fly-by. Is it intended?
Furthermore, CS ACNS.C.PBN.520 also specify glide path intercept in accordance with ED 75D §3.2.8.5: Why should the FAF transition be treated differently?
Note: For vertical accuracy when using SBAS/GNSS geometric altitude sources (CS ACNS.C.PBN.560), transition to final path is not covered
It is suggested to remove (e)

response	Accepted. Note that Subsection 4 as in the NPA has been removed due to other comments and new requirements applicable to Advisory VNAV have been developed and included in Subsection 5. Item (e) has been removed, as suggested, since CS ACNS.C.PBN.520 already addresses the point, as noted in the comment.

comment	*52*	comment by: *Dassault-Aviation*

Dassault-Aviation

P 54 CS ACNS.C.PBN.560

Comment:
(AMC1) Vertical accuracy when using SBAS/GNSS geometric altitude sources
(a) & (b) ETSO C145c class D 4 is compliant for RNP APCH to LPV minimums and should be added as an AMC

response	Not accepted See the response to comment 35.

comment	*53*	comment by: *Dassault-Aviation*

Dassault-Aviation

P 55 CS ACNS.C.PBN.565

Comment:
(AMC1) Area navigation system design — integrity in final approach. Table 9
Presentation of erroneous vertical and horizontal position or guidance is considered as a HAZARDOUS failure condition for RNP APCH to LNAV - LNAV/VNAV minima. This

is a new and notably more stringent requirement than the current certification documents for RNP APCH operations (AMC 20-27A, AC 20-138D). This could require heavy modifications to the navigation systems. Presentation of erroneous lateral position or guidance is considered only as a Major failure condition (CS ACNS.C.PBN.330): However in any case if the lateral position or guidance is erroneous, the vertical path even if "correct" will not lead to the expected position in space.

Please explain the rationale.

response	Partially accepted. Please see the response to comment 43.

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comment	*54*	comment by: *Dassault-Aviation*

Dassault-Aviation

P 55 CS ACNS.C.PBN.565

Comment:
(AMC1) Area navigation system design — integrity in final approach. Table 9 LNAV and LP minima are mentioned in the table, although those operations does not requires VNAV. Please confirm that means that the requirements apply to RNP APCH operations to LNAV / LP minimums, when advisory VNAV is used in final approach for those operations?
Please clarify

response	Partially accepted. Please see the response to comment 43.

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comment	*55*	comment by: *Dassault-Aviation*

Dassault-Aviation

P55 CS ACNC.C.PBN.570

Comment:
(AMC1) Area navigation system design — continuity
Loss of the VNAV guidance is considered Major, more stringent that in AMC 20-27A where the loss of RNP APCH functions is considered a Minor if the operator can revert to a different navigation system and proceed to a suitable airport (§ 6.5 - (b))
What is the rationale for this modification from AMC 20-27A?
Please substantiate

response	Noted Please see the response to comment 43.

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comment	*93*	comment by: *Transport Canada Civil Aviation Standards Branch*

Pg 52 appears to have the same mathematical formula error/ omission as noted on pg 45?

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response	Accepted. The formula has been corrected.

comment	*119* comment by: *Transport Canada Civil Aviation Standards Branch*
	The ACNS clauses and AMC clauses for Vertical Accuracy seem to duplicate since they both address Baro VNAV accuracy in the AMC. Do you need PBN 555? 555 does include a Path Error table (8) at FAP on page 53 that does not appear on page 46? I don't know if Pages 45 through 53 can be harmonized to remove overlap? If not then perhaps they need to be consistent on the inclusion of Table 8?
response	Accepted. Please see the response to comment 51.

comment	*121* comment by: *Transport Canada Civil Aviation Standards Branch*
	The tables have the same title but cover different Failure Conditions for the Approach Phase. Suggest combine or make titles different. (Lateral and along track) v (Horizontal and Vertical). Is lateral the same as horizontal? Or is Horizontal - Lateral and along track?
response	Partially accepted. Please see the response to comment 43.

comment	*194* comment by: *Garmin International*
	CS ACNS.C.PBN.510 Altitude constraints, and AMC1 ACNS.C.PBN.510 Altitude constraints - Page 47: For final approach navigation, it is not necessary for equipment to have "the capability to specify a vertical path between altitude constraints at two fixes in the flight plan" or to use the 4 different types of altitude constraints. ETSO-C146() is required to have the capability to construct a final approach vertical path defined by: • "the threshold location, threshold crossing height [TCH], and glidepath angle [GPA]" (see DO-229E 2.2.4.3.1 for LNAV/VNAV), or • the flight path alignment point (FPAP), landing threshold point/fictitious threshold point (LTP/FTP), TCH and GPA in the final approach segment (FAS) data block (see DO-229E 2.2.4.3.1 for LNAV/VNAV and DO-229E 2.2.5.3.1 for LPV). ETSO-C115() equipment can also construct an LNAV/VNAV final approach vertical path from the threshold location, TCH, and GPA. Suggest revising to indicate there are multiple methods of constructing the final approach vertical path, one of which may be via altitude constraints but others via the information in the above bullet points.
response	Partially accepted.

CS ACNS.C.PBN.510 has been removed, since the criteria are covered in Subsection 4, which has been repurposed. CS ACNS.C.PBN.505 has been revised to refer to a vertical approach path.

comment	195	comment by: *Garmin International*

AMC1 ACNS.C.PBN.520 Glide path intercept - Page 48:

It is incorrect to say that the final approach fix is intercepted. Suggest changing wording to: "The area navigation system should allow the final approach glide path to be intercepted …"

response	Accepted

AMC1 ACNS.C.PBN.520 has been amended to reflect the intent of the comment whilst maintaining consistency with the update to CS ACNS.C.PBN.505.

comment	196	comment by: *Garmin International*

AMC1 ACNS.C.PBN.520 Glide path intercept - Page 48:

Regarding "The installation of equipment with an ETSO authorisation against ETSO-C115d satisfies the requirement": The angular vertical deviation requirements of ETSO-C146() equipment were specifically designed to allow ILS-look alike interception of the final approach glide path. Consequently, ETSO-C146() equipment also should satisfy the requirement.

response	Accepted

A reference to ETSO-C146c has been added.

comment	197	comment by: *Garmin International*

GM1 ACNS.C.PBN.520 Glide path intercept - Page 48:

Regarding "The capability to intercept the final approach provides the flight crew with the ability to rejoin the published final approach track … following ATC vectors to support final approach sequencing": This GM mixes the concept of intercepting the final approach glide path (which seems to be the intent of CS ACNS.C.PBN.520 and AMC1 ACNS.C.PBN.520) with the concept of intercepting the extended final approach lateral path (e.g., see AMC 20-28 section 7.1 item 8). Either delete this GM or revise it to be consistent with intercepting the final approach glide path.

response	Accepted

This GM has been deleted.

comment	198	comment by: *Garmin International*

CS ACNS.C.PBN.525 Temperature compensation - Page 48:

It is not clear what is intended by "systems that are intended to operate equivalent to an instrument landing system (ILS)" in the context of "area navigation systems that use a barometric source for vertical position". Looking at item (b) under AMC1

ACNS.C.PBN.560, it appears that this phrase is intended to mean systems using SBAS and angular deviations per ETSO-C146() – but that is inconsistent with "navigation systems that use a barometric source for vertical position". Alternatively, could this be referring only to systems that use angular vertical scaling (see item (b) under AMC1 ACNS.C.PBN.535)?

Unless the exception can be clarified, suggest changing this paragraph to the following:

"Area navigation systems that use a barometric source for vertical position on the final approach segment provide:"

response	Partially accepted. Please see the response to comment 413.

comment	*199*	comment by: *Garmin International*

CS ACNS.C.PBN.525 Temperature compensation and AMC1 ACNS.C.PBN.525 Temperature compensation - Page 48:

Regarding "area navigation systems that use a barometric source for vertical position provide: (a) a selectable means to enable cold temperature compensation automatically ...": Requiring automatic temperature compensation is not appropriate as a general requirement since, as is acknowledged in AMC1 ACNS.C.PBN.525, temperature compensation is optional even for ETSO-C115d Class A equipment that requires baro VNAV functionality. Requiring temperature compensation is also a deviation from both the ICAO PBN Manual and FAA AC 20-138D that is not noted in the NPA introductory material.

Additionally, many existing systems do not provide automatic temperature compensation. How will these systems continue to be certified in new installations?

Suggest revising the text to be consistent with the optional nature of temperature compensation in ETSO-C115d, ICAO PBN Manual, and FAA AC 20-138D.

response	Partially accepted. Please see the response to comment 413.

comment	*200*	comment by: *Garmin International*

CS ACNS.C.PBN.530 Vertical deviation display - Page 49:

The non-numeric vertical deviation display cannot show "the defined vertical path" (it can only show the deviation from that path). Thus, this phrase should be removed from the sentence.

response	Accepted. The text has been revised to reflect the intent of the comment.

comment	*201*	comment by: *Garmin International*

GM1 ACNS.C.PBN.530 Vertical deviation display Page 50:

Regarding "intercept the final approach segment": The non-numeric vertical deviation display is used to intercept the final approach glide path. Suggest changing to "intercept the final approach glide path".

response	Partially accepted The text has been revised for consistency with the update to CS ACNS.C.PBN.505, resulting in the deletion of the referred to GM.

comment	*202*	comment by: *Garmin International*

AMC1 ACNS.C.PBN.535 Resolution and full-scale deflection of the vertical deviation display - Page 50:

Regarding the statement that "The area navigation system should provide a non-numerical vertical deviation display with a full-scale deflection of ± 150 ft." This guidance is appropriate for systems that use fixed vertical scaling but not systems that use angular vertical scaling, which is addressed later in AMC1 ACNS.C.PBN.535. Suggest revising this statement to "Area navigation systems that use fixed vertical scaling should provide …"

response	Accepted The text has been revised to reflect the intent of the comment.

comment	*203*	comment by: *Garmin International*

CS ACNS.C.PBN.540 Barometric altitude - Page 50:

It is not clear what is meant by "the approach is supported by barometric altitude sources". Suggest changing to "For area navigation systems that use a barometric source for vertical position on the final approach segment".

Note that AMC 20-28 (LPV approach) does not currently require two independent barometric altimetry sources, but barometric altitude is used prior to capturing the glide path and is also required to determine arrival at the DA. To aid in the ability to certify use of baro VNAV during final approach for small aircraft, consideration should be given to allow a single barometric altimetry source for non-type-rated CS-23 Level 1, 2 and 3 aircraft in similar fashion to the relaxation of the RF leg autopilot/flight director requirement in CS ACNS.C.PBN.815.

response	Partially accepted. Reference has been made to Barometric VNAV. Please see the response to comment 435 as well.

comment	*204*	comment by: *Garmin International*

AMC1 ACNS.C.PBN.550 Glide path alerting - Page 51:

CS ACNS.C.PBN.550 requires aircraft equipped with Class A TAWS to provide an excessive deviation below glide path alert for approaches to LPV minima. While

AMC1 ACNS.C.PBN.550 allows the excessive-deviation-below-the-glide-path alert to be provided by another system other than the TAWS, this may not be practical.

EASA Part-CAT AMC/GM includes GM2 CAT.IDE.A.345 item (l) "RNP APCH — LPV minima", subitem (2) that states: "For aircraft that have a TAWS Class A installed and do not provide Mode-5 protection on an LPV approach, the DH is limited to 250 ft." The same statement limiting LPV approaches to a 250 ft DH is included in EASA Part-NCC, Part-NCO, and Part-SPO AMC/GM.

A GM should be added under CS ACNS.C.PBN.550 that for aircraft that do not have an excessive-deviation-below-the-glide-path alert for LPV approach, the installation AFM should include a 250 ft DH limitation for LPV approach operations.

response	Not accepted. The text in GM2 CAT.IDE.A.345 reflects the notion that due to slow progress on development of TAWS solutions that would support this functionality, EASA was forced to issue approvals with such limitations included in the AFM(S), even though these installations technically did not comply with the criteria of AMC 20-28. At the time of publication of NPA 2018-02 however, such systems are widely available. EASA, therefore, sees no reason to continue to approve installations with those limitations. Please refer to Section 2.4 of the Explanatory note that accompanies the ED Decision, where more information is provided.

comment	*205* — comment by: *Garmin International*

AMC1 ACNS.C.PBN.565 Area navigation system design — integrity in final approach - Page 55:

Intended operations of Table 9 should not include LNAV or LP minima since vertical guidance is advisory in those cases.

response	Partially accepted. Please see the response to comment 43.

comment	*206* — comment by: *Garmin International*

AMC1 ACNS.C.PBN.565 Area navigation system design — integrity in final approach - Page 55:

Erroneous horizontal position will usually imply erroneous vertical position because of horizontal coupling error. In Table 9, the HAZARDOUS failure classification for LNAV/VNAV "presentation of erroneous vertical <u>and</u> horizontal position or guidance" is a new requirement (as compared to AMC 20-27A) that is excessive (not justified based on actual experience with aircraft compliant with AMC 20-27A). Suggest changing to MAJOR or removing this row altogether. Also note that Table 5 under AMC1 ACNS.C.PBN.330 establishes presentation of erroneous along-track distance (which couples into vertical position error) as a MAJOR failure condition.

response	Partially accepted. Please see the response to comment 43.

comment	*207*	comment by: *Garmin International*

AMC1 ACNS.C.PBN.570 Area navigation system design — continuity - Page 55:

Per existing guidance (AMC 20-27A), Loss of vertical guidance for LNAV/VNAV minima has been established as a MINOR failure condition. This paragraph should classify loss of vertical guidance as MINOR for LNAV/VNAV minima (consistent with AMC 20-27A) and MAJOR for LPV minima (consistent with AMC 20-28).

response	Partially accepted See the response to comment 43.

comment	*243*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 54 AMC1 ACNS.C.PBN.565

PROPOSED TEXT / COMMENT:

 It is proposed to write the AMC as follow :

"The area navigation system, including position sensors, displays, etc., is designed to provide a level of integrity that supports the classification of failure conditions resulting from the Safety analysis performed for compliance to CS 25.1309.

In absence of robust and complete safety process, the applicant should design it to provide a level of integrity that supports the classification of failure conditions defined in Table 9 below
In addition, current classification proposal doesn't seem right on several items (e.g. : Classification for RNP APCH down to LNAV or LNAV/VNAV minima as HAZARDOUS in the case of Presentation of erroneous vertical and horizontal position or guidance). So even if used as a guideline in specific cases, those proposals should be re-analysed with certification pilots (from both authority and industry).

RATIONALE / REASON / JUSTIFICATION:

Failure cases and their Safety Classifications are linked to the operations, architectures, mitigations in place and information presented to the crew. The only means to assess classification is through compliance to CS 25.1309 applying as per AMC 25.1309 the FHA/SSA process during certification, using pilots judgment and simulator as necessary.
Safety classifications should not be constraint by AMCs when a robust safety process is in place.
It can be understood to provide suggested classifications/guidelines in specifc cases for which safety analyse cannot be performed.

response	Partially accepted. Please see the response to comment 43.

comment	*264*	comment by: *ESSP-SAS*

CS ACNS.C.PBN.550 Glide path alerting. Existing AIR OPS regulation includes GM2 CAT.IDE.A.345:
(l) RNP APCH — LPV minima;
(2) For aircraft that have a TAWS Class A installed and do not provide Mode-5 protection on an LPV approach, the DH is limited to 250 ft."

This GM shall be also included in CS-ACNS NAV to have all the provisions aligned.

response	Not accepted.

The text in GM2 CAT.IDE.A.345 reflects the notion that due to slow progress on development of TAWS solutions that would support this functionality, EASA was forced to issue approvals with such limitations included in the AFM(S), even though these installations technically did not comply with the criteria of AMC 20-28.
At the time of publication of NPA 2018-02 however, such systems are widely available. EASA, therefore, sees no reason to continue to approve installations with those limitations.
Please refer to Section 2.4 of the Explanatory note that accompanies the ED Decision, where more information is provided

comment	*273*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.565 : The HAZARDOUS classification for the presentation of erroneous vertical and horizontal position or guidance for RNP APCH down to LNAV/VNAV minima is new without safety rationale. Highest classification is currently MAJOR in AMC20-27 and AC90-138D change 2, change without justification on EASA side would have significant impact on implementations and it would create a non-level playing field with FAA. Thales strongly disagree with this change to existing materials.

Thales proposal:

To change HAZARDOUS by MAJOR for RNP APCH down to LNAV/VNAV minima in table 9.

response	Partially accepted.

Please see the response to comment 43.

comment	*274*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.565 : VNAV in final approach section shall not create safety classification for RNP APCH down to LNAV minima (especially HAZARDOUS). There is no obstacle protection justification is minima and constraints are respected for LNAV minima.

Thales proposal:
Remove 'LNAV minima' of table 9. ['LP minima' can be removed too].

response	Partially accepted.

Please see the response to comment 43.

| comment | 277 | comment by: *THALES AVIONICS* |

CS ACNS.C.PBN.530 is ambiguous and may be understand as a requirement to implement a Vertical Display. It needs to be clarified.

Thales proposal :

To Change '[…] the defined vertical path and the deviation from that path' by '[…] the deviation from the defined vertical path'

| response | Accepted.
Please see the response to comment 200. |

| comment | 278 | comment by: *THALES AVIONICS* |

CS ACNS.C.PBN.525 : Cold temperature compensation is not mandatory in current EASA and current FAA AC20-138D regulation. This feature should be introduced as mandatory in the future only if an operational need (considering that geometric altitude solution are emerging) is confirmed and associated to an harmonization of FAA and EASA material.

Thales proposal :

CS ACNS.C.PBN.525 shall be optional starting with ' Where the area navigation system supports ….'

| response | Partially accepted.
Please see the response to comment 413. |

| comment | 279 | comment by: *THALES AVIONICS* |

CS ACNS.C.PBN.525 : Location of the word 'automatically' is confusing in the sentence.

Thales proposal:

To Change '(a) a selectable means to enable cold temperature compensation automatically from the initial approach fix to the missed approach holding fix';
 to
'(a) a selectable means to enable automatic cold temperature compensation from the initial approach fix to the missed approach holding fix';

| response | Partially accepted.
Please see the response to comment 413. |

| comment | 286 | comment by: *THALES AVIONICS* |

AMC1 ACNS.C.PBN.555 Error in ASE equation: factor 10-3 missing

Thales proposal:

To correct the ASE formula with 'ASE = − 8.8× 10−8× H² +6.5× 10−3x H+50'

response	Accepted. The formula has been corrected.

comment	*319*	comment by: *Leonardo Helicopters*

page 47

AMC1 ACNS.C.PBN.510   Altitude constraints

The altitude constraints should be defined as follows: (a)   an 'AT or ABOVE' altitude constraint;
(b)   an 'AT or BELOW' altitude constraint;
(c)   an 'AT' altitude constraint; or
(d)   a 'WINDOW' altitude constraint
[For H/C operations Window altitude constraint should be identified as optional respect the 'AT', 'AT or ABOVE and 'AT or BELOW']

response	Noted. The use of these altitude constraints no longer apply to the final approach segment and has been moved to Subsection 4. See the responses to comment 194 and 485 as well.

comment	*320*	comment by: *Leonardo Helicopters*

Page 54

GM1 ACNS.C.PBN.560   Vertical accuracy when using SBAS/GNSS geometric altitude sources

The lateral and vertical full-scale deflection requirements detailed in RTCA DO-229D **[Or DO-229E]**

response	Not accepted. References made to the RTCA Document DO-229D (MOPS) are considered to suffice.

comment	*329*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 54 AMC1 ACNS.C.PBN.560

PROPOSED TEXT / COMMENT:

AMC should also recognise ETSO C145c
It is suggested to reword the AMC in order :
- to make it generic refering to relevant sections of ED 75D
- to complete the list of ETSOs that allow to demonstrate compliance to the CS

RATIONALE / REASON / JUSTIFICATION:

response	Partially accepted References to ETSO-C145c has been added where necessary. A corresponding ED-75D reference has not been added, because none was found applicable.

comment	*363* comment by: *Embraer S.A.*

Embraer suggests to harmonize AMC1 ACNS.C.PBN.565 (Area navigation system design — integrity in final approach) with FAA AC 20-138D and EASA AMC 20-27A.

It is advisable to harmonize table 9 from AMC1 ACNS.C.PBN.565 with table 8 from FAA AC 20-138D and § 6.4 from EASA AMC 20-27A. Based on this harmonization, the integrity requirement for "Presentation of erroneous vertical and horizontal position or guidance" should be classified as "Major".
Also consider that the same system is providing lateral and vertical guidance and a misleading in the lateral position (along track error) can automatically cause a misleading in the vertical navigation.

To change the text from:

[...]

Table 9: Area navigation system failure conditions – integrity in final approach

Intended operations *Failure condition*	*RNP APCH down to LNAV or LNAV/VNAV minima* *Classification* *(not RNP AR APCH)*	*RNP APCH down to LP or LPV minima* *Classification*
Presentation of erroneous vertical position or guidance	*MAJOR*	*HAZARDOUS*
Presentation of erroneous vertical and horizontal position or guidance	*HAZARDOUS*	*HAZARDOUS*

[...]

To:

[...]

Table 9: Area navigation system failure conditions – integrity in final approach

Intended operations *Failure condition*	*RNP APCH down to LNAV or LNAV/VNAV minima* *Classification* *(not RNP AR APCH)*	*RNP APCH down to LP or LPV minima* *Classification*

Presentation of erroneous vertical position or guidance	*MAJOR*	*HAZARDOUS*
Presentation of erroneous vertical and horizontal position or guidance	*MAJOR* ~~*HAZARDOUS*~~	*HAZARDOUS*

[...]

response	Partially accepted.
	Please see the response to comment 43.

comment	*370*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.570 : Loss of vertical guidance is classified as MAJOR whereas in AMC20-138D change 2 the loss of RNP APCH function is minor if possibility to revert to another navigation mean. Regulation should be harmonized.
Loss of the vertical guidance in RNP APCH may trigger a GA or a change of minima (switch to LNAV).

