European Aviation Safety Agency
Rulemaking Directorate

EXPLANATORY NOTE

AMC-20 Amendment 5

Executive Director Decision 2009/019/R amends Executive Director Decision No. 2003/12/RM of 05 November 2003 on general acceptable means of compliance for airworthiness of products, parts and appliances (« AMC-20 »).

This Amendment 5 of AMC-20 incorporates the output from the following EASA rulemaking task:

Rulemaking Task No.	TITLE	NPA No.
20.003	Airworthiness and Operational Approval for on board equipment related to Required Navigation Performance/Area Navigation (RNP/RNAV) Approach Operations	2008-14

This NPA has been subject to consultation in accordance with Article 52 of the Basic Regulation[1] and Article 5(3) and 6 of the rulemaking procedure established by the Management Board[2]. The Agency has addressed and responded to the comments received on the NPA. The responses are contained in a Comment-Response Document (CRD) which has been produced for the NPA and which is available on the Agency's website.

Detailed changes incorporated in the NPA are summarised in the following pages for ease of reference.

[1] Regulation (EC) No 216/2008 of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.03.2008, p. 1).

[2] Management Board Decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material ("Rulemaking Procedure"), EASA MB 08-2007, 13.06.2007.

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TITLE: AMC-20 Amendment 5

Rulemaking Task No.:	20.003
Title:	Airworthiness and Operational Approval for on board equipment related to Required Navigation Performance/Area Navigation (RNP/RNAV) Approach Operations
NPA No.:	NPA 2008-14
CRD No.:	CRD 2008-14

LIST OF PARAGRAPHS AFFECTED

- Cover + Contents
- New AMC 20-26 added
- New AMC 20-27 added

In response to CRD 2008-14, the Agency received several reactions, which are reproduced below together with the Agency's responses:

Commentor/ Reference	Reaction	EASA Response
AOPA-Sweden general reactions	AOPA-Sweden suggests for clarification purpose that EASA should withdraw this NPA and move the airworthiness parts to Part 21, and the operational rules to NPA2009-2. The cause for that is to simplify the ruling, so you don't need to look in different documents	Not Accepted. RNP approach operations are not required by operational or airworthiness rules. Therefore the Agency considers the use of AMC to be the appropriate material in which to promulgate the standards for approval. These AMCs also have the advantage of grouping both the applicable operational and airworthiness aspect together in one document.
Airbus general reactions	This reaction refers to CRD Appendix B: AMC 20-26, Airworthiness Approval and Operational Criteria for RNP Authorisation Required (RNP AR) Operations, paragraph 6.1.3 (page 15 of Appendix B, page 169 of the CRD file) The following sentence has been added to the end of paragraph 6.1.3, RNP System Performance: "For all the above conditions the vertical excursion should not exceed 75 feet below the desired path." This sentence differs from the proposal in the NPA, and Airbus has not found any comment in the CRD that would justify this change. Airbus concern is related to use of "vertical excursion" wording and associated demonstration which would include extremely remote failures. The last sentence in AMC 20-26 § 6.1.3 " RNP System Performance" should be rewritten as follows:	Partially Accepted. This condition was introduced when reviewing the comments received, as it was noted that, as originally written, the 75ft vertical excursion requirement was only applicable to paragraph a). The paragraph was amended to include all conditions. The Agency accepts that the 75ft vertical excursion should not be applicable to extremely remote failure conditions. Under these conditions it should be demonstrated that the aircraft can be safely extracted from the procedure as described in Appendix 4. The Agency considers that the 75ft vertical excursion limit is applicable to the remote failure condition (probability between 10^{-5} and 10^{-7}), as it is assumed that the procedure will initially be continued.