Thales proposal:

To offer an minor classification for loss of vertical guidance in RNP APCH if the operator can revert to a different navigation system and proceed to a suitable airport

response	Partially accepted.
	Please see the response to comment 43.

comment	*380*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.525 : The sentence 'The capability to provide automatic temperature compensation is not required to obtain an ETSO authorisation against ETSO C115d' may be confusing as it does not indicate the action to select (whereas indicated in the CS).

Thales proposal:

To replace the sentence 'The capability to provide automatic temperature compensation is not required to obtain an ETSO authorisation against ETSO C115d'
By
'The capability to select the automatic temperature compensation is not required to obtain an ETSO authorisation against ETSO C115d

response	Not acceped.
	The requirement for temperature compensation has been reworded to indicate where this function is selectable by the pilot. The AMC is just indicating that temperature compensation is an optional function in RTCA DO-283B and, therefore, not all systems have this capability.
	Please also see the response to comment 413.

comment	*381*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.535 : The sentence 'It may be required to limit the length of the approach to exclude operating where the angular deviations no longer support monitoring and bounding of the FTE.' does not really make sense at system level – how the system could limit the length of a published approach, coded in the navigation database. The sentence is confusing at system level and does not add value as an AMC for the system.

Thales proposal:

To remove the sentence 'It may be required to limit the length of the approach to exclude operating where the angular deviations no longer support monitoring and bounding of the FTE'

response	Partially accepted

A change to the text has been made to better express the intent of the AMC text, but the paragraph has been retained.

comment	*389*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 50 AMC1 ACNS.C.PBN.535

PROPOSED TEXT / COMMENT:

AMC should also recognise ETSO C145c
It is suggested to reword the AMC in order :
- to make it generic refering to relevant sections of ED 75D
- to complete the list of ETSOs adding ETSO C145c that allows to demonstrate compliance to the CS

RATIONALE / REASON / JUSTIFICATION:

response	Not accepted

Partially agreed, ETSO-C145c cannot be considered as an AMC alone as such equipment does not provide display functions (sensor only). No reference to the applicable paragraph in ED-75D has been introduced, as it would not add to the description provided in the AMC.

comment	*413*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 48 CS ACNS.C.PBN.525 Temperature compensation
PROPOSED TEXT / COMMENT:

 It is proposed to delete the whole CS ACNS.C.PBN.525 and its AMC,

RATIONALE / REASON / JUSTIFICATION:

Airbus considers that it is not approriate to mandate capability "to enable automatic cold temperature compensation" for below reasons :

First, to Airbus knowledge it is rarely used by ANSPs (and in particular it is not used by European ANSPs) as it requires specific training for ATC controllers to ensure safe operation with A/C with no Temperature compensation.

In addition, there is no Cost/Operational Benefit :

- The concept to correct altimetry via a FMS profile is complex. The implementation is also complex (it impacts profiles, guidances and displays)
- The operationnal concept of use of this function is not proven in dense areas, the actual function deployment in Europe is at high risk.
- The transition altitude in Europe is 5000FT and will be mixed with transition from uncompensated to compensated, generating complexity and system risk as well as pilot difficulty to understand.

The function includes risks of pilot entry error and finally FAA does not require the function .

There are other means to secure obstacle clearance which are publication of appropriate intermediate altitudes ensuring Minimum Obstacle Clearance by procedure designers.

This point needs to be further discussed with EASA and Airbus Pilots after the comments period.

response	Partially accepted.

EASA considers that automatic temperature compensation, when properly applied, enhances safety. This is not just the case for operations within the FAS, but in the initial and, more particularly, the intermediate approach segment, too.

We recognise however that not all systems are currently capable of providing this functionality. For this reason, we have revised the requirement to a conditional one, in line with AMC2 CAT.OP.MPA.126.

In addition, we consider that automatic temperature compensation may create conflicts with ATC procedures, if these are not updated to avoid a potential loss of separation between aircraft employing temperature compensation and those that do not, e.g. loss of vertical separation between departing and arriving aircraft. Hence the requirement for the function to be selectable if provided outside the FAS.

Lastly, we consider that the new text is commensurate with, and supports, AMC2 CAT.OP.MPA.126.

comment	*414*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 50 AMC1 ACNS.C.PBN.535 Resolution and full-scale deflection of the vertical deviation display

PROPOSED TEXT / COMMENT:

The operational need of clear marking for +75ft is not understood. However reading the Note of the AMC it is understood that other designs may be accepted.

RATIONALE / REASON / JUSTIFICATION:

For clarification

response	Noted.

comment	*415*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 50 AMC1 ACNS.C.PBN.535 Resolution and full-scale deflection of the vertical deviation display

PROPOSED TEXT / COMMENT:

It is proposed to remove the following part of the AMC.
Systems that use angular vertical scaling should meet the following: (a) The deviation scaling suitably supports the flight technical error (FTE) monitoring and bounding (75-ft deviation); (b) The deviation limits are equivalent to the operational limits for glideslope deviations during an ILS approach. It may be required to limit the length of the approach to exclude operating where the angular deviations no longer support monitoring and bounding of the FTE. Vertical deviation displays that rely on the flight crew to assess the deviation based on whether or not the pointer still touches a marker are not considered acceptable. A vertical situation display is not considered to satisfy the requirements

RATIONALE / REASON / JUSTIFICATION:

The AMC should propose acceptable means and not forbid some designs. In addition the paragraph may be source of missinterpretation since scales monitoring are made of pointers and markers.

response	Partially accepted. In general, EASA agrees with the comment that AMC should not forbid certain designs. In some particular cases however, applicants have proposed vertical deviation designs that clearly did not meet the expectations of a proper crew interface. Since the industry has been reluctant to commit to standardising vertical deviation indicators and/or has been reluctant to implement those standards that were agreed by industry and authorities, EASA has few options to ensure that designs are appropriately designed to support the flight crews in monitoring the vertical deviation, than to clearly state what EASA does not consider appropriate. The text has however been moved from AMC to GM in response to this comment.

comment	*416*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 51 AMC1 ACNS.C.PBN.555

PROPOSED TEXT / COMMENT:

There is no operational need for performance demonstration in final approach above 20 000 ft MSL.
 It is proposed to limit the table at 20 000 ft.

RATIONALE / REASON / JUSTIFICATION:

response	Not accepted.
	The requirement is consistent with the requirements of ED-75D.

comment	*417*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 54 AMC1 ACNS.C.PBN.560 Vertical accuracy when using SBAS/GNSS geometric altitude sources

PROPOSED TEXT / COMMENT:

(a) (NSE) and (b) (FTEz) can be fulfilled by other classes than ETSO-C146c Class Gamma.
Typically Class Delta can also fulfill this requirement.
ETSO C145c should also be recognised.
Moreover other acceptable means than ETSOs should be provided
It is suggested to reword the AMC in order :
- to make it generic providing other acceptable means than ETSOs.
- to complete the list of ETSOs and classes of equipement that allow to demonstrate compliance to the CS

response	Partially accepted
	AMC1 ACNS.C.PBN.560 has been amended to change the references to operational Classes 3 or 4 and to reference ETSO-C145c operational Class 3.
	Consequently all references to ETSO C145c and ETSO-C146c in former Subsection 5 have been amended to be limited to the operational classes identified above.

comment	*432*	comment by: *FAA AIR*

Reference: The section of the NPA titled, "CS ACNS.C.PBN.525 Temperature compensation"
COMMENT: – *Substantive.* This section states, "Except for systems that are intended to operate equivalent to an instrument landing system (ILS), area navigation systems that use a barometric source for vertical position provide…" The exception is inappropriate considering an RNP approach flown to LPV minima and a GLS approach are both "operate equivalent to an ILS". Even for an ILS this exception is inappropriate. For example, using temperature compensation can offer a means to enable a smooth transition to, and intercept of, the approved vertical guidance for either an ILS, GLS or LPV final approach operation. In fact, using temperature compensation during these operations ensures the aircraft will intercept the approved vertical guidance at the point where the procedure designer intends the aircraft to intercept the glidepath, not prior to it or beyond it. During an ILS approach operation, use of temperature compensation in this manner helps the pilot backup the ILS approach operation with proper timing should they need to revert to LOC-only minimums as well.
RECOMMENDATION – Delete this exception and begin this section by simply stating, "An installed temperature compensation function should provide:…"
RATIONALE: – Pilots may apply temperature compensation for operational advantage to both conventional instrument operations as well as PBN instrument operations. Use of a properly designed and installed temperature compensation

function enables compliance with the intent of the procedure designs. The exception is inappropriate and unnecessary.

response	Partially accepted. Please see the response to comment 413

comment	**433**	comment by: *FAA AIR*

Reference: The section of the NPA titled, "AMC1.ACNS.C.PBN.535 Resolution and full-scale deflection of the vertical deviation display"

COMMENT – *Substantive.* This section states, "Systems that use angular vertical scaling should meet the following: (a) The deviation scaling suitably supports the flight technical error (FTE) monitoring and bounding (75-ft deviation);…" The reference to 75-ft deviation is inappropriate. The instrument approach systems providing angular vertical guidance for operational credit (e.g. ILS, GLS, LPV and MLS) provide defined vertical scaling set by compliance with a TSO (i.e. compliance with the standards the TSO invokes). There need not be any reference to any other vertical scaling standard. A properly installed system will enable bounding of FTE throughout the entire portion of the operation where the system provides angular vertical guidance.

RECOMMENDATION – Remove "(75-ft deviation)" from the statement.

RATIONALE – Reference to 75-ft conflicts with the existing public standards for systems offering approved, angular vertical guidance for operational credit.

response	Not accepted. The commentator is confusing the guidance provided by systems that use SBAS/GNSS geometric altitude and comply with (E)TSO-C145( )/146( ) with designs that use barometric altimetry to present ILS look-a-like angular guidance. Where the latter is the case, the design should ensure that the scaling supports FTE monitoring and bounding to the same +/- 75 ft. used in conventional designs that provide linear guidance.

comment	**435**	comment by: *FAA AIR*

Reference: The section of the NPA titled, "CS ACNS.C.PBN.540 barometric altitude"

COMMENT – *Substantive.* This section begins by stating, "When the approach is supported by barometric altitude sources, the aircraft displays the barometric altitude from two independent altimetry sources:". The intent of this statement is potentially misleading. That is, this statement implies an aircraft must have two barometric altimeters to provide approved vertical guidance for operational credit (i.e. to provide LNAV/VNAV vertical guidance during an RNP APCH). However, the minimum equipment for a general aviation aircraft to be eligible for operations under IFR is a single barometric altimeter. Thus, this misleads applicants into believing the only means to offer approved vertical guidance for operational credit is by installing at least two barometric altimeters. Then, this section conflates requirements for aircraft requiring a minimum flight crew of two pilots. That is, this section inappropriately repeats the requirements for the placement of the instruments in such an aircraft, which have nothing to do with whether or not the aircraft offers approved vertical guidance for operational credit thru baro-VNAV.

This requirement is also an extract from the requirements of the ICAO PBN Manual, Volume II, Chapter 6, RNP AR APCH. That is, this requirement is actually the

foundation for compliance with the RNP AR VEB when the applicant is using baro-VNAV to show compliance to the VEB. In other words, this requirement currently does not currently exist outside eligibility for RNP AR APCH. If this is an example of EASA raising the minimum performance standard for all applications of baro-VNAV, then the new specifications should explicitly state so, and they should try to justify the imposition of a new higher standard for all applications of baro-VNAV vertical guidance.

Meanwhile, this is yet another example where the NPA uses new words to describe an existing airworthiness standard. That is, the terms, "When the approach is supported by barometric altitude sources…" is a vague reference to application of baro-VNAV. As a result, the specs should specifically state they refer to application of baro-VNAV vertical guidance. As currently authored, the NPA confuses baro-VNAV with the required minimum equipment an aircraft eligible for IFR operations must include. That is, *every* instrument approach is "supported by barometric altitude" since every instrument approach includes procedural barometric altitudes. Again, a well-intentioned effort at simplicity, is in reality introduces opportunity for confusion and misunderstanding.

RECOMMENDAITON – Delete this section of the NPA. The section is misleading and redundant.

RATIONALE – See comment above.

response	Partially accepted.

Partially accepted.

The commentator is correct that IFR operations with Non Complex Aircraft (i.e. GA aircraft) require just one display of barometric altitude. That said, EASA considers it unlikely that single pilot, non-complex aircraft will be equipped with RNP systems providing approach Baro-VNAV capability to LNAV/VNAV minima. The vast majority will be equipped with systems that provide VNAV based on SBAS/GNSS geometric altitude.

In addition, EASA is concerned with operating RNP APCH procedures based on Baro VNAV that is essentially based on a single source and, therefore, considers the additional criterion appropriate.

With reference to the use of the term 'barometric altitude sources' EASA agrees. Where applicable, these references have been replaced by 'Barometric VNAV'.

comment	*436*	comment by: *FAA AIR*

Reference the section of the NPA titled, "CS ACNS.C.PBN.550 Glide path alerting and AMC1.ACNS.C.PBN.550 Glide path alerting"

COMMENT: – *Substantive.* These two sections appropriately call out requirements for alerting for deviation below glidepath during an RNP APCH flown to LPV minimums. However, these requirements and the AMOC ignore the RNP APCH operation flown to LNAV/VNAV minimums.

RECOMMENDATION: – Clarify the requirement to include RNP APCH operations flown to LNAV/VNAV minimums. Begin the first section by stating, "For RNP APCH operations flown to LPV or LNAV/VNAV minimums, aircraft…"

RATIONAL – A pilot may inadvertently deviate below the approved vertical guidance during an RNP APCH flown to LNAV/VNAV minimums, just as a pilot flying an RNP APCH to LPV minimums may do so. Thus, requiring deviation alerting for an RNP APCH flown to LNAV/VNAV minimums is logical, and implementing this requirement may help prevent a pilot from making an inadvertent descent below the LNAV/VNAV sloping obstacle clearance surface resulting in controlled flight into terrain

(CFIT). *Note: EASA should ensure a similar requirement exists to support GLS approach operations as well, which appears to be outside the scope of the NPA.*

response	Partially accepted.
	EASA is aware that in FAA AC 20-138D Change 2, applicants are highly recommended, but not required to install a Glidepath deviation alerting function on aircraft that have the capability to perform approaches to LPV and LNAV/VNAV minima.
	When discussing the requirement in AMC 20-28 to provide the capability to provide an alert for excessive downward deviation from the glide path, EASA has considered the case of approach procedures to LNAV/VNAV minima and considered that although it would have a safety benefit, implementation would likely be impractical. We furthermore considered that the minima on approaches to LPV minima were lower and commensurate with ILS CAT I procedures for which said function was already required. Extending the requirement to approaches to LNAV/VNAV minima would imply a new requirement, which we do not consider appropriate. But a note will be added to reflect the recommendation in FAA AC 20-138D Change 2.
	With respect to GLS: This is covered in the proposed updated CS-AWO (NPA 2018-06).

comment	*437*	comment by: *FAA AIR*

Reference: The section of the NPA titled, "SUPPLEMENTARY PERFORMANCE CRITERIA, Vertical performance". This section begins with subparagraph: CS ACNS.C.PBN.555 Vertical accuracy when using barometric altitude sources

COMMENT: – *Substantive.* This subsection of the NPA is misleading because of the new use of the words, "using barometric altitude sources". After review, it is easy to see this language and word choice is simply new wording for the existing barometric VNAV (baro-VNAV) standards. Failing to refer to this section as the standards for baro-VNAV will only confuse applicants, especially since ICAO Document 9613, the ICAO PBN Manual, RTCA DO-236C and FAA AC 20-138D all contain standards for baro-VNAV, not for "vertical accuracy using barometric altitude sources". Likewise, the standards for baro-VNAV are long-standing and serve as the foundation for aircraft eligibility use of baro-VNAV as approved vertical guidance for operational credit during RNP APCH ops conducted using the LNAV/VNAV line of minimums. The NPA's use of new terminology for baro-VNAV will simply confuse applicants and States implementing RNP APCH operations that contain a LNAV/VNAV line of minima.

RECOMMENDATION – Change all text referring to "using barometric altitude sources" to "using barometric VNAV (baro-VNAV)".

RATIONALE – Clarity on what the standards actually cover. Promote continued harmonization and consistency with existing guidance materials and requirements for baro-VNAV without adding unnecessary confusion by using new terminology.

response	Accepted.
	The text has been revised to reflect the recommendation.

comment	*438*	comment by: *FAA AIR*

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Reference Table 9, Area navigation system failure conditions – integrity in the final approach

COMMENT: *Substantive.* This table adds a new hazard classification for "presentation of erroneous vertical and horizontal position or guidance" and then classifies this aspect as HAZARDOUS for an RNP APCH when using either LNAV-only or LNAV/VNAV minimums. This conflicts with previous guidance in AMC 20-27A; and it conflicts with the existing specs in the ICAO PBN Manual, AC 20-138D and even the basis for the RNP MASPS (i.e. ED-75). This new classification is also unsupported by any justification for raising the minimum standard from MAJOR. Meanwhile, this conflicts with the content of Table 5 of the NPA where erroneous along-track error (i.e. an erroneous horizontal position) is a MAJOR failure condition. In addition, since erroneous vertical guidance is product of the aircraft's determination of its horizontal position; they are not independent of one another. Thus, if erroneous along-track error is MAJOR, then erroneous vertical guidance is also MAJOR by default.

RECOMMEDATION: Change the failure classification to MAJOR for erroneous vertical and horizontal position or guidance or completely delete this part of the table.

RATIONALE: None of the other existing specifications refers to "erroneous vertical and horizontal position or guidance". Thus, this is a completely new reference. Likewise, the current content of the NPA contradicts itself. In addition, the protection offered by the airworthiness standards for these operations protects against hazardous failure conditions. As a result, there is no practical justification for raising the standard to HAZARDOUS

| response | Partially accepted.
Please see the response to comment 43. |

| comment | *449* | comment by: *THALES AVIONICS* |

CS ACNS.C.PBN.530 (bis) : This requirement without AMC is close to CS ACNS.C.PBN.430 which has an associated AMC refereeing to ETSO C115D. The same AMC should be added.

Thales proposal:

To add an AMC to CS530 'Installation of equipment with an ETSO authorisation against ETSO-C115d supports the statement above; however, the applicant should ensure the display characteristics comply with the CS.'

| response | Accepted.
The text has been revised in line with the commentator's suggestion. |

| comment | *456* | comment by: *M.Jo (ATR)* |

CS ACNS.C.PBN.545 Active approach mode display
- ☐ Title is not corresponding to the text
- ☐ On an aircraft using only baro altitude, this CS requests a useless information.
Could it be possible to write an AMC covering design using only baro altitude? (potentially with a distinction about LPV. for example: "For aircraft using a same source for the vertical guidance outside LPV operation, ...")

response	Accepted. EASA agrees that the requirement only makes sense for aircraft that may use more than one source of altimetry for the VNAV and has amended the text accordingly.

comment	*488*	comment by: *GSA*

CS ACNS.C.PBN.550 Glide path alerting should be aligned with AIR OPS and include GM2 CAT.IDE.A.345:
(1) RNP APCH — LPV minima;
(2) For aircraft that have a TAWS Class A installed and do not provide Mode-5 protection on an LPV approach, the DH is limited to 250 ft.

response	Not accepted. The text in GM2 CAT.IDE.A.345 reflects the notion that due to slow progress on development of TAWS solutions that would support this functionality, EASA was forced to issue approvals with such limitations included in the AFM(S), even though these installations technically did not comply with the criteria of AMC 20-28. At the time of publication of NPA 2018-02 however, such systems are widely available. EASA, therefore, sees no reason to continue to approve installations with those limitations. Please refer to Section 2.4 of the Explanatory note that accompanies the ED Decision, where more information is provided.

comment	*508*	comment by: *EUROCONTROL*

AMC1 ACNS.C.PBN.510 Altitude constraints - Page 47

The EUROCONTROL Agency makes one comment under the form of a question:
For vertical navigation on Final Approach should we still worry about Altitude constraints?

AMC1 ACNS.C.PBN.520 Glide path intercept - Page 48

Para 1
The EUROCONTROL Agency makes two comments under the form of questions:
Should FAP not be added to FAF? Should there not be a definition and explanation of FAF and FAP as both terms are used within the document?

CS ACNS.C.PBN.550 Glide path alerting - Page 51

The EUROCONTROL Agency makes one comment:
It is astonishing to see certification credit for TAWS here since it is understood to be a safety net system (in addition, TTA for TAWS is likely not in line with the Annex 10 LPV requirements). According to Annex 10, Table 3.7.4.2-1, the navigation system performance requirements (including integrity alerting) have to be maintained

without such credit. For LPV minima, Annex 10 provides express requirements and guidance.

AMC1 ACNS.C.PBN.550 Glide path alerting - Page 51

The EUROCONTROL Agency makes the same comment as the one made above concerning 'CS ACNS.C.PBN.550 Glide path alerting'. The alert must be performed by the navigation system in accordance with Annex 10 requirements. Reliance on TAWS is not sufficient.

AMC1 ACNS.C.PBN.555 Vertical accuracy when using barometric altitude sources - Page 51-53

Section (e) - Page 52

The EUROCONTROL Agency makes one comment:
The use of FAP and exclusion of FAF is noticed. Again, as with 'AMC1 ACNS.C.PBN.520 - Glide path intercept - Page 48', it is suggested to include definitions for FAF and FAP. Moeover an exlanation of their relationship would help.

AMC1 ACNS.C.PBN.565 Area Navigation system design - integrity in final approach - Page 54

Table 9 - Page 55

The EUROCONTROL Agency makes one comment under the form of a question.

Why is the presentation of 'erroneous vertical position' classed as Major for LNAV/VNAV minima and Hazardous for LPV? It is believed that the safety impact is exactly the same in both intended operations.

response	**AMC1 ACNS.C.PBN.510 Altitude constraints - Page 47**

AMC1 ACNS.C.PBN.510 Altitude constraints - Page 47
Noted.
Although strongly discouraged, there may still be procedures in place with an SDF or other constraint in the FAS.
AMC1 ACNS.C.PBN.520 Glide path intercept - Page 48
Not accepted.
The AMC correctly refers to intercepting the FAF using a fly-by technique which is not a required procedure in case of a FAP.
CS ACNS.C.PBN.550 Glide path alerting - Page 51
Not accepted.
The CS article is not included to credit the use of TAWS, but rather to credit a mitigation against piloting errors that has been proven very effective on similar approaches (e.g. ILS) in the past. There is no relaxation of airworthiness criteria for RNP APCH procedures to LPV minima due to this CS.
AMC1 ACNS.C.PBN.550 Glide path alerting - Page 51
Not accepted.

The alert provided by the TAWS is not intended to replace the GNSS alerts required as per Annex 10. The TAWS alert mitigates for piloting error, not for GNSS errors.

AMC1 ACNS.C.PBN.555 Vertical accuracy when using barometric altitude sources - Page 51-53

Noted.

The reference to FAP no longer applies as bullet € has been deleted in response to other comment. As for the interception of the glide path, see the response to comment 195, please.

AMC1 ACNS.C.PBN.565 Area Navigation system design - integrity in final approach - Page 54

Partially accepted.

Reference is made to the response to comment 43.

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comment	511	comment by: *General Aviation Manufacturers Association*

Page 48: CS ACNS.C.PBN.525 Temperature compensation & AMC1 ACNS.C.PBN.525 Temperature compensation: Requiring automatic temperature compensation is not appropriate as a general requirement – this is an optional requirement under ETSO-C115d Class A equipment that requires a baro VNAV function. Further, how will existing certified equipment continue to be certified in a new installation.

Page 55: AMC1 ACNS.C.PBN.565 Area navigation system design — integrity in final approach" and "AMC1 ACNS.C.PBN.570 Area navigation system design — continuity: Classification of failure conditions between the stated AMC are not consistent with AMC 20-27A or AMC 20-28. Further, there seems to be an absence of guidance material regarding RNAV capabilities after RNP loss.

response	**Page 48:**

Partially accepted.

Please see the response to comment 413.

Page 55:

Partially accepted.

Please see the response to comment 43.

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comment	522	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

CS ACNS.C.PBN.525 Temperature compensation (a) :

In general, no correction of temperature should be done without any coordination with ATC before the Final Approach Fix (FAF) for traffic management purpose. Automatic temperature correction could, therefore, lead to safety side effects if the temperature compensation is done automatically from the IAF to the FAF.

So DGAC France recoçmmends to limit the perimeter of the intended function from the FAF to the MAPt.

response	Partially accepted.

Please see the response to comment 413.

comment	*523*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

CS ACNS.C.PBN.525 Temperature compensation (a) :
What about systems using Baro in the initial phase of the approach and geometric altitude in the final ? Are they excluded from this requirement ?

response	Partially accepted. Please see the response to comment 413.

comment	*524*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

AMC1 ACNS.C.PBN.550 Glide path alerting
An AMC is expected to understand how this requirement could be fulfilled without a TAWS. Which equivalent system can provide such alert ?

response	Noted. In most of today's aircraft, the alert is provided by the TAWS. EASA would however consider alternatives whereby the alert is provided by another system, provided that it is equally effective.

comment	*525*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

AMC1 ACNS.C.PBN.555 Vertical accuracy when using barometric altitude sources:

Expected accuracy for VNAV and "advisory VNAV" is the same. It gives an additional argument to suppress the "advisory VNAV" section of the CS. Indeed what is the interest to develop a kind of advisory VNAV function if the airworthiness criteria are almost the same than the "primary" one ?

response	Partially accepted. Please see the response to comment 485.

comment	*526*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

Table 9 seems to cover the VNAV function used on instrument flight procedure designed with a vertical guidance. However, the second and third columns mention : LNAV and LP minima which are used on approach procedures without designed vertical profile.

In addition, same comment than above mentionned for the "HAZARDOUS" classification.

As LP minima will be flown with a BaroVNAV function (otherwise LPV minima would be published), does "hazardous" classification would apply also to LP operations ?

response	Noted.

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In most of today's aircraft, the alert is provided by the TAWS. EASA would however consider alternatives whereby the alert is provided by another system, provided that it is equally effective.

comment	*527*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

Table 9 :
Could EASA clarify which column is dedicated to the use of SBAS VNAV down to LNAV/VNAV or down to LNAV ?

response	Noted. Please see the response to comment 43

comment	*532*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

CS ACNS.C.PBN.560 Vertical accuracy when using SBAS/GNSS geometric altitude sources :

Certification Memorandum "Clarification to AMC 20-27" dealing with the use of GNSS/SBAS altitude to fly RNP approaches to LNAV/VNAV minima required the need for a smooth transition from BARO-VNAV to SBAS. This aspect is not specified in this section and should be added. Also, it is not covered by CS Appendix A chapter 7(a).

response	Accepted. A new CS and AMC have been included to address transitions from one source of VNAV to another. A sub-bullet has been added in Appendix C paragraph 7 to verify that such transitions are smooth.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 6 — Supplementary specifications for RNP authorisation required (RNP AR)   p. 56-66

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comment	*20*	comment by: *M.Jo (ATR)*

CS ACNS.C.PBN.640 req (a):
what means near?
Moreover, What is the intent of the requirement?
Because at system level, system will load the data as extracted from the NavDB. Should the system check if the departure initial fix is at a position consistent with runway threshold area?
This requirement may be more applicable to NavDB and compliance with ARINC 424 rules.

response	Partially accepted.

Although database packing is part of the solution, the RNP system will have to be able to perform trajectory anticipation and provide guidance. Not all RNP systems will be able to do so for RNP AR Departures.

The word 'near' has been replaced by 'just beyond' in response to comment 478. The addition of the word 'just beyond' allows for a preceding fix prior to the initial fix of an RF leg, as some RNP systems require.

comment	21	comment by: *M.Jo (ATR)*

CS ACNS.C.PBN.640 req (b):
"lateral path guidance" is not explicit. Does it mean Auto-pilot engaged? LNAV Flight Director indications are enough?

response   Noted.
The requirement relates to engagement of LNAV at 50 Ft above the departure runway; AP or FD.

comment	22	comment by: *M.Jo (ATR)*

CS ACNS.C.PBN.640 req (c):
Similarly to comment made on req (a).
System will load NavDB content without checking if RF start point is before or after the end of runway. I didn't find existing departure having RF leg starting at runway end (WAMM RNAV SID RWY36 contains RF very close, but not at, from runway end). So, to demonstrate this requirement, a customized procedure will need to be designed and coded in navDB. It is an additional effort which seems useless in regards to the expected capability which appears to be basic for an FMS.

response   Not accepted.
The text is consistent with the consensus reached on RNP AR departures in the ICAO PBNSG.

comment	27	comment by: *Rockwell Collins, Inc.*

Page 65 AMC2 ACNS.C.PBN.670

Vertical accuracy, first sentence calls out operations down to RNP 0.23, should this be RNP 0.3?

Correct typo for RNP value from 0.23 to 0.3 (observation)

response   Partially accepted.
The RNP 0.23 is based on research made by the FAA and is contained in the note to AC 20-138D, Change 2, Appendix A, b.(1).(c). For practical purposes, this value has been changed to 0.3.

comment	56	comment by: *Dassault-Aviation*

Dassault-Aviation

P 57 CS ACNS.C.PBN.605

Comment:
(AMC1) System performance demonstration
(d) Definition of a safe extraction is new and very directive: it is the same requirement than (c) for lateral navigation, i.e., follow the lateral approach / missed approach path within the 2xRNP containment.
Please confirm that this is the intended meaning of the paragraph.
The best course of action for a safe extraction is highly dependent on the operational conditions of the approach performed: It may not be to follow the approach / missed approach path and should be determined at flight plan preparation.
In the scope of airworthiness certification, the OEM in accordance with certification authorities can only set guidelines for the determination of an operational safe extraction plan, as was the case in AMC 20-26.
It should be clarified that this definition is only an example of what the safe extraction procedure should be, but is not the only AMC.

response	Partially accepted.

As with the criteria of AMC 20-26, these criteria are intended to demonstrate the robustness or resilience of the aircraft in case of system failures. Hence, the question is not what a pilot would do in the event that such an error occurs, but what the aircraft still allows the pilot to do. In that context, EASA considers the requirements reasonable and appropriate.
The intent of the AMC is to better clarify EASA's expectations of what a safe extraction implies and is based on experience of our flight test experts with assessing compliance with the current AMC 20-26, section 6.1.3.(d).
That stated, EASA has slightly amended the AMC to add mode precision and clarification.

comment	*57*	comment by: *Dassault-Aviation*

Dassault-Aviation

P 58 CS ACNS.C.PBN.610

Comment:
(GM1) Source of horizontal position
It is understood that tightly coupled IRS is not mandatory for RNP AR operations: Please confirm

response	Partially accepted.

EASA confirms that a tightly coupled IRS is not required. It is however required to have an appropriate inertial system installed to support RNP AR operations. And AMC has been added to provide further clarification. In addition, a sentence has been added to the GM for additional clarification.

comment	*58*	comment by: *Dassault-Aviation*

Dassault-Aviation

P 65 CS ACNC.C.PBN.675

	Comment: (AMC1) Area navigation system design — RNP AR integrity. Table 12 For the failures conditions, in Table 12-row 3 "Simultaneous" is added in the wording of the condition vs. Table 9 in AMC1 ACNS.C.PBN.565: is there a reason? Please clarify (and update?)
response	Partially accepted. Please see the response to comment 43.

comment	*94*	comment by: *Transport Canada Civil Aviation Standards Branch*

Page 57, AMC1 ACNS.C.PBN.605 System performance demonstration

The 2nd Paragraph of item (d) states that : "the flight crew must be able to reasonably navigate the aircraft free of obstacles by using other navigational means to follow the missed approach procedure."

I see two issues here:

Using a term like "reasonably" will unduly lead to an interpretation debate with the applicant. Since the first line of the paragraph states that "Safe extraction is defined as within 2 x RNP for the applicable approach…", then the applicant should ensure that the design allows the flight crew to navigate the aircraft within 2 x RNP, up to a published safe altitude, to cater for approaches where the closest obstacle would be as close as 2 x RNP (as allowed by terps design).

The term "other navigational means" should be defined as to what would be acceptable (or unacceptable), i.e. is using TAWS for safe extraction acceptable even though TAWS are not a navigational mean per se? TCCA believes that subject to evaluation, using TAWS in a situation of safe extraction is may be considered acceptable depending on the design, independence/robustness and display fidelity

response	Accepted. The AMC has been amended to address the concerns expressed in the comment.

comment	*95*	comment by: *Transport Canada Civil Aviation Standards Branch*

Pg 66, Table 12

This table covers erroneous vertical position or guidance and erroneous lateral + vertical position or guidance. We believe that RNP <0.3, could be Catastrophic not Hazardous as depicted. Additionally, the immediate next section on Continuity is silent on the specifics of loss of lateral + vertical guidance, and only covers loss of vertical guidance (MAJOR). It is recommended this inconsistency be resolved, by providing an official position on the hazard severity of the loss of lateral and vertical guidance, in line with the 'erroneous' lateral + vertical case in Table 12.

response	Not accepted.

None of the existing guidance, whether it is EASA's AMC 20-26, FAA's AC 20-138D, Change 2 or the PBN Manual supports a Catastrophic failure condition as proposed. Please also see the response to comment 43.

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comment   *97*   comment by: *Transport Canada Civil Aviation Standards Branch*

NPA Section AMC1 ACNS.C.PBN.605 System performance demonstration

The NPA Section AMC1 ACNS.C.PBN.605 System performance demonstration states:

Analogous to demonstration of robustness for systems that support autoland, the intent of this requirement is to ensure robustness of the aircraft and its systems to failure conditions. Consequently, performing a safe extraction is not an acceptable means of demonstrating compliance against the criteria of CS ACNS.C.PBN.605(a), (b) and (c). These demonstrations rely on crew action to intervene and place the aircraft back on the target track, even if in an operational environment, the crew is expected to initiate a missed approach procedure when the lateral or vertical criteria are exceeded. For compliance demonstration purposes however, executing a missed approach is not considered appropriate for demonstration of compliance with these criteria.

(a) With reference to CS ACNS.C.PBN.605(a), any failure that is classified as 'probable' and supports the RNP AR operation should be assessed. Those failures that would require the flight crew to act or intervene should be assessed in a representative environment and design limit operational conditions by the applicant's flight test pilots. The impact of the failure and the flight crew intervention should be such that the aircraft can be maintained within the 1 × RNP value and within − 75 ft altitude deviation.
(b) With reference to CS ACNS.C.PBN.605(b), the same requirements apply for the case of an engine failure.
(c) With reference to CS ACNS.C.PBN.605(c), the same requirements apply, except that for the case of failures classified as 'remote' but not 'extremely remote', the impact of the failure and the flight crew intervention should be such that the aircraft can be maintained within the 2 × RNP value and within − 75 ft altitude deviation.

EASA is requested to clarify if the intent of this section is that an applicant is expected to demonstrate completion of the RNP approach with the failure, maintaining 2xRNP or 1xRNP as applicable per subparas (a), (b) and (c) above, as part of the compliance demonstrations (as opposed to conducting a missed approach as would be the case in an operational environment)?

If this is the intent, the following amended wording is recommended:

"Analogous to demonstration of robustness for systems that support autoland, the intent of this requirement is to ensure robustness of the aircraft and its systems to failure conditions. Consequently, performing a safe extraction contingency procedures, i.e. initiating a missed approach, is not an acceptable means of demonstrating compliance against the criteria of CS ACNS.C.PBN.605(a), (b) and (c). These demonstrations rely on crew action to intervene and place the aircraft back on the target track, even if in an operational environment, the crew is expected to

initiate a missed approach procedure when the lateral or vertical criteria are exceeded. For compliance demonstration purposes however, executing a missed approach is not considered appropriate for demonstration of compliance with these criteria."

response	Partially accepted. The text has been revised similarly in order to take the suggestion proposed by the commentator.

comment	*98* comment by: *Transport Canada Civil Aviation Standards Branch*
	AMC1 ACNS.C.PBN.605 System performance demonstration, paragraph: "Safe extraction is defined as within 2 × RNP for the applicable approach and missed approach procedure. The RNP for the missed approach procedure is usually higher than the RNP for the continued approach. For extremely remote navigational failure conditions (e.g. all flight management computers (FMCs) failed), the flight crew must be able to reasonably navigate the aircraft free of obstacles by using other navigational means to follow the missed approach procedure. " Comments/questions: The paragraph starts with a definition of safe extraction as within 2 x RNP. Does the statement "reasonably navigate" mean staying within 2 x RNP? Can a TAWS be considered as "other navigational means" even if it does not display the desired flight path? Subparagraph (d) does not mention the requirement to stay within 2 x RNP, which is applicable to Remote failures in subparagraph (c).

response	Noted. The statement 'reasonably navigate' does not imply staying within 2 x RNP. TAWS may be used to do so. Please also see the response to comments 56 and 94.

comment	*99* comment by: *Transport Canada Civil Aviation Standards Branch*
	Loss of lateral guidance MAJOR for RNP AR approach or departure with RNP ≥ 0.3 NM and missed approach with RNP ≥ 1.0 NM HAZARDOUS RNP AR approach or departure with RNP < 0.3 NM and missed approach with RNP < 1.0 NM Comment: The loss of lateral guidance needs to be defined. In highly integrated cockpits, the loss of guidance can be accompanied by the loss of flight plan display and lateral/vertical deviations. In this case, the criticality levels may have to be reevaluated to: HAZARDOUS for RNP AR approach or departure with RNP ≥ 0.3 NM and missed approach with RNP ≥ 1.0 NM CATASTROPHIC for RNP AR approach or departure with RNP < 0.3 NM and missed approach with RNP < 1.0 NM

response	Not accepted.

None of the existing guidance, whether it is EASA's AMC 20-26, FAA's AC 20-138D, Change 2 or the ICAO PBN Manual supports a Catastrophic failure condition as proposed.

Please also see the response to comment 43.

comment	*122*	comment by: *Transport Canada Civil Aviation Standards Branch*

Neither table addresses the Classification for loss of function. They do address the more signficant malfuction failure conditions, but the classification for loss of function(s) would be good to state.

Actually - I see it under continuity below the table: Loss of the capability of the area navigation system to provide vertical guidance is considered a MAJOR failure condition.

Suggest add to table to make it easier to spot.

response	Partially accepted. Please see the response to comment 43.

comment	*123*	comment by: *Transport Canada Civil Aviation Standards Branch*

I note that malfunction for LNAV/VNAV is Hazardous for simultaneous erroneous horizontal and vertical guidance - but AC20-138D Table 8 Page 93 (Typical Hazard Classifications) identifies Miseading Information for LNAV/VNAV as Major.   Is this a recognised difference? (SSD /SEI type of thing).

response	Partially accepted. Please see the response to comment 43.

comment	*124*	comment by: *Transport Canada Civil Aviation Standards Branch*

Page 57 2nd Paragraph - functional hazard analysis

response	Accepted. The typo has been corrected.

comment	*125*	comment by: *Transport Canada Civil Aviation Standards Branch*

Page 61 and 65

It's not clear if boxes meeting other TSOs meet the stated reqts. So it doesn't help an applicant pick one TSO'd box for departures and approaches. Is a box that meets ETSO C115d also good for the RNP AR Approcahes.   Is a box that meets ETSO C146c also good for RNP AR departures?

response	Accepted. References to ETSO-C115d in AMC1 ACNS.C.PBN.640 and ETSO-C146c in AMC2 ACNS.C.PBN.670 have been removed.

comment	*131*	comment by: *European Helicopter Association (EHA)*

With regards to "CS ACNS.C.PBN.601 Applicability", it has to be considered that at the current date RNP AR departure are not included in the 4th edition of the PBN manual. The airborne community officially doesn't have any information\detailed requirements or references for RNP AR departure

response	Noted.

Noted.
Please see the response to comment 87.

comment	*132*	comment by: *European Helicopter Association (EHA)*

In the para "GM1 ACNS.C.PBN.605 System performance demonstration", it is written that "As regards applications for RNP AR approval, the involvement of flight test pilots in this exercise has shown to be crucial". Is this a specific requirement for RNP AR approval?

response	Noted.

Noted.
GM contains no requirements. Consequently, there is no explicit requirement for flight test pilots to be involved in the approval process. Implicitly however, it is difficult to imagine an application for RNP AR approval against CS-ACNS without the involvement of flight test pilots.

comment	*133*	comment by: *European Helicopter Association (EHA)*

With regards to "Table 10: Area navigation system failure conditions — RNP AR integrity", can the HAZARDOUS classification for a MA with RNP 0.3 for helicopters be moved to MAJOR? A MAJOR classification could be considered in the light of the introduction of RNP 0.3 nav spec. In RNP0.3 all phases of flight, the presentation of erroneous lateral position guidance in MA is considered a MAJOR failure condition.
The RNP AR requirements have been developed several years ago and they seem not to be in line\harmonized with the ones related to RNP 0.3 all phases of flight.

response	Not accepted.

Not accepted.
RNP AR procedures, even at an RNP of no less than 0.3 NM are considerably different from RNP 0.3 procedures for helicopter operations. In the former case, there are no buffers beyond 2 x RNP 0.3. In other words, there may be obstacles at RNP 0.6. In the latter case, there are considerable margins beyond 2 x RNP 0.3, hence the different failure classification.
Please also see the response to comment 43.

comment	*208*	comment by: *Garmin International*

CS ACNS.C.PBN.601 Applicability - Page 56:

Regarding "Criteria for RNP AR departures (RNP AR DP) are provided consistently with the ICAO Navigation Specification for RNP AR departures." The ICAO 9613 4th

edition does not include a navigation specification for RNP AR departures. While NPA section 2.3.3 acknowledges "The CSs also introduce new requirements for RNP AR departures", given the many discrepancies that have been identified between existing AMCs and this proposed CS, it is difficult to trust that the "Criteria for … (RNP AR DP) are provided consistently with" a **draft** ICAO Navigation Specification. Further, while the ICAO PBN Study Group does have an Industry representative, a large segment of Industry has not been afforded the opportunity to review the draft RNP AR DP requirements, so it is difficult to judge whether these requirements are, in fact, consistent or even appropriate.