	*"For **the probable failures and engine failures**, the **vertical cross-track deviation (vertical FTE)** should not exceed 75 feet below the desired path."* This wording would be consistent with all other Advisory Materials related to RNP AR, e.g. ICAO Doc 9613 PBN Manual, FAA AC 90-101, as shown below: <u>ICAO Doc 9613 PBN Manual Third Edition - 2008, paragraph 6.3.3.3.1.2 "Demonstration of path steering performance- Flight Technical Error":</u> *"a) Acceptable criteria to be used for assessing probable failures and engine failure during the aircraft qualification will demonstrate that the aircraft trajectory is maintained witihn a 1xRNP corridor and 22 m (75 ft) vertical.* <u>FAA AC 90-101 - Appendix 4 " Track Deviation Monitoring":</u> *"The cross-track deviation limit must not exceed 75 feet vertically'*	In reviewing this reaction the Agency has noticed an inconsistency in the wording of Appendix 4, paragraph 4.c)(2) in relation to the requirements of § 6.1.3. The current wording refers to improbable cases. This appendix was based on the PBN manual, where the FAA definitions have been used, which define 'improbable' as having a probability between 10^{-5} and 10^{-9}. The Agency, on the other hand, differentiates between 'Remote' failures (10^{-5} to 10^{-7}) and 'Extremely Remote' failures (10^{-7} to 10^{-9}). Appendix 4 has therefore been revised to better reflect the cases identified in § 6.1.3 (probable, OEI, remote and extremely remote).
Boeing general reactions	<u>BOEING COMMENT TO</u>: AMC 20-26 (as revised) Appendix 6, **AMC 20-26/PBN Manual/AC 90-101 Comparison Table** Pages 58 - 62 <u>COMMENTS/JUSTIFICATION</u>: A number of the listed items in the table need to be updated based upon the revised criteria in the AMC: 1. 1. **<u>Item 7.1, 1</u>**: The three items for RNP < 0.3 and Navigation Display Alternative are unique to the AMC and do not have a comparable requirement or guidance in the FAA AC. Remove the FAA AC reference. Add "Unique to AMC" in the comment	Accepted The text has been amended accordingly.

	column. 2. 2. **Item 7.1, 21 – Main Track and Leg Transitions:** In the Comments column, this should be identified as *"less stringent than the AC."* 3. 3. **Item 7.1, 34 – Navigation Database:** Remove the reference to AC App 2, 3.f(3) 4. 4. **Item 8.1.1 -- Existing Installations**: This item should be numbered *8.1.2, Existing Installations* 5. 5. **Item 8.8** -- **Manufacturer Operational Support Documentation:** Delete this line item. **JUSTIFICATION:** Changes made as a result of comments to the NPA did not get inserted into this section. 1. 1. The changes to the AMC have resulted in requirements and alternatives that are not contained in the FAA AC. 2. 2. The AMC requirements do not require the FA leg type as required by the FAA AC. 3. 3. Database validity is covered in Item 7.1, 20. 4. 4. The current reference is incorrect. 5. 5. There is no 8.8 in the AMC.	
IFATCA general reactions	In General IFATCA supports the implementation of the proposed RNP approaches as they promote aviation safety providing improved guidance to runway ends that are not fitted with a Precision Approach such as ILS. The documents, whilst having an interface with ATC, are not of direct impact to controllers as they don't contain specific operating instructions for ATCOs.	Noted. The Agency thanks you for your support with this NPA. As mentioned, these AMC do not directly impact on ATC controls as they are primarily addressing aircraft airworthiness and operational requirements. As the Agency 2nd extension was recently agreed by the parliament and council, the Agency has initiated a

	Overall, the focus of these papers is on the technical aspects of the operation from an aircraft perspective. Some of the interesting ATC interactions are not covered. For instance, how is a controller made aware through flight planning that an aircraft is capable of an RNP APCH? The ATC operating procedures for RNP APCHs are not really touched upon by the document, which simply refers out to State AIPs. IFATCA would like to know how EASA will address these ATC operating procedures for RNP Approaches? IFATCA notes that APV SBAS procedures are not covered in these AMCs, so we would be interested to know when EASA will be publishing an AMC to cover SBAS operations.	continuous rulemaking programme during which the rules applicable to ANSP will be addressed. This programme is a long-term commitment, and the specific rules or AMC applicable to ANSP providing RNP Approaches are not planned to be addressed in the short term. In order to ensure the approval and equipage status of aircraft are correctly communicated to ANSP's, ICAO state letter AN 13/2.1-09/9 has introduced an amendment to Doc 4444 that increased the amount of information to be supplied in the flight plan from November 2012. In the new flight plan item 18 will be used to indicate the RNP approval status of the aircraft. With respect to SBAS operations, the Agency has published NPA 2009-04 with respect to airworthiness approval and operational criteria for approach operations to LPS minima using SBAS.
2012IFATCA AMC 20-26 para 10	Existing Text: These proposed AMC are not fully harmonised with the requirements has specified in the ICAO document 9613 Performance Based Navigation Manual nor with that of the FAA. A number of the RNP system performance requirements and functionality as described in the proposed AMC 2026 paragraphs 6.13, 7.1 and 7.2 are more stringent than those defined in both FAA AC90101 and ICAO doc 9613. Comment: "More stringent" requirements can create discontinuities. IFATCA is concerned as to how	Not Accepted. The Agency appreciates IFATCA comments regarding the provision of the rationale for items that are not fully harmonised. As the AMCs provide an acceptable means of compliance for an applicant wishing to conduct RNP APCH or RNP AR APCH operations, the Agency considers that this document is not the correct location for such rationale. Within AMC 20-26 the differences were highlighted as an aid to applicants that have previously optioned an approval within the FAA system and who now wish to comply with the Agency's standards.