Suggest revising this statement to more accurately reflect that it is EASA's view that the RNP AR DP criteria is consistent with a draft ICAO Navigation Specification, which may be subject to change once broader Industry is provided the opportunity to review it.

response	Partially accepted.
	EASA acknowledges that ICAO information on RNP AR Departure Procedures is not available to a wider audience yet. The dilemma for EASA is that there is demand from operators and States for such procedures, and ignoring the developments could hinder the development and utilisation of these. On the other hand, awaiting publication of the ICAO specifications would provide more transparency.
	Considering the agreement within ICAO on the aircraft eligibility criteria for RNP AR DPs, EASA opted for a more proactive approach and decided to include those criteria in the CS-ACNS.
	EASA agrees to modify the wording to reflect the suggestion made by the commentator.
	EASA however notes that Industry is well represented in the ICAO PBNSG through the ICCAIA.

comment	*209* comment by: *Garmin International*
	GM1 ACNS.C.PBN.601 Applicability - Page 56:
	Regarding "An applicant that meets the conditions above and intends to apply for RNP AR approval is encouraged to contact EASA at the earliest opportunity to discuss the details of the technical and compliance demonstration.
	… An applicant that applies for RNP AR approval is encouraged to contact EASA at the earliest opportunity to discuss the technical details of the compliance demonstration."
	These two sentences are nearly identical. Suggest removing one of the sentences.

response	Accepted.
	The text has been revised to reflect the suggestion made by the commentator.

comment	*210* comment by: *Garmin International*
	GM1 ACNS.C.PBN.605 System performance demonstration - Page 58:

Regarding "the involvement of flight test pilots in this exercise has shown to be crucial": Suggest changing to "the involvement of flight test pilots in this exercise has been shown to be crucial." (add "been" to this phrase)

response   Accepted.
The text has been revised to reflect the suggestion made by the commentator.

comment   *211*   comment by: *Garmin International*

CS ACNS.C.PBN.610 Source of horizontal position - Page 58:

"The area navigation system utilises the global navigation satellite system (GNSS) as primary source of horizontal position and is backed by an appropriate inertial position source." Per AMC 20-26 section 8.5: "Except where specifically designated on a procedure as Not Authorised, DME/DME updating can be used as a reversionary mode during the approach or missed approach when the system complies with the RNP."   AMC   20-26:

- Implies an inertial position source may be required for RNP AR operations less than RNP 0.3 (Section 7.2 Table 2 item 2 (1) No single-point-of-failure) and Missed Approach less than RNP 1.0 (Section 7.2 Table 2 item 3 (1) Single-point-of failure);

- Section 8.5 Note 1 also indicates "In general, Distance Measurement Equipment (DME) (i.e. position updating from two or more ground stations, DME/DME) will not be sufficient to achieve RNP AR operations where the performance required is less than 0.3 NM."

But AMC 20-26 currently has no explicit requirement that the backup navigation source must be only through an inertial position source.

This paragraph should continue to allow use of DME/DME updating as a backup navigation source under the same conditions as specified in AMC 20-26.

response   Not accepted.
EASA has received and assessed one application for RNP AR approval on an aircraft whereby the backup navigation source was DME/DME. This resulted in a limitation requiring the operator to perform an assessment of the adequacy of the DME infrastructure for RNP AR operations as part of the process to obtain an operational approval. This has been proven to be impossible for an operator to perform. After discussing this particular case in the ICAO PBNSG, it was agreed that the use of an inertial position source would become a requirement for all applications for airworthiness approval of an aircraft's capability to perform RNP AR operations. The CS-ACNS reflects this agreement.

comment   *212*   comment by: *Garmin International*

CS ACNS.C.PBN.640 RNP AR departures - Page 60:

Regarding item (e), it is not clear why the INS alignment and position update cannot be conducted immediately prior to takeoff. It is also unclear why the INS alignment and position update cannot be conducted manually via an operational checklist. Suggest revising to address both of these considerations.

response	Accepted CS ACNS.C.PBN.640(e) and AMC1 ACNS.C.PBN.640 have been revised to reflect the intent of the comment.

comment	*213*	comment by: *Garmin International*

AMC2 ACNS.C.PBN.670 Vertical accuracy - Page 65:

It should be clarified that this AMC applies when the vertical position is provided by SBAS/GNSS geometric altitude sources (like AMC2 ACNS.C.PBN.440).

response	Accepted The text of AMC2 ACNS.C.PBN.670 has been amended to reflect the suggestion made by the commentator.

comment	*214*	comment by: *Garmin International*

AMC1 ACNS.C.PBN.675 Area navigation system design — RNP AR integrity - Page 66:

Erroneous horizontal position will usually imply erroneous vertical position because of horizontal coupling error. In Table 12, the HAZARDOUS failure classification of RNP >= 0.3 (and missed approach RNP >= 1.0nm) operation for "simultaneous presentation of erroneous vertical and horizontal position or guidance" is a new requirement (as compared to AMC 20-26 section 6.2.2) that is excessive. Suggest changing to MAJOR. Also note that Table 10 under AMC1 ACNS.C.PBN.660 establishes presentation of erroneous along-track distance (which couples into vertical position error) as a MAJOR failure condition.

response	Partially accepted. Please see the response to comment 43.

comment	*244*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

page 63 AMC1 ACNS.C.PBN.660

PROPOSED TEXT / COMMENT:

It is proposed to write the AMC as follow :
"The area navigation system, including position sensors, displays, etc., is designed to provide a level of integrity that supports the classification of failure conditions resulting from the Safety analysis performed for compliance to CS 25.1309.

In absence of robust and complete safety process, the applicant should design it to provide a level of integrity that supports the classification of failure conditions defined in Table 11 below.

In table 11, third column states "Approach or departure with RNP < 0.3 NM", while in table 2 RNP AR departures are in the range 1NM -0.3 NM. It is therefore proposed to remove "or departure" in the third column.
In addition, current classification proposal doesn't seem right on several items (e.g. : loss of horizontal guidance in RNP AR approach with RNP < 0.3 NM and missed approach with RNP < 1.0 NM).
So even if used as a guideline in specific cases, those proposals should be re-analysed with certification pilots (from both authority and industry).

RATIONALE / REASON / JUSTIFICATION:

Failure cases and their Safety Classifications are linked to the operations, architectures, mitigations in place and information presented to the crew.
The only means to assess classification is through compliance to CS 25.1309 applying as per AMC 25.1309 the FHA/SSA process during certification, using pilots judgment and simulator as necessary.
Safety classifications should not be constraint by AMCs when a robust safety process is in place.
It can be understood to provide suggested classifications/guidelines in specifc cases for which safety analyse cannot be performed.

response	Partially accepted. Please see the response to comment 43.

comment	*245* comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

page 64 AMC1 ACNS.C.PBN.665

PROPOSED TEXT / COMMENT:

It is proposed to write the AMC as follow :
"The area navigation system, including position sensors, displays, etc., is designed to provide a level of integrity that supports the classification of failure conditions resulting from the Safety analysis performed for compliance to CS 25.1309.
In absence of robust and complete safety process, the applicant should design it to provide a level of integrity that supports the classification of failure conditions defined in Table 11 below."

RATIONALE / REASON / JUSTIFICATION:

Safety Classifications are linked to the operations, architectures and mitigations in place. They are the result of a Safety analysis performed for compliance to CS 25.1309 as per AMC 25.1309 and should not be constraint by AMCs when a robust safety   process   is   in   place.

However The need to provide guidances if specifc cases for which complete and justified safety analyse cannot be performed (e.g. : STC) is however undertood.

| response | Partially accepted.
Please see the response to comment 43. |

| comment | *246* | comment by: *AIRBUS* |

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

page 66 AMC1 ACNS.C.PBN.675

PROPOSED TEXT / COMMENT:

It is proposed to write the AMC as follow :

"The area navigation system, including position sensors, displays, etc., is designed to provide a level of integrity that supports the classification of failure conditions resulting from the Safety analysis performed for compliance to CS 25.1309.

In absence of robust and complete safety process, the applicant should design it to provide a level of integrity that supports the classification of failure conditions defined in Table 12 below.

In table 12, third column states "Approach or departure with RNP < 0.3 NM", while in table 2 RNP AR departures are in the range 1NM -0.3 NM. It is therefore proposed to remove "or departure" in the third column.
In addition, current classification proposal doesn't seem right on several items (e.g. : Presentation of erroneous vertical position or guidance" in Approach with RNP < 0.3 NM or missed approach with RNP < 1.0 NM OR Simultaneous presentation of erroneous vertical and horizontal position or guidance" in Approach or departure with RNP ≥ 0.3 NM and missed approach with RNP ≥ 1.0 NM).
So even if used as a guideline in specific cases, those proposals should be re-analysed with certification pilots (from both authority and industry).

RATIONALE / REASON / JUSTIFICATION:

Failure cases and their Safety Classifications are linked to the operations, architectures, mitigations in place and information presented to the crew. The only means to assess classification is through compliance to CS 25.1309 applying as per AMC 25.1309 the FHA/SSA process during certification, using pilots judgment and simulator as necessary.
Safety classifications should not be constraint by AMCs when a robust safety process is in place.
It can be understood to provide suggested classifications/guidelines in specifc cases for which safety analyse cannot be performed.

| response | Partially accepted.
Please see the response to comment 43. |

| comment | *247* | comment by: *AIRBUS* |

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

page 66 AMC1 ACNS.C.PBN.680

PROPOSED TEXT / COMMENT:

It is proposed to write the AMC as follow :

"Loss of the capability of the area navigation system to provide vertical guidance should be classified through the Safety analysis performed for compliance to CS 25.1309.
In absence of robust and complete safety process, the applicant should consider the Loss of the capability of the area navigation system as a MAJOR failure condition.

RATIONALE / REASON / JUSTIFICATION:
Failure cases and their Safety Classifications are linked to the operations, architectures, mitigations in place and information presented to the crew. The only means to assess classification is through compliance to CS 25.1309 applying as per AMC 25.1309 the FHA/SSA process during certification, using pilots judgment and simulator as necessary.
Safety classifications should not be constraint by AMCs when a robust safety process is in place.
It can be understood to provide suggested classifications/guidelines in specifc cases for which safety analyse cannot be performed.

response	Partially accepted. Please see the response to comment 43.

comment	*275* comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.675 : The HAZARDOUS classification for Simultaneous presentation of erroneous vertical and horizontal position or guidance for RNP AR approach and departure with RNP >= 0,3 and missed approach with RNP >=1 is new without safety rationale. Highest classification is currently MAJOR in AMC20-26 and AC90-138D change 2, change without justification on EASA side would have significant impact on implementations and it would create a non-level playing field with FAA.

Thales proposal:

To change HAZARDOUS by MAJOR RNP AR approach and departure with RNP >= 0,3 and missed approach with RNP >=1 in table 12.

response	Partially accepted. Please see the response to comment 43.

comment	*280* comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.635 : the sentence '[…] the system should allow the flight crew to select the appropriate line of minima' is not correct as the intent of the CS

requirement and previous AMC sentence is to select the RNP values associated with lines of minima.

Thales proposal:

To replace : ''[…] the system should allow the flight crew to select the appropriate line of minima […]' by '[…] the system should allow the flight crew to select the RNP values associated with lines of minima […]'

response	Accepted The text has been revised to reflect the suggestion made by the commentator.

comment	*287*	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.601 : Criteria apply for operations in accordance with ICAO 9905 but ICAO 9905 does not include RNP AR departure procedure. Criteria shall be limited to RNP AR approach operations as long as RNP AR departures are not in ICAO 9905.

Thales proposal:

To replace 'The criteria of this Subsection only apply to operations […]' by 'For RNP AR approach operations, the criteria of this Subsection only apply to operations […]'.

response	Not accepted. The criteria for RNP AR Departure procedures are expected to be included in ICAO Doc. 9905 in the future. Please also see the response to comment 87.

comment	*305*	comment by: *Europe Air Sports*

Page 58
AMC1 ACNS.C.PBN.605 System performance demonstration

2nd full block on the page: Question: "…then EASA expects that the applicant would limit…": Why not ask for definitely doing so?

Rationale: In our view this is a safety aspect, elsewhere you are requiring a "must demonstrate" for comparable conditions.

response	Accepted The text has been revised to reflect the suggestion made by the commentator.

comment	*306*	comment by: *Europe Air Sports*

Page 65
AMC2 ACNS.C.PBN.670 Vertical accuracy

Both text blocks: Question: Why do you use "meters" here?

Rationale: Elsewhere only "feet" are applied.

response	Noted In DO-229D (the basis for ETSO-C146c) the VAL parameter is expressed in meters.

comment	*328*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 65 AMC2 ACNS.C.PBN.670

PROPOSED TEXT / COMMENT:

AMC should also recognise ETSO C145c
It is suggested to reword the AMC in order :
- to make it generic refering to relevant sections of ED 75D
- to complete the list of ETSOs that allow to demonstrate compliance to the CS

RATIONALE / REASON / JUSTIFICATION:

response	Partially accepted Specific references to ETSO's have been removed from AMC2 ACNS.C.PBN.670 (see the response to comment 125) and a reference to ED-75D does not make sense in this context.

comment	*341*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 56 CS ACNS.C.PBN.605 System performance demonstration

PROPOSED TEXT / COMMENT:

It is proposed to change
"For criteria (a), (b) and (c) above, the' vertical excursion does not exceed 75 feet below the desired path"
to
"For criteria (a), (b) and (c) above, the vertical vertical effect of failures whose primary effect is on the lateral axis does not exceed 75 feet below the desired path."

RATIONALE / REASON / JUSTIFICATION:

Missing clarification that "-75 ft" requirement is only referring to the vertical effect of failures whose primary effect is on the lateral axis

response	Not accepted. The suggestion could result in failures that only have an effect on the vertical axis to be ignored. Moreover, the text is consistent with the text of AMC 20-26, section 6.1.3.

comment	*344*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 57 AMC1 ACNS.C.PBN.605 System performance demonstration

PROPOSED TEXT / COMMENT:

It is proposed to clarify the AMC and to replace :
"For compliance demonstration purposes however, executing a missed approach is not considered appropriate for demonstration of compliance with these criteria''
by
"For compliance demonstration purposes however, executing a safe extraction is not considered appropriate for demonstration of compliance with these criteria"

RATIONALE / REASON / JUSTIFICATION:

response | Accepted
The text has been revised to reflect the suggestion made by the commentator.

comment | *364*   comment by: *Embraer S.A.*

Embraer suggests to harmonize CS ACNS.C.PBN.605 (System performance demonstration) with EASA AMC 20-26.

EASA AMC 20-26 indicates that the required demonstration of RNP system performance, including lateral and vertical path steering performance (FTE), will vary according to the type of AR operation being considered. According to AMC 20-26, it falls for the competent Authority, responsible for the approval of the procedure, to assess the RNP level for the considered operation in accordance with the Flight Operations Safety Assessment (FOSA) (Appendix 5 of EASA AMC 20-26). For example, AMC 20-26 differentiates low RNP for obstacle clearance or separation in an obstacle rich environment or high density air traffic environment. The more challenging the operation/scenario/environment is, the more stringent the requirements are. A typical procedure limited to 0.3 NM on approach and with missed approach limited to 1.0 NM, without RF legs, should not require the extensive evaluation described in this requirement. If the text of the proposed requirement CS ACNS.C.PBN.605 remains as it is, it will create an undue burden for the aircraft operators, without enhancing the safety of the operation.

To change the text from:

CS ACNS.C.PBN.605 System performance demonstration
(See AMC1 ACNS.C.PBN.605 and GM1 ACNS.C.PBN.605)
The performance (including the RF function) of the aircraft's system is demonstrated under a variety of operational, meteorological and failure conditions, commensurate with the intended operation.
Criteria for assessing RNP significant failures under design limit performance conditions are the following:
(a) the lateral excursions observed as a result of probable failures are contained within a 1 × RNP corridor;

(b) the lateral excursions observed as a result of one-engine-inoperative (OEI) are contained within a 1 × RNP corridor;
(c) the lateral excursions observed as a result of remote failures are contained within a 2 × RNP corridor;
(d) a demonstration is made that the aircraft remains manoeuvrable and a safe extraction can be flown for all extremely remote failures.

For criteria (a), (b) and (c) above, the vertical excursion does not exceed 75 feet below the desired path.

To:

CS ACNS.C.PBN.605 System performance demonstration
(See AMC1 ACNS.C.PBN.605 and GM1 ACNS.C.PBN.605)
The performance (including the RF function) of the aircraft's system is demonstrated under a variety of operational, meteorological and failure conditions, commensurate with the intended operation.
Criteria for assessing RNP significant failures under design limit performance conditions are the following:
(a) the lateral excursions observed as a result of probable failures are contained within a 1 × RNP corridor;
(b) the lateral excursions observed as a result of one-engine-inoperative (OEI) ~~are contained within a~~ must be documented against an objective of containment within 1 × RNP corridor;
(c) the lateral excursions observed as a result of remote failures ~~are contained~~ must be documented against an objective of containment within a 2 × RNP corridor;
(d) a demonstration is made that the aircraft remains manoeuvrable and a safe extraction can be flown for all extremely remote failures.

For criteria (a), (b) and (c) above, the vertical excursion does not exceed 75 feet below the desired path.

The required demonstration of RNP system performance, including lateral and vertical path steering performance (FTE), will vary according to the type of AR operation being considered e.g. low RNP for obstacle clearance or separation in an obstacle rich environment or high density air traffic environment. It will be for the competent Authority, responsible for the approval of the procedure, to assess the RNP level for the considered operation in accordance with the Flight Operations Safety Assessment (FOSA).

| response | Not accepted.
EASA acknowledges that AMC 20-26 contained such language, but considers that the FOSA does not support the airworthiness approval, but supports the operational approval. Certification supports the operational approval and makes the FOSA easier to complete. From the perspective of the airworthiness approval however, EASA cannot know when and where an aircraft will be operated. Consequently, we have to assume that the aircraft will be operated in the most terrain and obstacle challenging environments.
In addition, it is nearly impossible to define what a terrain or obstacle rich environment is.
For these reasons, EASA does not agree with inclusion of the proposed text. |

comment	*365*	comment by: *Embraer S.A.*

Embraer suggests to harmonize AMC1 ACNS.C.PBN.605 (System performance demonstration) with EASA AMC 20-26.

The same rationale from the previous comment (# 364) applies for AMC1 ACNS.C.PBN.605.
Besides this, in regards to the given definition of safe extraction, one must question how a 2 x RNP corridor be maintained in the case of all FMCs' loss? Typically, on demanding RNP AR procedures, it is not possible to navigate within the required accuracy (even considering 2 x RNP) using other sensors due to lack of those or line of sight with them in terrain challenging environments.

To change the text from:

AMC1 ACNS.C.PBN.605 System performance demonstration
The applicant should demonstrate the aircraft capability in terms of performance under design limit operational conditions (e.g. tailwinds and crosswinds, centre-of-gravity (CG) limits, temperature limits), and on representative procedures that include RF legs of varying radii. The applicant should also assess the effects of configuration changes (e.g. gear and flap extension and retraction).
The applicant should conduct a safety impact assessment based on the aircraft's system safety assessments (SSAs) and identify all failure conditions that could potentially impact on performance. The failure hazard analysis and system safety assessment of all the aircraft's systems that support RNP AR operations (RNAV systems, flight controls systems, flight guidance systems, displays, etc.) should therefore be revisited to identify these failures. System failures should include latent failures ('integrity') and detected failures ('continuity'). For the detected failures, the monitor limit of the alert, the time to alert, the flight crew reaction time, and the aircraft response should all be taken into account and verified to ensure that the aircraft does not exit the obstacle clearance volume.
Analogous to demonstration of robustness for systems that support autoland, the intent of this requirement is to ensure robustness of the aircraft and its systems to failure conditions. Consequently, performing a safe extraction is not an acceptable means of demonstrating compliance against the criteria of CS ACNS.C.PBN.605(a), (b) and (c). These demonstrations rely on crew action to intervene and place the aircraft back on the target track, even if in an operational environment, the crew is expected to initiate a missed approach procedure when the lateral or vertical criteria are exceeded. For compliance demonstration purposes however, executing a missed approach is not considered appropriate for demonstration of compliance with these criteria.
(a)   With reference to CS ACNS.C.PBN.605(a), any failure that is classified as 'probable' and supports the RNP AR operation should be assessed. Those failures that would require the flight crew to act or intervene should be assessed in a representative environment and design limit operational conditions by the applicant's flight test pilots. The impact of the failure and the flight crew intervention should be such that the aircraft can be maintained within the $1 \times RNP$ value and within – 75 ft altitude deviation.
(b)   With reference to CS ACNS.C.PBN.605(b), the same requirements apply for the case of an engine failure.

(c)   With reference to CS ACNS.C.PBN.605 (c), the same requirements apply, except that for the case of failures classified as 'remote' but not 'extremely remote', the impact of the failure and the flight crew intervention should be such that the aircraft can be maintained within the 2 × RNP value and within – 75 ft altitude deviation.

(d)   With reference to CS ACNS.C.PBN.605(d), the applicant should demonstrate that no 'extremely remote' failure limits the flight crew's ability to:

— intervene and place the aircraft back on the target track contained within the alert threshold; or

— safely extract the aircraft through manual intervention.

Safe extraction is defined as within 2 × RNP for the applicable approach and missed approach procedure. The RNP for the missed approach procedure is usually higher than the RNP for the continued approach. For extremely remote navigational failure conditions (e.g. all flight management computers (FMCs) failed), the flight crew must be able to reasonably navigate the aircraft free of obstacles by using other navigational means to follow the missed approach procedure.

For departure procedures with close-in RF legs at or just beyond the departure end of the runway, and for missed approach procedures with close-in RF legs, the retraction of the landing gear and flaps and subsequent rapid acceleration may affect the area navigation system's ability to conduct accurate turn anticipation. An inaccurate turn anticipation calculation may result in an overshoot of a close-in RF turn. When this performance characteristic is present, the applicant should consider including a limiting airspeed for the initial phase of the departure or the missed approach in the AFM. The airspeed limit should not be lower than the best-climb airspeed with one-engine-inoperative.

The severity level of the above demonstrations (failure conditions in combination with the RNP approach containment requirements), as assessed by the test pilot, must still match the probability of the applicable failure condition (ref.: CS 25.1309).

Specific evaluations should be conducted to assess path excursions upon failures and the resulting RNP levels. Results should be documented in the AFM, AFM Supplement, or any appropriate aircraft operational support document which is approved by EASA and made available to the operator. In other words: If, for example, the worst-case result of the assessments that have been conducted to demonstrate compliance for 'remote' failures shows that the aeroplane diverts 0.40 NM from the published track, then EASA expects that the applicant would limit the authorised RNP to 0.20 NM.

To:

AMC1 ACNS.C.PBN.605 System performance demonstration

The applicant should demonstrate the aircraft capability in terms of performance under design limit operational conditions (e.g. tailwinds and crosswinds, centre-of-gravity (CG) limits, temperature limits), and on representative procedures that include RF legs of varying radii. The applicant should also assess the effects of configuration changes (e.g. gear and flap extension and retraction).

The applicant should conduct a safety impact assessment based on the aircraft's system safety assessments (SSAs) and identify all failure conditions that could potentially impact on performance. The failure hazard analysis and system safety assessment of all the aircraft's systems that support RNP AR operations (RNAV systems, flight controls systems, flight guidance systems, displays, etc.) should therefore be revisited to identify these failures. System failures should include latent failures ('integrity') and detected failures ('continuity'). For the detected failures, the monitor limit of the alert, the time to alert, the flight crew reaction time, and the

aircraft response should all be taken into account and verified to ensure that the aircraft does not exit the obstacle clearance volume.

Analogous to demonstration of robustness for systems that support autoland, the intent of this requirement is to ensure robustness of the aircraft and its systems to failure conditions. ~~Consequently, performing a safe extraction is not a~~ An acceptable means of demonstrating compliance against the criteria of CS ACNS.C.PBN.605(a), (b) and (c). ~~These demonstrations~~ rel~~y~~ies on crew action to intervene and place the aircraft back on the target track, even if in an operational environment, the crew is expected to initiate a missed approach procedure when the lateral or vertical criteria are exceeded. For compliance demonstration purposes however, executing a missed approach is not considered appropriate for demonstration of compliance with these criteria, according with the type of AR operation that credit is being sought for. It will be for the competent Authority, responsible for the approval of the procedure, to assess the RNP level for the considered operation in accordance with the Flight Operations Safety Assessment (FOSA) to determine if a safe extraction is an acceptable means of compliance or not.

(a)   With reference to CS ACNS.C.PBN.605(a), any failure that is classified as 'probable' and supports the RNP AR operation should be assessed. Those failures that would require the flight crew to act or intervene should be assessed in a representative environment and design limit operational conditions by the applicant's flight test pilots. The impact of the failure and the flight crew intervention should be such that the aircraft can be maintained within the 1 × RNP value and within − 75 ft altitude deviation. This demonstration can rely on crew action to intervene and place the aircraft back on the target track, or apply a contingency procedure when the guidance is lost.

(b)   With reference to CS ACNS.C.PBN.605(b), the same requirements apply for the case of an engine failure. This demonstration canrely on crew action to intervene and place the aircraft back on the target track.

(c)   With reference to CS ACNS.C.PBN.605 (c), the same requirements apply, except that for the case of failures classified as 'remote' but not 'extremely remote', the impact of the failure and the flight crew intervention should be such that the aircraft ~~can~~ should be maintained within the 2 × RNP value and within − 75 ft altitude deviation. The demonstration should evaluate the contributions of: (i) Remote systems failures that may impact the RNP capability; and (ii) GNSS satellite outages. Remote system failures should include latent failures (integrity) and detected failures (continuity). For the detected failures, the monitor limit of the alert, the time to alert, the crew reaction time, and the aircraft response should all be considered when ensuring that the aircraft does not exit the obstacle clearance volume. Remote failures are failures with a probability between 10^{-5} and 10^{-7} per operation.

(d)   With reference to CS ACNS.C.PBN.605(d), the applicant should demonstrate that no 'extremely remote' failure limits the flight crew's ability to:

— intervene and place the aircraft back on the target track contained within the alert threshold; or

— safely extract the aircraft through manual intervention.

~~Safe extraction is defined as within 2 × RNP for the applicable approach and missed approach procedure. The RNP for the missed approach procedure is usually higher than the RNP for the continued approach. For extremely remote navigational failure conditions (e.g. all flight management computers (FMCs) failed), the flight crew must be able to reasonably navigate the aircraft free of obstacles by using other navigational means to follow the missed approach procedure.~~

For departure procedures with close-in RF legs at or just beyond the departure end of the runway, and for missed approach procedures with close-in RF legs, the retraction of the landing gear and flaps and subsequent rapid acceleration may affect the area navigation system's ability to conduct accurate turn anticipation. An inaccurate turn anticipation calculation may result in an overshoot of a close-in RF turn. When this performance characteristic is present, the applicant should consider including a limiting airspeed for the initial phase of the departure or the missed approach in the AFM. The airspeed limit should not be lower than the best-climb airspeed with one-engine-inoperative.

The severity level of the above demonstrations (failure conditions in combination with the RNP approach containment requirements), as assessed by the test pilot, must still match the probability of the applicable failure condition (ref.: CS 25.1309).

Specific evaluations should be conducted to assess path excursions upon failures and the resulting RNP levels. Results should be documented in the AFM, AFM Supplement, or any appropriate aircraft operational support document which is approved by EASA and made available to the operator. ~~*In other words: If, for example, the worst-case result of the assessments that have been conducted to demonstrate compliance for 'remote' failures shows that the aeroplane diverts 0.40 NM from the published track, then EASA expects that the applicant would limit the authorised RNP to 0.20 NM.*~~

response	Partially accepted.
	For the concern related to operational approval, reference is made to the response to comment 364.
	With regards to suggested changes to items a through d, EASA considers that it is not necessary to state matters that are already covered in other CSs or are obvious.
	With regards to the definition of safe extraction, please see the response to comment 98.

comment	**366** comment by: *Embraer S.A.*
	Embraer suggests to harmonize AMC1 ACNS.C.PBN.675 (Area navigation system design — RNP AR integrity) with FAA AC 20-138D and EASA AMC 20-26.
	It is advisable to harmonize table 12 from AMC1 ACNS.C.PBN.675 with § A2-3.f from Appendix 2 from FAA AC 20-138D and § 6.2.2 from EASA AMC 20-26. Based on this harmonization, the integrity requirement for "Presentation of erroneous vertical and horizontal position or guidance" should be classified as "Major".
	Also consider that the same system is providing lateral and vertical guidance and a misleading in the lateral position (along track error) can automatically cause a misleading in the vertical navigation.
	To change the text from:
	[...]
	Table 12: Allowable failure condition of the vertical guidance provided by the area navigation system

Intended operations	Approach or departure with RNP ≥ 0.3 NM and	Approach or departure with RNP < 0.3 NM or

Failure condition	*missed approach with RNP ≥ 1.0 NM*	*missed approach with RNP < 1.0 NM*
Presentation of erroneous vertical position or guidance	*MAJOR*	*HAZARDOUS*
Simultaneous presentation of erroneous vertical and horizontal position or guidance	*HAZARDOUS*	*HAZARDOUS*

[...]

To:

[...]

Table 12: Allowable failure condition of the vertical guidance provided by the area navigation system

Intended operations *Failure condition*	*Approach or departure with RNP ≥ 0.3 NM and missed approach with RNP ≥ 1.0 NM*	*Approach or departure with RNP < 0.3 NM or missed approach with RNP < 1.0 NM*
Presentation of erroneous vertical position or guidance	*MAJOR*	*HAZARDOUS*
Simultaneous presentation of erroneous vertical and horizontal position or guidance	*MAJOR* ~~*HAZARDOUS*~~	*HAZARDOUS*

[...]

response	Partially accepted. Please see the response to comment 43.

comment	*371* comment by: *THALES AVIONICS*
	CS ACNS.C.PBN.610 : Specification to back the GNSS by an IRS for all the RNP AR operation is new – it is not in part of current RNP AR regulations. AMC20-26 for RNP AR < 0,3 is : 'Loss of GNSS. After initiating a go-around or missed approach following loss of GNSS, the aircraft must automatically revert to another means of navigation that complies with the navigation accuracy for the time necessary to fly the go-around or the missed approach.'

The AMC20-26 text for RNP AR < 0,3 and MA <0,1 is more performance based oriented. CS text should be performance oriented with a reference in the AMC to IRS as an acceptable implementation.
Moreover the terminology 'appropriate' needs to be clarified.

Thales proposal:

To modify the CS with the following text : 'The area navigation system utilises the global navigation satellite system (GNSS) as primary source of horizontal position and is backed with another appropriate means of navigation.'
And to clarify in an associated that an IRS that meets the requirements of Appendix B is an appropriate back-up means of navigation. Other means of navigation with the same performance may be appropriate.

response	Partially accepted.

Partially accepted.
The feasibility of using navigation systems other than an inertial positioning system has not been proven and is, therefore, not being considered. Should such a system be developed in the future, then the CS-ACNS may be amended.
EASA has added an AMC to provide guidance on what is expected from the inertial position source and 'appropriate' has been deleted from the CS.

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comment | *372* | comment by: *THALES AVIONICS*

CS ACNS.C.PBN.640 : Thales made a comment on CS ACNS.C.PBN.610 to suggest not to require an IRS as a back-up but an appropriate other navigation means (than can be an IRS). Thus in accordance (e) of CS ACNS.C.PBN.640 has to be tuned to apply only when an IRS is installed.

Thales proposal:

To add "When INS is installed…." at the beginning of (e) of CS ACNS.C.PBN.640

response | Not accepted.
See the response to comment 371.

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comment | *382* | comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.660 : The HAZARDOUS classification for misleading information for RNP MA < 1 NM is more stringent than the current AMC20-26 where Missed Approach are less than RNP 1.0 [major for the loss / no criteria for the misleading]. It would impact current technical solution developed for RNP AR 0.3/0.3 (with 0.3 capability in missed approach) without safety rationale.

The safety classification for RNP AR MA <1 NM should be commensurate with RNP AR APCH >=0.3 with a MAJOR classification.

Thales position

To change HAZARDOUS by MAJOR for RNP MA < 1 NM in table 10.

response | Partially accepted.

Please see the response to comment 43.

| comment | 383 | comment by: *THALES AVIONICS* |

AMC1 ACNS.C.PBN.665 **:** The HAZARDOUS classification for misleading information for RNP MA < 1 NM is more stringent than the current AMC20-26 where Missed Approach are less than RNP 1.0 [MAJOR for the loss]. It would impact current technical solution developed for RNP AR 0.3/0.3 (with 0.3 capability in missed approach) without safety rationale.
The safety classification for RNP AR MA <1 NM should be commensurate with RNP AR APCH >=0.3 with a MAJOR classification.

Thales position

To change HAZARDOUS by MAJOR for loss of lateral guidance for RNP MA < 1 NM in table 11.

| response | Partially accepted
Please see the response to comment 43. |

| comment | 384 | comment by: *THALES AVIONICS* |

AMC1 ACNS.C.PBN.675 The HAZARDOUS classification for misleading information for RNP MA < 1 NM is significantly more stringent than the current AMC20-26 where Missed Approach are less than RNP 1.0 [major for the loss / no misleading criteria]. It would impact current technical solution developed for RNP AR 0.3/0.3 (with 0.3 capability in missed approach) without safety rationale.
The hazardous criteria for misleading vertical guidance during a MA is not understood. AC20-138D change 2 does not focus on vertical guidance criteria for MA. In accordance with other Thales comment on RNP AR APCH >=0.3; the introduction of safety classification for RNP AR MA <1 NM should be commensurate with RNP AR APCH >=0.3 with a classification no more than MAJOR for lateral guidance and Minor for vertical guidance.

Thales position

To change in table 12 for RNP MA < 1 NM :
-       - HAZARDOUS to MINOR for 'Presentation of erroneous vertical position or guidance'
-       - HAZARDOUS to MAJOR for 'Simultaneous presentation of erroneous vertical and horizontal position or guidance '

| response | Partially accepted
Please see the response to comment 43. |

| comment | 385 | comment by: *THALES AVIONICS* |

AMC1 ACNS.C.PBN.680 : Loss of vertical guidance in RNP APCH is proposed as MAJOR whereas it is MINOR in AC20-138D change 2 (different leve playing field). Thales does not agree.
Loss of vertical guidance will trigger a Go Around.

	Thales proposal: To replace MAJOR by Minor in AMC1 ACNS.C.PBN.680
response	Partially accepted. Please see the response to comment 43.

comment	*418*	comment by: *AIRBUS*
	PARAGRAPH / SECTION THE COMMENT IS RELATED TO: Page 57 AMC1 ACNS.C.PBN.605 System performance demonstration **PROPOSED TEXT / COMMENT:** Item a should preciclarified using wording of previous paragraph : 'With reference to CS ACNS.C.PBN.605(a), any failure that is classified as 'probable' and potentially impact on performance'	
response	Not accepted. EASA considers that the impact on performance can only be determined following an assessment.	

comment	*419*	comment by: *AIRBUS*
	PARAGRAPH / SECTION THE COMMENT IS RELATED TO: Page 58 GM1 ACNS.C.PBN.610 Source of horizontal position **PROPOSED TEXT / COMMENT:** "Attitude and heading reference systems (AHRSs), including an AHRS with inputs from air-data computers, are not considered to provide a level of performance that would be adequate to support RNP AR operations." Excluding AHRS type of equipment focuses on some navigation sensors instead of needs which is to meet criteria of Appendix B. It is proposed to add an AMC precise it.	
response	Partially accepted. Please see the response to comment 371.	

comment	*420*	comment by: *AIRBUS*
	PARAGRAPH / SECTION THE COMMENT IS RELATED TO: Page 60 AMC1 ACNS.C.PBN.630 Radius to fix (RF) leg transition **PROPOSED TEXT / COMMENT:** The failures to be taken into account could be misinterpreted. It is understood that the goal is not to run statistical analyses. To clarify it is proposed to remove the following part of the AMC	

"(d) failure conditions.
With reference to failure conditions (d),"
Note : demonstration proposed in AC 20-138D appendix 7 does no require to consider failures.

| response | Not accepted.
The statement below (d) is considered to sufficiently clarify what is meant with (d). |

| comment | *421* | comment by: *AIRBUS* |

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 60 AMC1 ACNS.C.PBN.635 Navigation accuracy for RNP AR operations
PROPOSED TEXT / COMMENT:

Systems do not allow to select "Lines of minima" but "RNP values". It is suggested to write the AMC as follows :
"If the area navigation system proposes to the flight crew multiple RNP values on an RNP AR approach procedure, the system should allow the flight crew to select the appropriate RNP value for use on the final approach segment."

RATIONALE / REASON / JUSTIFICATION:

It is proposed to clarify the "lines of minima" and to clarify that "offer" is the proposition of diffeent RNP values to the crew.

| response | Accepted
The text has been revised to reflect the suggestion made by the commentator. Please also see the response to comment 280. |

| comment | *439* | comment by: *FAA AIR* |

Reference: The section of the NPA titled, "Subsection 6 – Supplementary specifications for RNP authorization required (RNP AR)"
COMMENT – *Substantive.* Overall, this subsection is inadequate in its content. The subsection does not invoke or offer the level of detail consistent with the RNP AR aircraft eligibility requirements (functional and performance requirements) documented in the ICAO PBN Manual, Document 9613, Volume II, Chapter 6, nor those found in FAA ACs 90-101A and AC 20-138D (reference Appendix 2). This subsection also fails to define the requirements this part of the NPA does contain properly.
For example, the subsection fails to detail the explicit requirements an installed RNP system must meet for the aircraft to be eligible for RNP AR operations (reference either Volume II, Chapter 6, of the ICAO PBN Manual or Appendix 2 of AC 20-138D for the detailed RNP AR aircraft eligibility requirements, including both performance and functional requirements) . As one specific example of this failure, the subsection abjectly fails to identify the integrity requirements for the RNP AR procedures stored in the aircraft's onboard navigation database, failing to require database integrity consistent with the target level of safety for RNP AR operations (i.e. 1×10^{-7}). Reference FAA AC 20-138D, Appendix 2, paragraph A2-7., database integrity requirements. Instead of invoking requirements consistent with current FAA

guidance and those of the ICAO PBN Manual, all this subsection requires of the aircraft's navigation database is "sufficient data resolution" (see CS ACNS.C.PBN.655). In addition, unlike the PBN Manual guidance and FAA requirements, the NPA specs require no explicit demonstration of RF leg capability consistent with the demands for an RNP AR procedure design and the worst-case winds for such designs, as described in both the PBN Manual and FAA guidance in AC 20-138D. Nor is there a direct requirement to use the templates you publish in Subsection 8 of the NPA found in this subsection. One must read Subsection 8 specs for RF legs to discern an NPA requirement to use the RF procedural templates. These examples of shortfalls in this subsection of the NPA highlight how inadequate in defining RNP AR eligibility requirements; and, in practical application, this could lead States to question the aircraft eligibility of any aircraft receiving an airworthiness approval for RNP AR operations through application of the content of this subsection of the NPA. Meanwhile, the criteria for eligibility for RNP AR departure procedures (RNP AR DP) completely fails to address all aspects of aircraft eligibility for these new, unique operations, as claimed when the NPA states in paragraph 2.3.3, Compatibility with the ICAO PBN Manual, "The CSs also introduce new requirements for RNP AR departures. These are based on agreement reached by the PBNSG on the future aircraft qualification requirements for such procedures, which EASA considers mature enough to be already incorporated into the CSs." The specs in paragraph CS ACNS.C.PBN.640, RNP AR departures, does not invoke, nor does reference, the draft RNP AR DP nav specs currently under development by the ICAO PBN SG. For example, the absence of a requirement for the aircraft OEM to provide takeoff and climb performance data supporting confirmation of the capability to execute an RNP AR DP (including procedures requiring an RF leg at the departure end of the runway) is the best example of this particular shortfall in the subsection's guidance. This is yet another example of how the NPA's effort to "simplify the certification process" (as stated in fourth paragraph of the Executive Summary) results in failure to specify the actual basis and specifications reflecting harmonization of existing public standards and the resulting interoperability.

RECOMMENDATION – Delete this subsection in its entirety, and then replace it with content similar in detail and scope to the content of the ICAO PBN Manual, Volume II, Chapter 6, aircraft eligibility requirements. This new criteria should include the new, detailed, draft nav specs for RNP AR DPs, currently under development by the ICAO PBN Study Group's RNP AR Working Group (available to EASA as a member of the ICAO PBN SG).

RATIONALE – Consistency in demonstration of airworthiness eligibility for RNP AR operations. This consistency is essential if States are to accept the statements of aircraft eligibility when operators desire operations to conduct the RNP AR procedure operators can find in the State's aeronautical information publications (AIP). Failure to require consistent, harmonized airworthiness eligibility requirements will lead to delays in operators receiving permission to conduct a State's RNP AR procedures while the State's regulators pursue confirmation of eligibility from the aircraft OEM through the operator desiring operation approval. This creates an untenable scenario for both the operators of the aircraft in question and the State regulators responsible for overseeing the conduct of RNP AR operations in their sovereign airspace.

response	Partially accepted.
	In many instances, the aspects identified by the commentator as omitted from Subsection 6 are actually covered by the more generic sections 1, 2, 3, 5 and 8 of the

CS. It should be remembered that Subsection 6 contains supplementary requirements that need to be applied in addition to the criteria of the previously mentioned sections. Reference is made to Table 1 in Subsection 1.

In addition, some of the comments refer to aspects that EASA considers important, but not strictly part of the airworthiness approval. One example is the reference to databases. These aspects are covered in other regulations.

The commentator does however rightfully point at the aircraft eligibility requirements of the PBN Manual. EASA has reviewed those and corrected omissions where required.

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comment	*450*	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.620 the terminology 'If the RNP cannot be maintained during a radius to fix (RF) leg, …' is not precise enough to determine applicability of the requirement.

Thales proposal:

Based on CS2130 terminology, to replace CS ACNS.C.PBN.620 text by 'When the area navigation system is unable to maintain the RNP value during a radius to fix (RF) leg, the flight guidance mode remains in lateral navigation.'

response	Accepted

The text of CS ACNS.C.PBN.620 Reversion has been revised to reflect the suggestion made by the commentator.

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comment	*452*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.660 and AMC1 ACNS.C.PBN.665: New safety consideration is introduced about along track distance. What is the distance which has a MAJOR safety impact during RNP AR operation? Is it the along track distance to active waypoint? Is it the along track distance between waypoints? Is the along-track distance to the destination?

Thales proposal:

To indicate explicitly the distance to consider (distance to active waypoint / distance between waypoints / distance to the destination) and to precise the rationale for a MAJOR classification during RNP AR operation.

response	Partially accepted.

Please see the response to comment 43.

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comment	*453*	comment by: *THALES AVIONICS*

AMC1 ACNS.C.PBN.665 : In the title of the third column of table 11 there is a 'and ' instead of a 'or' (not coherent with Table 10).

Thales proposal:

In the title of the third column of table 11 , to replace 'RNP AR approach or departure with RNP < 0.3 NM and missed approach with RNP < 1.0 NM '

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An agency of the European Union

	By 'RNP AR approach or departure with RNP < 0.3 NM or missed approach with RNP < 1.0 NM '
response	Partially accepted. Please see the response to comment 43.

comment	*457*	comment by: *M.Jo (ATR)*
	CS ACNS.C.PBN.610 Source of horizontal position This CS requires to have IRS/IRU embedded for RNP AR operation. Which is confirmed by the sentence in GM about AHRS. With this CS RNP AR capability will no more be granted on aircraft without IRS/IRU onboard. Could it be possible to add an AMC about a demonstration of performance equivalent to the performance requested with IRS/IRU?	
response	Not accepted. The requirement is consistent with the agreement reached in the PBNSG on requiring an IRU/INS for RNP AP operations.	

comment	*470*	comment by: *The Boeing Company*
	Page: 56 Paragraph: GM1 ACNS.C.PBN.605 System performance demonstration **THE PROPOSED TEXT STATES**: (d) a demonstration is made that the aircraft remains manoeuvrable and a safe extraction can be flown for all extremely remote failures. **REQUESTED CHANGE**: (d) a demonstration is made or analysis shows that the aircraft remains manoeuvrable and a safe extraction can be flown for extremely remote failures. **JUSTIFICATION**: Demonstration as the sole means of compliance requires that the airplane be placed in an extremely remote condition which itself has a very low likelihood of occurrence. Not all applicants have the ability to utilize or simulate all failures in lab facilities and demonstration alone is not a comprehensive means for exhibiting aircraft performance. Perhaps another suggestion would be to delete "all" and replace it with "all RNP AR relevant systems…".	
response	Not accepted. The text is consistent with AMC 20-26.	

comment	*471*	comment by: *The Boeing Company*
	Page: 57 Paragraph: AMC1 ACNS.C.PBN.605 System performance demonstration	

THE PROPOSED TEXT STATES:

"The applicant should demonstrate the aircraft capability in terms of performance under design limit operational conditions (e.g. tailwinds and crosswinds, centre-of-gravity (CG) limits, temperature limits), and on representative procedures that include RF legs of varying radii. The applicant should also assess the effects of configuration changes (e.g. gear and flap extension and retraction)."