	discontinuities within global ATM can be minimised. <u>Justification</u> While it is ready accepted that States can require more than ICAO requires, IFATCA is wondering what process is in place that keeps track of additional requirements to ICAO It is assumed that if it is more stringent then there is a reason – and if there is a reason then this should be clearly stated and kept track of – and if the reason and rationale is strong enough then if may be sufficient for ICAO to "update" its requirements so that in the end the (European) system is harmonized with ICAO <u>Suggestion:</u> "Not fully harmonized" items should not only be listed (as in Appendix 6) but should also explicitly state the difference with a rationale for the difference. This is to permit review to minimize differences (that is differences only when needed) and assist in global harmonization of ATM.(that is acceptance of rationale and need for "extra" requirements in global requirements).	
IFATCA AMC 20-27 para 5.1	IFATCA notes that AMC 20-27, which covers APV Baro-VNAV operations, stipulates that GNSS is the primary navigation sensor to be used. However, it is known that a successful trial of APV Baro-VNAV procedures has been conducted at London Gatwick using British Airways B737-400 which used DME/DME for their navigation capability. Even without GNSS these aircraft were still able to adhere to the 0.3 navigation accuracy required.	Not Accepted. The standards for this AMC are derived from the Performance Based Navigation Manual (ICAO Doc 9613), in which it states that multi-sensor systems may use other sensor combinations such as DME/DME or DME/DME/IRU that provide the navigation performance acceptable for RNP APCH. However, such cases are limited due to the increased complexity in the infrastructure requirements and assessment, and

	Consideration be given to permitting the use of DME/DME, as a suitable navigation sensor for such approach procedures where the DME infrastructure has been assessed as being suitable to permit operations within the defined navigation accuracy.	are considered not to be practical or cost-effective for widespread application. Therefore GNSS is to be considered as the primary navigation systems for RNP APCH.
KLM general reactions	The two very last pages are appendix 5 to AMC20-27 but in the top right hand corner it says appendix 4. This has to be adjusted.	Accepted. Text amended.
Swedish Transport Agency, Civil Aviation Department (Transportstyrelsen, Luftfarts-avdelningen) general reactions	NPA 2008-14 page 72 **6.2.2 Altimeter sensor requirement for APV BARO-VNAV operation** Relevant text: "In addition to requirements of paragraph 6.2.1 above, the RNAV equipment that automatically determines aircraft position in the vertical plane should use inputs from equipment that can include: a) . . . . b) . . . . c) . . . . d) . . . ." Comment: The text in the NPA is unclear whether one or more of the alternatives in a) to d) should be included. Proposal: The text should be changed to read: "should use inputs from equipment that can include: a) . . . ***.; or*** b) . . . ***.; or***" c) . . . ***.; or*** d)	Accepted. Text amended.