REQUESTED CHANGE:

"The applicant should validate the aircraft capability…"

JUSTIFICATION:

Aircraft capability regarding the items listed are validated in fundamental certification and other systems testing and demonstrations. These performance limits must meet criteria for PBN use, (e.g. bank authority). The resultant performance should be measured against the PBN specified requirements for authorization against specific criteria. Charted or otherwise required operational limits, such as temperature limitations and non-favorable winds for PBN designs, should be included in such validations.

response | Not accepted.
EASA considers that in many cases, items, or parts thereof, may have been validated during the demonstration of aircraft performance during the initial certification. Experience has shown however, that the results of these validations cannot always be used for credit for RNP AR certification, because the particular aspects of RNP AR operations have not been taken into account in the original certification effort. Validation will then only result in partial compliance. Hence, EASA believes that the requirement to demonstrate should be retained.

comment | *472*   comment by: *The Boeing Company*

Page: 57
Paragraph: AMC1 ACNS.C.PBN.605 System performance demonstration

THE PROPOSED TEXT STATES:

"The applicant should conduct a safety impact assessment based on the aircraft's system safety assessments (SSAs) and identify all failure conditions that could potentially impact on performance. The failure hazard analysis and system safety assessment of all the aircraft's systems that support RNP AR operations (RNAV systems, flight controls systems, flight guidance systems, displays, etc.) should therefore be revisited to identify these failures. System failures should include latent failures ('integrity') and detected failures ('continuity'). For the detected failures, the monitor limit of the alert, the time to alert, the flight crew reaction time, and the aircraft response should all be taken into account and verified to ensure that the aircraft does not exit the obstacle clearance volume."

REQUESTED CHANGE:

"The applicant should conduct a safety impact assessment based on the aircraft's system safety assessments (SSAs) and identify remote failure conditions that could potentially have an impact on performance. … "

JUSTIFICATION:

"All" cannot be quantified nor exhaustively analyzed.

response | Partially accepted.

The AMC does not require a quantification or an exhaustive analysis, but rather requires a review of failures that could impact RNP AR operations. EASA agrees to replace 'all' by 'any'.

In addition, we do not agree to limit the assessment to failures that have been classified as 'remote'.

comment | *473*   comment by: *The Boeing Company*

Page:57
Paragraph: AMC1 ACNS.C.PBN.605 System performance demonstration

THE PROPOSED TEXT STATES:

"Analogous to demonstration of robustness for systems that support autoland, the intent of this requirement is to ensure robustness of the aircraft and its systems to failure conditions. Consequently, performing a safe extraction is not an acceptable means of demonstrating compliance against the criteria of CS ACNS.C.PBN.605(a), (b) and (c). These demonstrations rely on crew action to intervene and place the aircraft back on the target track, even if in an operational environment, the crew is expected to initiate a missed approach procedure when the lateral or vertical criteria are exceeded. For compliance demonstration purposes however, executing a missed approach is not considered appropriate for demonstration of compliance with these criteria."

REQUESTED CHANGE:

"The intent of this requirement is to demonstrate robustness of the aircraft and its systems to failure conditions. Consequently, performing a safe extraction is not an acceptable means of demonstrating compliance against the criteria of CS ACNS.C.PBN.605(a), (b) and (c). For probable, one-engine inoperative, or remote failure conditions, demonstrating the aircraft is able to maintain containment, may rely on crew action to intervene and place the aircraft back on the target track, even if in an operational environment, the crew would be expected to initiate a missed approach procedure (e.g. when the lateral or vertical criteria are exceeded). For compliance demonstration purposes, executing a missed approach is not considered sufficient for demonstration of compliance with these criteria."

JUSTIFICATION:

The meaning of the original paragraph was unclear. The edits suggested were not an attempt to change the fundamental requirement, but to make it clear what is required by the applicant. The use of the word "may" in the middle of the paragraph is used to acknowledge that there are some failure conditions that may not always be require the crew to intervene.

response | Partially accepted.

The text has been revised to address the elements of the change suggested by the commentator, together with other proposals for amendment. See also response to comment 97.

comment	474	comment by: *The Boeing Company*

Page: 57
Paragraph: AMC1 ACNS.C.PBN.605 System performance demonstration

THE PROPOSED TEXT STATES:
"(b) With reference to CS ACNS.C.PBN.605(b), the same requirements apply for the case of an engine failure."

REQUESTED CHANGE:
"(b) With reference to CS ACNS.C.PBN.605(b), single engine failures should be assessed by detailed FTE data collection and analysis containing the industry recommended 30% engine-out conditions, or by a demonstration by representative environment and design limit operational conditions by the applicant's flight test pilots. The impact of the engine failure should be shown such that the aircraft can be maintained within the 1 × RNP value and within – 75 ft altitude deviation."

JUSTIFICATION:
The original text is ambiguous. The intent is to hold Engine Out performance equivalent to probable events: at a 1 RNP threshold. The requirements should explicitly state these requirements, similar to (a) just above. Additionally, industry standard testing of engine out performance should be acceptable if the resultant performance is sufficient to meet the RNP threshold.

response	Partially accepted.

The text has been amended to make a reference to the subsection (a) above. EASA does not agree to incorporate the reference to 30 % engine out conditions; these may not consider the specific RNP AR environment.

comment	475	comment by: *The Boeing Company*

Page: 57
Paragraph: AMC1 ACNS.C.PBN.605 System performance demonstration

THE PROPOSED TEXT STATES:
"Safe extraction is defined as within 2 × RNP for the applicable approach and missed approach procedure. The RNP for the missed approach procedure is usually higher than the RNP for the continued approach. For extremely remote navigational failure conditions (e.g. all flight management computers (FMCs) failed), the flight crew must be able to reasonably navigate the aircraft free of obstacles by using other navigational means to follow the missed approach procedure."

REQUESTED CHANGE:
"For extremely remote navigational failure conditions (e.g. all flight management computers (FMCs) failed), the flight crew must be able to reasonably navigate the aircraft free of obstacles by using other navigational means to follow the missed approach procedure."

JUSTIFICATION:
Inclusion of the "safe extraction" definition here is ambiguous in that it may be understood to apply to requirements a-d, specifically including "d." "Safe extraction"

beyond the design criteria area for 2X RNP is otherwise implied: The highest level of integrity required for RNP AR approach is 10^-7. It follows that the probability of erroneous lateral guidance causing aircraft outside of 2XRNP containment is on the order of 10^-7. Extremely remote failure conditions have a probability on the order of 1x10^-7 or less. Therefore, it is not appropriate to assume an extremely remote failure condition must be able to keep the aircraft within 2xRNP. Maintaining 2xRNP is the goal, but when 1xRNP cannot maintained, missed approach should be considered/initiated. Suggest the clause is moved to explain "safe extraction" when first introduced in the section above.

Deleting the second sentence, regarding the RNP value on the Missed approach, does not directly affect the "safe extraction" and therefore is not germane to this discussion.

response	Partially accepted. Please see the response to comment 56 and 94.

comment	*476*　　　　　　　　　　　　　　comment by: *The Boeing Company*

Page: 58

Paragraph: GM1 ACNS.C.PBN.610 Source of horizontal position

THE PROPOSED TEXT STATES:

"INS or IRU are generally not considered suitable as a sole source of horizontal position for RNP AR applications described herein. However, it is recognized that many multi-sensor navigation systems utilize INS or IRU within their navigation calculations to provide continuity when the other higher accuracy sensor(s) is (are) momentarily unavailable.

Attitude and heading reference systems (AHRSs), including an AHRS with inputs from air-data computers, are not considered to provide a level of performance that would be adequate to support RNP AR operations."

REQUESTED CHANGE:

"INS or IRU are generally not considered suitable as a sole source of horizontal position for RNP AR applications described herein. However, it is recognized that many multi-sensor navigation systems utilize INS or IRU within their navigation calculations to provide continuity when the other higher accuracy sensor(s) is (are) momentarily unavailable.

Sole-source attitude and heading reference systems (AHRSs), including an AHRS with inputs from air-data computers, are not considered to provide a level of performance that would be adequate to support RNP AR operations."

JUSTIFICATION:

Terminology related to the names of systems and whether they are sufficient as a positioning source may cause confusion. Some aircraft use a system called an AHRU that provides hybrid GPS and inertial performance for RNP AR operations and coasting. Based upon the original text, one might confuse a system with an AHRS and be deemed unacceptable simply because of its name.

response	Partially accepted. Please see the response to comments 371.

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comment	*477*	comment by: *The Boeing Company*

Page: 60
Paragraph: AMC1 ACNS.C.PBN.635 Navigation accuracy for RNP AR operations

THE PROPOSED TEXT STATES:
"If the area navigation system offers multiple RNP values associated with lines of minima on an RNP AR approach procedure, the system should allow the flight crew to select the appropriate line of minima for use on the final approach segment. The system should then acquire the associated RNP value(s) for the procedure from the navigation database."

REQUESTED CHANGE:
" … the system should allow the flight crew to select the appropriate Line of Minima or RNP value for use on the final approach segment."

JUSTIFICATION:
In many systems, the flight crew can only select the appropriate RNP value via the RNP system, not line of minima; either selection implies BOTH the appropriate RNP alerting threshold and commensurate line of charted minima.

| response | Partially accepted
Please also see the response to comment 280. |
|---|---|

comment	*478*	comment by: *The Boeing Company*

Page: 60
Paragraph: CS ACNS.C.PBN.640 RNP AR departures

THE PROPOSED TEXT STATES:
The area navigation system provides the following capabilities to support RNP AR departure procedures:
(a) The area navigation system allows loading and execution of a flight plan where the initial fix of the RNP AR DP defined path is placed at or near the approach end of the take-off runway.
(b) The area navigation system provides lateral path guidance not later than when reaching 50 feet above the departure runway.
(c) The area navigation system is capable of executing an RF leg where the first fix defining the RF leg begins at the departure end of the runway.
(d) The area navigation system provides a means for the flight crew to confirm availability of GNSS for aircraft positioning immediately prior to take-off.
(e) The INS position is automatically updated upon pressing the take-off/go-around (TOGA) button or during the take-off roll.

REQUESTED CHANGE:
Combine (a) and (c) into the following:

…
(a) The area navigation system allows loading and execution of a flight plan where the RNP AR DP defined path begins at or just beyond the departure end of the

runway (DER), including the use of an RF leg.

…

Delete (c)

…

Consider adding the following note associated with (a):

Note: Locating an initial fix of an RNP AR DP at or near the approach end of the takeoff runway is one acceptable means to facilitate executing an RF leg at the departure end of the runway (DER). The straight segment from the initial fix leading to the fix defining the beginning of the RF leg at the DER helps ensure the aircraft's path is tangent to the RF leg to capture of the RF leg guidance.

JUSTIFICATION:
Harmonization with ICAO PBN Manual (latest draft of RNP AR departure criteria). The minimum requirement is to ensure an RF leg can be flown beginning at the DER. As long as the system can do that, there is no reason to require a defined path over the runway prior to the DER, but it is a possible acceptable means of compliance. This subject was debated as part of the ICAO PBN Manual updates for RNP AR departures. Requiring a defined path over the runway also complicates procedure design criteria (ICAO Doc 9905).

response	
	Partially accepted.
	In point (a), 'near' has been replaced by 'just beyond' for consistency with the text of the draft ICAO text.
	Point (c) has however been retained. EASA considers that this text provides more clarity than the addition to (a) as proposed by the applicant.
	The note has been added as GM.

comment	*479*	comment by: *The Boeing Company*

Page: 60
Paragraph: CS ACNS.C.PBN.640 RNP AR departures

THE PROPOSED TEXT STATES:
The area navigation system provides the following capabilities to support RNP AR departure procedures:
(a) The area navigation system allows loading and execution of a flight plan where the initial fix of the RNP AR DP defined path is placed at or near the approach end of the take-off runway.
(b) The area navigation system provides lateral path guidance not later than when reaching 50 feet above the departure runway.
(c) The area navigation system is capable of executing an RF leg where the first fix defining the RF leg begins at the departure end of the runway.
(d) The area navigation system provides a means for the flight crew to confirm availability of GNSS for aircraft positioning immediately prior to take-off.
(e) The INS position is automatically updated upon pressing the take-off/go-around (TOGA) button or during the take-off roll.

REQUESTED CHANGE:
…
(e) The INS and area navigation system provides the means to conduct a full INS

alignment and subsequent position update during ground operations immediately prior to takeoff.

Consider adding the following notes associated with (e):

Note 1: This requirement helps ensure the best performance from the aircraft's INS and area navigation system should a loss of GNSS occur after takeoff when the RNP system reverts to INS-only navigation.

Note 2: Many aircraft meet these requirements through automatic means, but this does not preclude meeting the requirements through manual INS alignment and manual INS position updates.

Note 3: In many aircraft, an automatic INS position update occurs during the actual takeoff (e.g. when the pilot flying depresses the "TOGA" button); and this meets the position updating requirement above.

Note 4: When the aircraft does not include an automatic means to conduct an INS position update and requires a manual INS position update, the aircraft should be within 1,000 FT of the start point of the aircraft's takeoff roll when conducting the position update.

JUSTIFICATION:

Requiring an automatic INS update via TOGA or on the runway should not be a minimum requirement for being able to maintain RNP operations in the event of loss of GNSS. The recommended changes harmonizes with the ICAO PBN Manual (latest draft of RNP AR departure criteria) requirements for INS alignment.

response	Partially accepted. Please see the response to comment 212.

comment	*486* comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 57 AMC1 ACNS.C.PBN.605 System performance demonstration

PROPOSED TEXT / COMMENT:

Safe extraction following a failure should be defined by the means to control the aircraft and remain clear of obstacles while climbing to a safe altitude.

This may be ensured:
- by staying within a 2xRNP corridor each side of the intended track, or,
- by adopting a specific extraction trajectory, as defined for each procedure during ops approval, with sufficient navigation accuracy to remain clear of obstacles.

RATIONALE / REASON / JUSTIFICATION:

"Safe extraction is defined as within 2 × RNP for the applicable approach and missed approach procedure."
This new definition is extremely prescriptive and lead to have the same constrainsts on 'extremely remote failure' than the ones on 'remote failures' from a lateral excursion point of view.

response	Partially accepted. Please see the response to comment 56.

comment	515	comment by: *M.Jo (ATR)*

Safety classifications (for example in table 12) are gathering appr/dep with RNP<0.3 and missed-appr < 1.0 whereas it was separated in previous regulations and sometimes with different classifications.

Is it confirmed that classifications are harmonized for these different operations?

Because for missed-appr< 1NM, some classifications move from MAJ to HAZ.

response	Partially accepted. Please see the response to comment 43.

comment	516	comment by: *M.Jo (ATR)*

Table12:
Classification HAZ in the case of Presentation of erroneous vertical and horizontal position or guidance is a change from existing regulation. Is it confirmed?

response	Partially accepted. Please see the response to comment 43.

comment	519	comment by: *AIRBUS HELICOPTERS*

<u>Comment</u>: after CS ACNS.C.PBN.655, insert new CS ACNS.C.PBN.6XX for Monitoring and Alerting to include Class A TAWS.

response	Not accepted. The carrying of a TAWS Class A is already included in the EU Air-OPS regulatory framework for RNP AR operations.

comment	528	comment by: *EUROCONTROL*

AMC1 ACNS.C.PBN.605 System performance demonstration - Page 57

The EUROCONTROL Agency makes one comment.
<u>Para 2</u>: RNAV system described in RNP AR. It is proposed to spell out RNAV and replace the abbreviation by 'area navigation system'.

GM1 ACNS.C.PBN.610 Source of horizontal position - Page 58

The EUROCONTROL Agency makes one comment giving rise to a question.

<u>Para 2</u>: INS or IRU are *generally* not considered suitable as sole source of horizontal position for RNP AR. Could the proposed text mean that it is even envisaged to consider a continuation of an AR approach based on inertial information? This would need clarification. In addition, it is suggested to define what is meant by 'momentarily' (a matter of 1 second/5 seconds/15 seconds?).

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AMC1 ACNS.C.PBN.650 Lateral deviation display - Page 61

The EUROCONTROL Agency makes one comment under the form of two questions followed by a recommendation.

As with 'AMC1 ACNS.C.PBN.320 - Non numeric lateral deviation display scaling for approach - Page 39' why does the proposal indicate that the lateral deviation display should not be greater than two (2) times the applicable RNP? Should not it be a maximum deflection at 1 x RNP value instead? Although manual flight not considered management of deviation must be observed. The provision of an explanation is recommended.

AMC1 ACNS.C.PBN.670 Vertical accuracy - Page 65

The EUROCONTROL Agency makes one comment followed by a recommendation.

This section seems to be mixing vertical requirements with ANPE values derived from lateral RNP requirement. It is to be noted that ANPE and WPR are calculated as zero in horizontal flight. There is also no FTE (which was prevbiously defined as a lateral quantity, but now seeems a vertical quantity) for aircraft without AP or FD coupled (may this be an indication that manual flight is not allowed in AR?). The proposal needs clarification.

AMC2 ACNS.C.PBN.670 Vertical accuracy - Page 65

The EUROCONTROL Agency makes firstly one comment, giving rise to three questions concerning the documentary basis supporting the proposal, and followed by a recommendation.

It is difficult to understand why a VAL of 50-m restricts operations down to RNP 0.23 and a VAL of 35-m enables operations down to the RNP 0.1. Where is this limitation stipulated? Is it in ICAO Doc. 9905 or PANS OPS 8618? Otherwise where can this limitation be found?

The EUROCONTROL Agency makes two other comments, the latter being followed by a proposal.

Both statements in this section are completely out of context:

"The installation of equipment with an ETSO authorisation against ETSO-C146c that supports a 50-m vertical alert limit (VAL) satisfies the requirement for operations down to RNP 0.23." The 50-m VAL is part of the RNP APCH specification and cannot be used for AR. It also assumes the existence of a FAS data block, not present for AR. RNP 0.23 is not part of the scalability set (0.1 RNP increments).

"The installation of equipment with an ETSO authorisation against ETSO-C146c that supports a 35-m VAL satisfies the requirement for operations down to RNP 0.1." The support of a 35-m VAL in RNP APCH mode with a FAS data block does not automatically guarantee any size of lateral performance in RNP AP mode. The performance is also dependent on the GNSS/SBAS system used at the time (and

certain systems do not perform to that RNP level). It is therefore proposed to delete this paragraph entirely. Please note that ETSO-C161a equipment performs to the same lateral level as does ETSO-C146c.

response

AMC1 ACNS.C.PBN.605 System performance demonstration - Page 57
Partially accepted.
RNP system will be used throughout the document in response to comment 140.
GM1 ACNS.C.PBN.610 Source of horizontal position - Page 58
Not accepted.
The very latest aircraft designs include inertial systems that, depending on the situation and the applicable RNP value, may continue the approach procedure in case of loss of GNSS. But EASA does not consider this a requirement. For this reason, the requested clarification is not considered appropriate.
Neither is it possible to define 'momentarily' in detail, as this may vary from one design to another.
AMC1 ACNS.C.PBN.650 Lateral deviation display - Page 61
Not accepted.
Although the flight crew may monitor 1 x RNP to comply with operational requirements, EASA considers that this does not imply that the full scale deflection should also be set to 1 x RNP.
AMC1 ACNS.C.PBN.670 Vertical accuracy - Page 65
Not accepted.
The VEB and ANPE are consistent with the requirements of the PBN Manual. Note also that AP/FD is required for RNP AR operations.
AMC2 ACNS.C.PBN.670 Vertical accuracy - Page 65
Not accepted.
The text is consistent with long established criteria of FAA AC 20-138D Change 2 and is based on studies conducted by the FAA.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 7 — Supplementary specifications for applications for advanced-RNP (A-RNP)   p. 67

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comment | *215*   comment by: *Garmin International*

CS ACNS.C.PBN.705 Leg transition - Page 67:

It is not correct to characterize radius to fix and holding to manual termination legs as "leg transitions". Suggest creating individual CS for each of these capabilities that use the same terminology as the ICAO PBN manual and AC 20-138D Appendix 3. To align with the ICAO PBN manual, use the terms, "RF Legs" and "RNAV holding".

response | Accepted.
The text has been amended to reflect the intent of the comment, both in PBN.705 and PBN.805.
Paragraph (b) has been deleted, since this is already covered by CS ACNS.C.PBN.260.

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comment | *216*   comment by: *Garmin International*

CS ACNS.C.PBN.705 Leg transition - Page 67:

No AMC is identified for "holding to manual terminator". AC 20-138D, A3-4 identifies RTCA/DO-283B paragraph 2.2.1.2.6 as an acceptable means of compliance.

response	Partially accepted. See the response to comment 215 and AMC1 ACNS.C.PBN.260.

comment	217	comment by: *Garmin International*

CS ACNS.C.PBN.715 RNP scalability - Page 67:

No AMC is identified for RNP scalability. See CS ACNS.C.PBN.270 and AMC1 ACNS.C.PBN.270 which are not appropriate for subsection 2, but could be used here (in subsection 7) as means of compliance for RNP scalability. There are also other Garmin comments on RNP scalability criteria that should be moved into this CS or a related AMC.

response	Partially accepted. An AMC has been added to suggest a means of compliance with the requirement. EASA however disagrees that CS ACNS.C.PBN.270 and AMC1 ACNS.C.PBN.270 are not appropriate for inclusion in Subsection 2: the AMC1 ACNS.C.PBN.270 requirement allows for default setting of the RNP in accordance with DO-229( ) Section 2.2.2.6.1.

comment	218	comment by: *Garmin International*

CS ACNS.C.PBN.725 Display of aircraft track - Page 67:

In current guidance material, the requirement for display of current aircraft track (or track angle error) is associated only with the RNP AR Nav Spec. See AMC 20-26, 7.1, item 7. Suggest moving this requirement to subsection 6 (RNP AR).

response	Not accepted This requirement supports the monitoring of performance on RF legs.

comment	373	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.715 : The terminology 'selectable' is used twice in the requirement. This terminology is not appropriate and introduces confusion as it seems to create a link between the two it refers to two different ideas.

Thales proposal:

To Change '(selectable from 0.3 to 1.0 NM in tenth(s) of NM).' to '(ranging from 0.3 to 1.0 NM in tenth(s) of NM)'.
To change 'change manually selectable by the flight crew' to 'manually adjustable by the flight crew'.

response	Accepted The text has been revised to reflect the suggestion made by the commentator.

comment	*440*	comment by: *FAA AIR*

Reference: The section of the NPA titled, "Subsection 7 – Supplementary specifications for applications of advanced-RNP (A-RNP)"

COMMENT: *Substantive.* This section of the NPA offers no reference for the specification of the advanced functions making up potential applications of A-RNP operations. That is, the section simply the A-RNP functions the NPA requires, but offers no airworthiness approval basis for the functions, such as the standards found in ETSO-C115d.

RECOMMENDATION: Revise this subsection and require compliance with the A-RNP functional and performance requirements embraced by ETSO-C115d.

RATIONALE: Standardization and harmonization of the installed performance of the A-RNP functions listed in this subsection. Failure to ensure standardization and harmonization may result in disparate aircraft performance during RNP procedures and operations requiring A-RNP functionality.

response	Partially accepted

An AMC has been added to CS ACNS.C.PBN.715 to include equipment authorised against ETSO-C115d as an AMC.

For RF legs, parallel offsets and FRT, compliance with ETSO-C115d is ensured, where applicable, by the references made to other subsections of the document.

comment	*501*	comment by: *EUROCONTROL*

Subsection 7 — Supplementary specifications for applications for advanced-RNP (A-RNP) - Page 67

The EUROCONTROL Agency makes one comment.
Please update the subsection title: Advanced RNP (A-RNP).

CS ACNS.C.PBN.701 Applicability - Page 67

The EUROCONTROL Agency makes one comment.
Please replace by Advanced RNP (A-RNP).

CS ACNS.C.PBN.715 RNP scalability - Page 67

The EUROCONTROL Agency makes one comment giving rise to a question.
PBN Manual (ICAO Doc. 9613 Ed. 4) has scalability as an option. Does CS-ACNS have it as a requirement?

CS ACNS.C.PBN.720 Fixed radius transitions - Page 67

The EUROCONTROL Agency makes one comment giving rise to a question.
PBN Manual (ICAO Doc. 9613 Ed. 4) has fixed radius transitions (FRTs) as an option. Does CS-ACNS have it as a requirement?

response	**Subsection 7 — Supplementary specifications for applications for advanced-RNP (A-RNP) - Page 67** Not accepted.

The Subsection title is considered adequate.
CS ACNS.C.PBN.701 Applicability - Page 67
Not accepted.
Please see the response to comment 378.
CS ACNS.C.PBN.715 RNP scalability - Page 67
Partially accepted.
The section on scalability has been revised in response to other comments and in response to recent consensus reached in the PBNSG.
CS ACNS.C.PBN.720 Fixed radius transitions - Page 67
Noted.
CS ACNS.C.PBN.720 has been deleted and Table1 has been updated to reflect that FRT is optional.

comment	*529*	comment by: *DGAC Deputy Head of aircraft and operations rulemaking department*

CS ACNS.C.PBN.715 RNP scalability:

Taking into account that the original goal of PBN is to offer a reduced set of navigation specifications to ease the development, in an harmonized way, of RNAV application all around the world; scalability represents a risk to increase the number of different RNAV applications where the pilot would have the obligation to know which RNP value is required in such or such RNAV route/procedure.
As a consequence if scalability is developed as part of the advanced RNP nav spec it should be done in a such a way that it becomes transparent for the crew. In other words the RNP value should be automatically set in the system (an coded in the database).

Today scalability is implemented in RNP AR where the required RNP value can be 0.1. On aircraft architecture which does not offer the automatic coding of the RNP value, the operational procedure lead to a certain level of complexity which may be acceptable in the scope of RNP AR (particular OPS procedures and training) but not acceptable outside RNP AR application.

Therefore, DGAC France considers that this requirement should not open the possibility to manage the RNP value manually.

| response | Partially accepted.
The section on scalability has been revised in response to other comments and in response to recent consensus reached in the PBNSG. |
|---|---|

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 8 — Supplementary specifications supporting radius to fix (RF)	p. 68-70

comment	*180*	comment by: *ERAA*

NPA text:

AMC1 ACNS.C.PBN.805 RF functional requirements

'Test procedures for aircraft capability to perform RF legs in approach and departure should make use of the RF demonstration templates described in Appendix C to Subpart C.'

'Appendix C to Subpart C'

Comment:

It is unclear for us as a European operator how the proposed procedures - which pertain to US airspace - can be made accessible to the RNAV system on which RF legs shall be demonstrated. Some guidance in this respect would be helpful.

What is understood by the expression 'engineering simulation' does this include normal Full Flight Simulators? Can all of the demonstration be carried out in an FSS?

response | Not accepted
The templates were indeed developed in the US, but may be adapted for use in European airspace. It is not intended that operators perform these demonstration procedures. CS-ACNS does not apply to the operators, but rather to applicants for airworthiness approval of an aircraft's capability to perform PBN operations.

comment | *182* | comment by: *ERAA*

NPA text:

CS.ACNS.C.PBN.820 Display of computed path

'The area navigation system displays the intended path on an appropriately scaled moving map display in the flight crew's maximum field of view.'

Comment:

Unfortunately, there is a large population of regional aircraft and business aircraft which - although they have RNAV/FMS and flight guidance systems that are fully capable of constructing and flying RF legs - do not have map display systems that can actually show the arc leg. - We are aware of initiatives elsewhere where the hard requirement for a map display showing the RF leg is being reconsidered.

It should be noted that we have flown DME arcs with these map displays for decades without reported loss of situational awareness.

On the display systems that cannot show the arc, typically the begining and end point of the RF leg will be shown, and likewise an indication of XTE will be shown at all times. The leg will usually be flown auto-coupled or with flight director. However, for initial missed approach - where the RF leg will add substantially to flight safety - it may be more appropriate to use another display than map, e.g. arc/partial compass or full card. Initial missed approach is a critical phase of flight where the availability of a positive track guidance throughout turn is particularly important.

We understand that it is proposed that RF can be approved for manual flight with a moving map display and CDI. It is difficult to see that flying FMS constructed RF legs with flight guidance in the form of FMS coupled flight director or autopilot without a map dispaly that shows the arc should incur more risk than manual flight with map display.

In the ATM Master Plan, PCP and PBN IR regulations RF is a specified functionality, e.g. associated with RNP-1 terminal airspace. It would be very unfortunate if a large population of existing aircraft would be excluded from taking advantage of these rationalizations.

Our position is that it would be better to allow for the use of RF leg without map display that shows the arc - under a set of preconditions - in order that these aircraft may benefit from increased flight safety, airspace rationalization and contribute to lower emissions and noise footprints.

It should be borne in mind that retrofitting new display systems is prohibitively expensive.

ERA would be interested in cooperating with EASA with respect to setting up preconditions for the use of RF leg without map display that shows the arc.

response	Noted
	EASA notes the concerns expressed by ERAA and accepts the invitation to discuss these. We do wish to state, however, that the current alleviations for non-type rated CS-23 Class 1-3 aircraft are based on an agreement reached with the ICAO PBNSG, supported by a comprehensive set of demonstrations performed by a leading manufacturer of avionics equipment targeted at this market.
	Consistent with the example above, the requested alleviation to operate RF legs without a moving map display would also have to be supported by an extensive demonstration exercise. In addition, EASA would generally seek agreement from the ICAO PBNSG, or other leading aviation authorities, before providing alleviation.

comment	*233*	comment by: *Garmin International*

CS ACNS.C.PBN.815 Autopilot/Flight director - Page 69:

Garmin appreciates the EASA alleviation to not require autopilot or flight director to execute RF legs for CS-23 Level 1, 2 and 3 aircraft under the stated conditions. This will assist the GA community in being able to perform A-RNP operations.

Garmin also appreciates the other alleviations for CS-23 aircraft in other CS-ACNS Subpart C sections.

response	Noted.

comment	*290*	comment by: *Europe Air Sports*

Subpart C – Navigation (NAV)
Section 1 – Performance-Based Navigation (PBN)
Subsections 8 (Radius to Fix), 9 (Fixed Radius Transition) and 10 (Parallel Offset)

In the paragraphs lying under these subsections addressing some of the PBN functionalities, no provision should lead to the conclusion that they should be available in any GNSS receiver and that they should be deployed everywhere.
For GA, it is crucial that their use in PBN procedures should be kept as low as possible since they are not available on all PBN-equipped aircraft.
We are far from it.
So, designers of PBN procedures should be convinced to limit the need for these PBN functionalities only to cases where they bring a real added-value and to consider an alternative procedure for aircraft which are not fitted with such PBN functionalities.

response	Noted.

The comment is appreciated, but is not directly related to the amendment of CS-ACNS. EASA has, however, raised this concern at the PBNSG and Edition 5 of the PBN manual may contain language that addresses the commentator's comments.

comment	*293*	comment by: *Europe Air Sports*

Subpart C – Navigation (NAV)
Section 1 – Performance-Based Navigation (PBN)
Subsection 8 (Radius to Fix)
Paragraph CS ACNS.C.PBN.815 Autopilot/Flight director

Firstly, on GA light aircraft, the question to consider is more about the availability of the RF functionality in the GNSS receiver together with the relevant display than the availability of an autopilot.

We strongly recommend to deploy GNSS procedures with a RF leg transition only when strictly necessary. At least until the time when this PBN functionality is available in all GNSS receivers.

Secondly, it does not seem realistic to execute manually radius to fix (RF) leg transitions with the required accuracy, i.e. 0.1 NM. And the availability of the display of the RF leg transition is a prerequisite.

response	Noted.

Please also see the response to comment 290.

comment	*308*	comment by: *Europe Air Sports*

Page 69
CS-ACNS.C.PBN.815 Autopilot/Flight director…":

Thanks for adding Level 2 and Level 3 aircraft. We propose to add CS-VLA (now included in CS-23) as well.

Rationale: For the completeness of the picture.
and:

Question: "except for non-type-rated CS-23 Level 1, 2 and 3 aircraft…": Is "non-type-rated" the correct term?

response	Partially accepted. With regards to inclusion of VLA, please see the response to comment 301. The wording has been revised to better express that the alleviation applies to aircraft for which a type rating is not required.

comment	*404*	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.815 : This specification is not performance based. It should specify a level of performance to maintain (RF) leg applicable to all aicraft. Need of autopilot to maintain Performance to execute RF leg may depend on aircraft type (for example diffrences to consider between large aeroplane and rotorcraft).

Thales proposal:

To revisit the text to be more performance based.

response	Not accepted. Although EASA concurs that the requirement is not necessarily performance based, it is considered that the text is consistent with an agreement reached in the ICAO PBNSG. Drafting the text in a more performance based manner could open the door for solutions for which there may not be international agreement, which EASA would be reluctant to accept. Please also see the response to comment 182.

comment	*423*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 68 CS ACNS.C.PBN.805 RF functional requirements

PROPOSED TEXT / COMMENT:

It is understood that 30° and 8° are minimum values. This could be clarified with a wording such as "a minimum of" or via an AMC.

response	Accepted The text has been revised to reflect the suggestion made by the commentator.

comment	*424*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 69 AMC1 ACNS.C.PBN.805 RF functional requirements

PROPOSED TEXT / COMMENT:

It is proposed to remove "RF turn entry and exit criteria". Proposed text : "Within the demonstration, the applicant should be seeking to confirm that the FTE is commensurate with the identified RNP navigation accuracy"

RATIONALE / REASON / JUSTIFICATION:

RF turn entry and exit criteria are not defined.

response	Accepted
	The text has been revised to reflect the suggestion made by the commentator.

comment	*458*	comment by: *M.Jo (ATR)*
	CS ACNS.C.PBN.805 RF functional requirements	
	Commanding a bank angle of up to 30° is requested whereas some aircraft flying at "low" speeds can fly under unfavorable wind RF legs designed with 25° of bank without needing to bank up to 30°.	
	Could it be possible to add an AMC or GM to know how to demonstrate compliance for aircraft with a maximum bank lower than 30°?	
	Wording for 8° could be reviewed (even if identical to existing AMC). Because actually 8° should be a minimum. So the "up to" is ambiguous.	

response	Partially accepted.
	With respect to the 8°, please see the response to comment 423.
	EASA does not agree to make exceptions with regards to the 30° requirement. This is consistent with the lateral performance criteria of ED-75D.

comment	*530*	comment by: *EUROCONTROL*
	CS.ACNS.C.PBN.805 (b) RF functional requirements - Page 68	
	The EUROCONTROL Agency makes one comment giving rise to two questions.	
	It had always been understood that the maximal commandable angle of bank (AOB) was 25 degrees. With this proposal has the commanded AOB changed? Where does the 30 degrees limit come from?	

response	Noted.
	The 30° bank angle requirement is consistent with ED-75D and considers that to compensate for unfavourable winds on an RF turn requiring a bank of 25 degrees, an additional margin of 5 degrees is required.

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 9 — Supplementary specifications supporting fixed radius transition (FRT)   p. 71

comment	*291*	comment by: *Europe Air Sports*
	Please see our comment regarding Subsection 8 on page 68.	

response	Noted.
	Please see the response to that comment.

comment	*531*	comment by: *EUROCONTROL*

CS ACNS.C.PBN.901 Applicability - Page 71

The EUROCONTROL Agency makes the same comment as that made for 'CS ACNS.C.PBN.720 - Fixed radius transitions - Page 67', namely that A-RNP in PBN Manual has FRT as an option. Does CS-ACNS have it as a requirement?

Second sentence: please use 'Advanced RNP'.

response | Partially accepted.
The FRT functionality has been made optional for A-RNP. Advanced RNP will be replaced by A-RNP as much as possible, please see the responses given to comments 378 and 428 about the spelling of this navigation specification.

---

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subsection 10 — Supplementary specifications supporting parallel offset

p. 72-73

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comment | *59*   comment by: *Dassault-Aviation*

Dassault-Aviation

P 72 CS ACNS.C.PBN.1005

Comment:
(CS)   Parallel   offset   capabilities
(a) (1) ED 75D §3.7.2.2.4.1, specify an intercept angle of 30° to and from the offset track, ICAO PBN Manual an angle between 30° and 45° (II-C-4-16 §4.3.3.7.1 g)): What is the rationale to keep 30° (45°, if possible, can offer a quicker intercept)? Please clarify

response | Not accepted
The PBN Manual is being updated to be consistent with ED-75D. EASA has decided to maintain consistency with ED-75D.

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comment | *60*   comment by: *Dassault-Aviation*

Dassault-Aviation

P 72 CS ACNS.C.PBN.1005

Comment:
(CS) Parallel offset capabilities
(a) (3) (iii) (A) ED 75D §3.7.2.2.4.1, specify a maximum course change course of 120° to discontinue an offset, ICAO PBN Manual of 90° (II-C-4-4 § 4.2.3.1): What is the rationale to choose a maximum course change of 90°?
Please clarify

response | Partially accepted.

The CS and AMC have been revised with consideration of the suggestion made by the commentator.

| comment | 292 | comment by: *Europe Air Sports* |

Please see our comment regarding Subsection 8 on page 68.

| response | Noted. |

Please see the response to that comment.

| comment | 346 | comment by: *AIRBUS* |

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 73 CS ACNS.C.PBN.1010 Indication of parallel offset status

PROPOSED TEXT / COMMENT:

Reading the CS it seems that estimated time of arrival is required. However as ETA is still under evaluation it is understood that this is not the intention. Could EASA clarify the requierement ?

RATIONALE / REASON / JUSTIFICATION:

For clarification

| response | Noted. |

The requirement is consistent with CS ACNS.C.PBN.285 Display of active waypoint. Please also consider the response to comment 443.

| comment | 367 | comment by: *Embraer S.A.* |

Embraer suggests to harmonize CS ACNS.C.PBN.1010 (Indication of parallel offset status) with FAA AC 20-138D and EUROCAE ED-75D.

CS ACNS.C.PBN.1010 (c) asks for the indication of the offset value in the flight crew's maximum field of view. This is not required according to §A3-3 from FAA AC 20-138D and §3.7.2.2.4 from EUROCAE ED-75D. Besides this, there are implementations that display such information out of the maximum field of view, compliant with those aircraft human factors' philosophy.

To change the text from:

CS ACNS.C.PBN.1010 Indication of parallel offset status
When in offset mode, the area navigation system provides:
(a) lateral guidance parameters relative to the offset path;
(b) distance and estimated time of arrival information relative to the offset reference points;
(c) a continuous indication of the parallel offset status and of the offset value in the flight crew's maximum field of view;

(d) the cross-track deviation indication during the operation of the offset referred to the offset track.

To:

CS ACNS.C.PBN.1010 Indication of parallel offset status
When in offset mode, the area navigation system provides:
(a) lateral guidance parameters relative to the offset path;
(b) distance and estimated time of arrival information relative to the offset reference points;
(c) a continuous indication of the parallel offset status ~~and of the offset value~~ in the flight crew's maximum field of view;
(d) the cross-track deviation indication during the operation of the offset referred to the offset track.

response	Accepted. The wording has been amended accordingly.

comment	405	comment by: *THALES AVIONICS*

CS ACNS.C.PBN.1005 : (a) (3) is too detailed for a CS and is more reflecting a possible implementation to a more generic objective which is to not continue an offset through unusual flight path geometries.
Moreover the 90° criteria for (a) (3) (iii) is unnecessary constraint an is not coherent with MOPS (possible value is 120°) but no value has to be forced by regulation.

Thales proposal:

. To replace the complete (a) (3) by ' automatically cancel the offset pathl flight path geometry is not appropriate' and move the detailed of possible unappropriate geometries in AMC.
. To not specify a detailed angle value for the course change (will be adjusted appropriately for each implementation).

response	Partially accepted. The CS and AMC have been revised with consideration of the suggestion made by the commentator.

comment	459	comment by: *M.Jo (ATR)*

CS ACNS.C.PBN.1005 Parallel offset
☐ (iii) (A): Why condition on course change of 90° (was 120° in the past) is required? Some FMS are able to manage course change of more than 90°.
We can understand that offset along a course change of more than 90° could lead to larger excursion, but it could be interesting to allow the systems managing these cases.

response	Partially accepted. The CS and AMC have been revised with consideration of the suggestion made by the commentator.

Page 225 of 241

An agency of the European Union

comment	*533*	comment by: *EUROCONTROL*

CS ACNS.C.PBN.1001 Applicability - Page 72

Para 1

The EUROCONTROL Agency makes a comment under the form of three questions.

Why is parallel offset only restricted to en-route? Is this a restriction that can be found in PBN Manual or PANS OPS 8168? Could there not be tactical benefits also with a use on SIDs/STARs (obviously not APCH)?

Para 2

The EUROCONTROL Agency makes one comment/suggestion under the form of a question.

Why could parallel offset not be associated to RNP 1 as well? RNP 1 could be used en-route.

CS ACNS.C.PBN.1005 Parallel offset capabilities - Page 72

The EUROCONTROL Agency makes one comment under the form of a request for verification.

Para (a) (1)
Please confirm the intercept angle since ED 75D introduced a 45 degrees engagement/disengagement requirement.

response	**CS ACNS.C.PBN.1001 Applicability - Page 72**

Para 1
Not accepted.
The use of parallel offset is limited to en-route in the navigation specification for Advanced RNP, and RNP 4 does not apply to SIDs and STARs.
Para 2
Not accepted.
The PBN Manual does not recognise the application of RNP 1 for en-route operations.
CS ACNS.C.PBN.1005 Parallel offset capabilities - Page 72
Not accepted.
ED-75D states: 'To improve the repeatability of the transition to an offset path and allow more predictable operations, the angle at which the transition path leaves the original path has been specified as a 30-degrees track change (this is also true for the returning transition path from the offset path to the original path)'. Hence the 30 degrees intercept angle is considered correct.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Appendix A — Installation and testing guidance

p. 74-81

comment	*15*	comment by: *Luftfahrt-Bundesamt*
	Appendix A, (2) (e) Typo "0do"	
response	Accepted. The '0do' has been replaced with a reference to Appendix B.	

comment	*28*	comment by: *Rockwell Collins, Inc.*
	Page 75 Appendix A (2)(d) fourth line: Bullet (2)(d) refers to AC 25-7 and AC 23-8 which I believe are FAA Advisory Circulars. Shouldn't they be replaced by EASA versions? If that material doesn't exist should the reference be clarified by adding "FAA" for these two references? Replace references with EASA equivalents. (observation)	
response	Accepted. 'FAA' has been placed in front of the ACs. There is currently no material for VOR and DME. This may be developed for a future amendment of CS-ACNS.	

comment	*29*	comment by: *Rockwell Collins, Inc.*
	Page 75 Appendix A Item (2)(e): Bullet (2)(e) has another embedded link with text of "0". Replace "0" with correct text, "Appendix B". Change "0" in link to "Appendix B" (suggestion)	
response	Accepted. The '0do' has been replaced with a reference to Appendix B.	

comment	*96*	comment by: *Transport Canada Civil Aviation Standards Branch*
	Page 75,Para (e) Typo in the sentence after the word "criteria of". The referenced paragraph hasn't been inserted properly.	
response	Accepted. The '0do' has been replaced with a reference to Appendix B.	

comment	*219*	comment by: *Garmin International*
	Appendix A (2)(d) - Page 75: Regarding "The latest revisions of AC 25-7 and AC 23-8 provide guidance …": Are	

these referring to FAA advisory circulars? If so, suggest clarifying this by including "FAA" before "AC 25-7".

response	Accepted
	See the response to comment 28

comment	*220*	comment by: *Garmin International*

Appendix A (2)(e) - Page 75:

There appears to be a broken cross-reference: "…criteria of 0do…". Perhaps this is intended to be a cross-reference to Appendix B (INS/IRU standard performance and functionality).

response	Accepted.
	The '0do' has been replaced with a reference to Appendix B.

comment	*221*	comment by: *Garmin International*

Appendix A (2)(f) - Page 75:

Regarding "If applicable, the applicant should confirm that the antenna to aircraft centre of navigation offset is appropriate to the installation for GNSS SBAS equipment supporting LPV." Per DO-229E 2.2.4.3.3, the navigation center offset is also applicable to LNAV/VNAV approaches. Suggest changing to "… supporting LPV and/or LNAV/VNAV."

response	Accepted.
	The text has been revised to reflect the commentator's suggestion.

comment	*222*	comment by: *Garmin International*

Appendix A (5)(b) - Page 78:

Regarding "then the approach performance will need to be evaluated per the latest revision of AC 23-17C, AMC1 to CS 25.1329, or AC 29-2C": Are the references to AC 23-17C and AC 29-2C to FAA advisory circulars? If so, suggest clarifying this by including "FAA" before each of these references. Also, suggest removing the letter revisions on each of the FAA AC references since "the latest revision" should suffice.

Additionally, there is no reference to part 27 guidance. Should there be?

response	Accepted.
	'FAA' has been added before the above references.
	There is no specific guidance in/to part 27.

comment	*223*	comment by: *Garmin International*

Appendix A (7)(b) - Page 79:

Regarding "then the approach performance will need to be evaluated per the latest revision of AC 23-17b, AMC1 to CS 25.1329, or Appendix B of CS-29/AC 29.1329 contained in AC 29-2 (or equivalent means)": Are the references to AC 23-17b and AC 29-2 to FAA advisory circulars? If so, suggest clarifying this by including "FAA" before each of these references. Also, suggest removing the letter revisions on each of the FAA AC references since "the latest revision" should suffice.

Additionally, there is no reference to part 27 guidance. Should there be?

response	Accepted. 'FAA' has been placed in front of the ACs. Reference to FAA AC 29-2c, containing AC 20-1329 has been removed as the content is already covered under Appendix B to CS-29 and equivalent means may be accepted too. There is no specific guidance in/to Part 27.

comment	*224*	comment by: *Garmin International*

Appendix A (7)(f) - Page 79 - 80:

As noted in Garmin's comment on CS ACNS.C.PBN.510 Altitude constraints, and AMC1 ACNS.C.PBN.510 Altitude constraints, there are multiple methods to constructing a final approach vertical path; however, ETSO-C146() is not required to use altitude constraints to do so. Suggest revising item (7)(f) so that the evaluation should be performed only for equipment that uses altitude constraints to construct a final approach vertical path.

response	Accepted. Bullet (f) of paragraph (7) have been deleted. Bullet (a) of paragraph (6) has been retained, but Subsection 4 has been repurposed and compliance with Subsection 4 has been made optional. Reference is also made to the response to comment 485.

comment	*225*	comment by: *Garmin International*

Appendix A (7)(g) - Page 80:

This evaluation should be required only if the installation includes an autopilot.

response	Accepted. New bullet (f) (previously bullet (g)) has been modified and reads: '(f) Where the area navigation system is capable of automatically intercepting a vertical path, the vertical fly-by and the autopilot response (if applicable) should be evaluated under different configurations and winds.'

comment	*226*	comment by: *Garmin International*

Appendix A (7)(i) - Page 80:

As noted in Garmin's comment on AMC1 ACNS.C.PBN.550 Glide path alerting, EASA Part-CAT, Part-NCC, Part-NCO, and Part-SPO AMC/GM allows for an LPV approach operational limitation to DH of 250 ft "For aircraft that have a TAWS Class A installed and do not provide Mode-5 protection on an LPV approach". In such cases, this evaluation should ensure the AFM includes the limitation in lieu of performing the excessive-deviation-below-the-glide-path alert evaluation.

response	Not accepted. Please see the response to comment 204.

comment	*311*	comment by: *Europe Air Sports*

Page 75
Appendix A
(2) Equipment installation
(e)

..."satisfy the criteria of 0do..." appears to be a text error.

response	Accepted. The '0do' has been replaced with a reference to Appendix B.

comment	*350*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 75 Appendix A

PROPOSED TEXT / COMMENT:

Item 2(e) reads "Inertial systems that satisfy the criteria of 0do not need further evaluation.".
It is understood that this refers to "appendix B".

RATIONALE / REASON / JUSTIFICATION:

For clarification

response	Accepted. The '0do' has been replaced with a reference to Appendix B.

comment	*351*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:

Page 80 Appendix A

PROPOSED TEXT / COMMENT:

§ 9(c) seems to be linked to the vertical performance demonstration and not to the lateral. However this § 9(c) refers to CS 2140 that deals with lateral performance. It

seems that tehre is a wrong reference in the appendix A (should it be 555 instead of 2140?)
Could EASA clarify ?

RATIONALE / REASON / JUSTIFICATION:

For clarification

response	Partially accepted. Former paragraph 9 has been removed and its content has been moved to other paragraphs of the Appendix, as appropriate.

comment	*352*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:
Page 74 Appendix A

PROPOSED TEXT / COMMENT:

To explain when to consider paragraph 9 in appendix A item 1.

RATIONALE / REASON / JUSTIFICATION:

Item 1(a) explains when to consider paragraphs 2 to 8 from appendix A. It does not explain when to consider paragraph 9.

response	Partially accepted. Former paragraph 9 has been removed and its content has been moved to other paragraphs of the Appendix, as appropriate.

comment	*353*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:
Page 76 Appendix A

PROPOSED TEXT / COMMENT:

It is proposed to write item '3) (E) as follow :
"The applicant should determine satisfactory electromagnetic compatibility (EMC) between the installation of the area navigation system and other on-board equipment (this may be partially accomplished through ground tests).

RATIONALE / REASON / JUSTIFICATION:

Item (3) (e) calls for an "evaluation" that could be interpretated as "tests activities", whereas anlysis could also be acceptable.

response	Partially accepted. Bullet (e) of paragraph (3) has been removed as it is covered by CS-25, etc.

comment	*368*	comment by: *Embraer S.A.*

Embraer suggests to correct a typo reference to the INS/IRU standard performance and functionality appendix, because there is a typographical error in letter "e" of §2 of the Appendix A.

To change the text from:

[...] (e) Inertial systems that satisfy the criteria of 0do not need further evaluation. [...]

To:
[...] (e) Inertial systems that satisfy the criteria of <u>Appendix B</u> -0- do not need further evaluation. [...]

response	Accepted. The '0do' has been replaced with a reference to Appendix B.

comment	*441*	comment by: *FAA AIR*

Reference: "Appendix A – Installation and testing guidance"; specifically subparagraph, "(2) Equipment installation; (c) For multi-sensor installation, under sensor failure conditions, the applicant should verify the following:"
COMMENT: *Substantive.* While the requirements in this subparagraph are wholly appropriate, they are also incomplete. These requirements fail to address the need to evaluate the loss of the GNSS signal in space (SIS). Since ICAO recognizes the probability of the loss of the GNSS SIS as probable (a 1×10^{-4} event), the specs in this section of the NPA should address the need to evaluate the performance of the multi-sensor system when GNSS is lost due to interference or jamming, whether intentional or unintentional.
RECOMMENDATION: Update subparagraph (2)(c) of this appendix to read, "…, under sensor failure conditions and during loss of the GNSS signal-in-space (GNSS SIS), the applicant…"
RATIONALE: Completeness and practical reality operational implementation of PBN faces when the operation(s) require GNSS for eligibility.

response	Accepted. The text has been revised to include the suggested change.

comment	*442*	comment by: *FAA AIR*

Reference: Appendix A, subparagraph (2)(d), requirements for the DMS sensor supporting DME/DME-based navigation.
COMMENT: This paragraph requires an applicant to record data to show "…sufficient signal parameters and sensor performance data to provide a clear indication of satisfactory sensor performance." This is wholly inappropriate given the eligibility specs should include confirmation of DME sensor qualification through ETSO/TSO award for the installed DME sensor. As written, the NPS suggests the ETSO/TSO's DME sensor performance requirements are inadequate.
RECOMMENDATION: Update this portion of the NPA to require compliance with the most current ETSO/TSO for a DME sensor installation and delete the requirement to record data to justify use of a DME sensor with an ETSOA/TSOA, as part of an

aircraft's multi-sensor RNP system's capabilities. If EASA feels the current DME sensor standard

response	Not accepted. The equipment qualification is covered in CS ACNS.C.PBN.205.

comment	*455* comment by: *THALES AVIONICS*

Typo in App 1 - (2) (e) : '….the criteria of 0do…' does not mean anything

<u>Thales proposal</u>:

To correct the typo in App 1 - (2) (e)

response	Accepted. The '0do' has been replaced with a reference to Appendix B.

comment	*480* comment by: *The Boeing Company*

Page: 75
Paragraph: Appendix A – Installation and testing guidance, (2) (e)

THE PROPOSED TEXT STATES:
(e) Inertial systems that satisfy the criteria of 0do not need further evaluation.

REQUESTED CHANGE:
(Fix reference: "…criteria of 0do…")

JUSTIFICATION:
Criteria reference is not correct.

response	Accepted. The '0do' has been replaced with a reference to Appendix B.

comment	*481* comment by: *The Boeing Company*

Page: 75, 76
Paragraph: Appendix A – Installation and testing guidance, (3) (c)

THE PROPOSED TEXT STATES:
(c) The lack of interference from VHF radios should be demonstrated on the completed installation of navigation sensors (GNSS, DME where applicable, etc.) by tuning each VHF transmitter to the frequencies listed below and transmitting for a period of 30 seconds while observing the signal status of each satellite being received. Degradation of individually received satellite signals below a point where the satellite is no longer available will require additional isolation measures to be taken:
(i) 121.150 MHz; 121.175 MHz; 121.200 MHz; 131.250 MHz; 131.275 MHz; and 131.300 MHz (for radios with 25-kHz channel spacing); and
(ii) 121.185 MHz; 121.190 MHz; 130.285 MHz and 131.290 MHz (for radios with 8.33-kHz channel spacing);

REQUESTED CHANGE:

Clarify that these requirements are intended for the airworthiness certification applicant and not the operator.

JUSTIFICATION:

These tests only need to be performed once relative to airworthiness approval, not by each operator. Additionally, operators don't typically have the required equipment to evaluate individual satellite tracking information.

response | Noted.

The CS-ACNS is by definition not intended for operators, but provides guidance to applicants for the airworthiness approval of CNS functions.

comment | *534* comment by: *EUROCONTROL*

Appendix A - Installation and testing guidance - Page 74-81

Para (1)(a)(v) - Page 74

The EUROCONTROL Agency makes a comment under the form of a suggestion: use 'Advanced RNP' on first and second lines.

Para (2)(e) - Page 75

The EUROCONTROL Agency makes a comment through a request for explanation. What does 'O' mean in sentence 'Inertial systems that satisfy the criteria of 0 do not need further evaluation.'?

Para (2)(f) - Page 75

The EUROCONTROL Agency makes three comments, the second and third ones under the form of suggestions.

A reference to ETSO-C161a needs to be added.

The following extract of the proposal "…is appropriate to the installation for GNSS SBAS equipment supporting LPV' needs be clarified. It is suggested to replace it by '…is appropriate to the installation of GNSS equipment supporting approach operations'.

The note at the end of Para (2)(f) is inappropriate as written since PANS-OPS permits for up to 12 feet of difference between Navigation reference point and wheel height for all navigation systems. The Rules here should not be more stringent than PANS-OPS Vol. 2. It is therefore suggested to justify the difference between the proposal and PANS-OPS.

Para (3)(c) - Page 75

The EUROCONTROL Agency makes a comment under the form of a suggestion.

VHF COM interference should also be tested with the lowest tunable channel (most often 118.025 MHz, often used as ATIS channels, not only above 121 MHz) to be in line with Annex 10 requirements.

Para (7) - Page 79-80

The EUROCONTROL Agency makes a comment under the form of a suggestion.

'AMC1 ACNS.C.PBN.670 Vertical accuracy - Page 65' has a requirement for vertical FTE size. Why is this not coupled with a testing requirement for the vertical FTE in this section?

Para (7)(i) - Page 80

The EUROCONTROL Agency makes one comment.

As commented above, TAWS is not a credited component for meeting LPV integrity, but a safety net. The test should actually test PBN system integrity, not TAWS integrity. There should not be a specific interface between PBN approach system and TAWS. The only input is the GPA from any approach system (as correctly written on P. 99).

response	Para (1)(a)(v) - Page 74

Para (1)(a)(v) - Page 74
Not accepted.
Please see the response to comment 378.
Para (2)(e) - Page 75
Accepted.
The '0' has been replaced with a reference to Appendix B.
Para (2)(f) - Page 75
Partially accepted.
For the comment regarding ETSO-C161a, please see the response to comment 483.
For the comment regarding installation for GNSS SBAS equipment supporting LPV, please see the response to comment 221.
The note is consistent with criteria of RTCA DO-229E and thus retained.
Para (3)(c) - Page 75
Not accepted.
The requirement in Annex 10 refers to VHF data broadcast interference immunity. This is applicable to GBAS installations that are not considered in this document. Moreover, the text is consistent with FAA AC 20-138D, Change 2.
Para (7) - Page 79-80
Not accepted.
The requirement in PBN.670 is specific to RNP AR APCH. The criteria of Paragraph 7 of Appendix C are applicable to non-RNP AR operations. Guidance on testing for RNP AR is considered too specific to be provided in the Appendix.
Para (7)(i) - Page 80
Not accepted.
Please see the response to comment 508.

<table>
<tr><td>

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Appendix B — INS/IRU standard performance and functionality

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p. 82

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comment	*228*	comment by: *Garmin International*

Appendix B (2)(a) - Page 82:

Regarding "The equipment should support an unambiguous display in the flight crew's optimum field of view an indication when its outputs are invalid.": While it is appropriate for an INS/IRU to support display of an indication to the flight crew when its outputs are invalid, it is not typical that this indication will be "in the flight crew's optimum field of view" since an INS/IRU is most often one of several positioning sensors in a multi-sensor FMS.

Indications of individual positioning sensor status are typically provided on an MCDU page that may be in the flight crew's secondary field of view. It is only when a combination of positioning sensor failures occurs such that the FMS is unable to maintain the RNP value that an indication is provided in the optimum field of view (see CS ACNS.C.PBN.2130).

Suggest revising this item to "The equipment should support the ability to display its status information to the flight crew (e.g., aligning/ready, valid/invalid position, estimated position accuracy, etc.)."

response	Partially accepted. The wording has been revised to address the concern expressed by the commentator.

comment	*354*	comment by: *AIRBUS*

PARAGRAPH / SECTION THE COMMENT IS RELATED TO:
Page 82 Appendix B

PROPOSED TEXT / COMMENT:

It is suggested to remove "in-air alignement capability" in item (2) (d) (i) of Appendix B as an in-air alignement capability cannot be a minimum requirement.

RATIONALE / REASON / JUSTIFICATION:

For clarification

response	Accepted. The text has been modified in line with the suggestion.

comment	*482*	comment by: *The Boeing Company*

Page: 82
Paragraph: Appendix B — INS/IRU standard performance and functionality

THE PROPOSED TEXT STATES:
(c) The alignment, updating, and navigation computer functions of the system must not be invalidated by normal aircraft power interruptions and transients.
(d) The equipment should provide or support the following functions and displays:
(i) valid ground and in-air alignment capability at all latitudes appropriate for the intended use of the installation;
(ii) a display of alignment status;
(iii) the present position of the aeroplane in suitable coordinates.
(e) The circular error of the equipment should be lower than or equal to 2 nautical miles per flight hour on a 95-per-cent basis.

REQUESTED CHANGE:
(c) The alignment, updating, and navigation computer functions of the system must not be invalidated by aircraft power transients.
(d) The equipment should provide or support the following functions and displays:
(i) valid ground alignment capability at all latitudes appropriate for the intended use of the installation;
(ii) a display of alignment status;
(iii) the present position of the aeroplane in suitable coordinates.
(e) The circular error of the equipment should be lower than or equal to an initial drift rate of 8 nautical miles per flight hour for the first 30 minutes of free inertial operation on a 95-per-cent basis.

JUSTIFICATION:
(c) What is a normal power interruption? It isn't defined and it could be interpreted as normal aircraft shutdown. The requirement is for the system to work through transients.
(d) (i) In-air alignments should not be a minimum requirement.
(e) 2 nm per hour is an average over many hours. Instantaneous rates may exceed this if observed over a shorter period. This 2 nm per hour pretty much translates to a requirement for a Ring Laser Gyro (RLG) systems. In a PBN environment the instantaneous performance of the system should meet the requirements. 2nm per hour is neither necessary nor sufficient. The more important point is that the modeling of the accuracy degradation with time (i.e. drift rates etc) should be appropriate such that the achieved performance can be determined to meet the PBN requirements. The recommended change harmonizes the requirement with the ICAO PBN Manual.

response | Partially accepted.
With regard to bullet (c), the reference to interruptions has been replaced. The text now refers to 'normal aircraft power transients'.
The requirement for in-flight alignment has been removed in response to comment 354.
Bullet (e) is related to the text in Volume II, Part B, section 3.2.1.1 of the PBN Manual, which states that 'Based on evaluated IRU performance, the growth in position error after reverting to IRU can be expected to be less than 2 NM per 15 minutes' as a note for the NAVAID infrastructure. The requirement for the airborne equipment is consistent with this expectation.

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3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Appendix C — RF leg demonstration templates

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comment	*16*	comment by: *Luftfahrt-Bundesamt*

Initial Issue of CS-ACNS, Book 2, Page 92, Table 2	Track Angle Rate / True Airspeed should be in line with Regulation (EC) 1207/2011, Annex II, Part C

response	Noted. Not under the scope of this amendment.

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comment	*227*	comment by: *Garmin International*

Appendix C AppC-2.3 — Approaches:

FAA AC 20-138D Chg 2 Appendix 7 paragraph A7-2.3 includes four approaches. Consider whether to include the fourth RNP AR only approach. If included, make appropriate updates to AppC-2.3 item (1) and add new item (5).

response	Noted Approach 4 as shown in FAA AC 20-138D: This procedure is intended for RNP AR operations only. The procedure is unique and incorporates an RF leg beginning at the missed approach point. This configuration will require the aircraft to begin the missed approach and track the RF leg while climbing and accelerating. Two additional RF legs each with increasing radii follow the initial RF leg consecutively. At the AC publication date, this approach 4 was only intended for future RNP AR operations. This does not impact previous recognition of RF leg capability.

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comment	*313*	comment by: *Europe Air Sports*

Appendix C — RF leg demonstration templates
Various pages

Figures 2, 3, 4, 5, 6, 7: Unreadable on print-outs, better when presented on a computers' screen.

Proposal: Invert colours next time, the good old solution of figure 1.

response	Accepted. The figures have been revised in accordance with the suggestion.

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comment	*314*	comment by: *Europe Air Sports*

An agency of the European Union

Page 97
AppC-3.2 – Airborne test conditions

(7) "…for each aircraft gross weight configuration…": A bit open, this formula, we think.

Proposal: Promote reasonable steps.

Rationale: This will provide for results acceptable to the competent authorities.

response	Accepted Paragraph (7) has been modified as follows: (7) Perform steps (1) through (6) for each appropriate aircraft gross weight configuration and for each test procedure.

comment	*535* comment by: *EUROCONTROL*
	Appendix C - RF leg demonstration templates - Page 83 AppC-3.1 - Initial set-up - Page 96 The EUROCONTROL Agency makes one comment under the form of a question. The process contains a standard day and hot-day test point. However, most baro-VNAV procedures are limited by cold temperature. Why is there no cold-day test point?
response	Noted. For the purpose of performing these tests, the hot-day conditions are more sizing than the low temperature conditions.

3. Proposed amendments and rationale in detail — 3.1. Draft CSs, AMCs and GM — Amendments to CS-ACNS Book 1 and Book 2 (draft EASA decision) | Subpart C — Navigation (NAV) | SECTION 1 — PERFORMANCE-BASED NAVIGATION (PBN) | Subpart E — Others

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comment	*536* comment by: *EUROCONTROL*
	TAWS INSTALLATIONS TESTING GUIDANCE MATERIAL - Page 99 The EUROCONTROL Agency makes two comments, the former under the form of a question and the latter under that of a suggestion. Why is "GPWS" not changed to "TAWS" throughout the entire section? In both instances in (c) "GBAS" should be changed to "GLS" in line with ICAO use of the terms (GLS may need to be defined as "GBAS Landing System").
response	Not accepted. The reference is to a part that is out of scope of this amendment.

Appendix A - Attachments

[PDF] ad_airbus_helicopters_.pdf

Attachment #1 to comment #537