UK CAA general reactions	Please see the attached letter from the CAA which confirms we have no comments on the CRD to NPA 2008/14.	Noted. The Agency thanks you for your support.
KLM the response to comment #113 by Boeing on segment "B. Draft Decision - AMC 20-27: 5. Assumptions	Note that DMEDME use has been deleted from PANS-OPS. This is a major step backwards. It hampers the basic RNP philosophy of multi sensor capabilities.	Noted. The infrastructure requirements and assessment are considered not to be practical or cost-effective for widespread application of DME/DME RNP approach operations. Therefore, as per the ICAO PBN manual, for RNP approach operations GNSS is to be considered as the primary navigation systems.
KLM the response to comment #356 by Lauri LAINE on segment "B. Draft Decision - AMC 20-27: 5. Assumptions"	RNP APCH does apply secondary areas, based on the probabilistic approach (independent vertical and lateral error). Only RNP AR does not.	Noted. The Agency thanks you for your comment. This is one of the principle differences between the procedure designs.
KLM the response to comment #323 by FAA on segment "B. Draft Decision - AMC 20-27: 6. RNP APCH Airworthiness Criteria - 6.3 Accuracy"	**HCE value** FAA uses a conservatively estimated value of 100 m. AC proposes (arbitrary) value of 0.2 NM (370 m). The FAA value is conservative and the AMC is additionally conservative without proper justification. This creates a difference with FAA and ICAO that is not acceptable. When there is a reason to deviate this should be coordinated by EASA with FAA and ICAO but not change the figures without a valid argument. Therefore this shall be changed to 100 m **F/D, A/P** FAA give credit for F/D, A/P use. AMC does not without justification for not doing so. This is an important benefit and this credit shall be taken into account in this AMC as well. **3SD value use**	HCE Values Accepted. The value of the HCE has been amended to 24ft to be consistent with the assumed horizontal NSE. As a result, the values quoted in paragraph 6.3.2 e) have been amended accordingly. F/D A/P Not accepted. These FTE values permit manual flight if a Vertical Deviation Indicator with a sufficient full scale deflection is installed. This does not prevent the use of autopilot or flight director which would lead to a lower FTE. Where approach procedures require a lower FTE, they will be subject to RNP APCH AR approval requirements.

	IFPP is working on a redesign of the vertical margin and will be based on a VEB philosophy	3SD value use Noted Once the redesigned vertical margins have been established, they will be reviewed and any amendments to the AMC will be initiated in accordance with the Agency's rulemaking procedures.
KLM the response to comment #22 by KLM on segment "B. Draft Decision - AMC 20-27: 6. RNP APCH Airworthiness Criteria - 6.3 Accuracy"	Reply misses the point. Of course the F/D or A/P can be used. However, no credit is given for this use. The FTE shall be lowered to 100 ft 3SD, this would lower the error budget hence the OCH, hence the RVR/CMV. The FTE in table 6.3.2 e shall be replaced by 100 ft instead of 150 and that will lower the Vertical TSE based on the RSS of the variables (which can be used as the VEB for design) between 20 and 50 ft. In the new EU OPS RVR/CMV this will lower the RVR/CMV between 100 and 300 m. There is no reason to maintain 150ft now in the table and therefore replace it. The note below the table talks about an additional buffer for abnormal operations, but PANS-OPS is based on Normal operations. The 322 ft out of PANS-OPS is based on an add on of the variables (not RSS), which is already conservative. Putting more conservatism to it in this AMC is not justified and will only create a difference with ICAO. The level playing field is influenced negatively to EU carriers and unacceptable. With these figures now placing buffer upon buffer	Partially Accepted. An FTE of 150ft will allow the OCH that is currently applied to the used ones without imposing compliance with a strict airworthiness requirement. The Agency agrees that lowering the FTE could result in a reduction in the OCH that could be applied during the procedure design; however, any reduction in this requirement will be subject to RNP APCH AR approval requirements. The Agency notes that the paragraph below the table is misleading in the information supplied. Additional buffers are not applied to the aircraft requirements but are applied by the procedural design criteria. The text of this paragraph has been deleted and replaced by a series of notes. The Agency is aware that ICAO is reviewing the VEB for BARO-VNAV. Once the redesigned vertical margins have been established, they will be reviewed and any amendments to the AMC will be initiated in accordance with the Agency's rulemaking procedures. In reviewing this reaction, the Agency noted that the wording of Note 2 to paragraph 6.3.2 d) had been changed incorrectly following the NPA consultation.

	negates the benefits of the systems. IFPP is working on an update of the final approach vertical protection. Application of A/P, F/D may even lead to much lower OCH, if a controlling obstacle can be ignored in case of using A/P, F/D. In such case this must be noted on the approach chart just like the case of ILS CAT II/ III. See also FAA comments on pages 122 It is unacceptable that EASA puts higher figures and more conservatism in this AMC, it creates differences with ICAO and puts a disadvantage on European carriers compared to the rest of the world complying with ICAO.	Approach procedure design requirements are design with the assumption the aircraft comply with a 3 sigma FTE and that flight crew procedures are established to bound deviations from the desired path. The note has therefore been deleted. Flight crew procedure requirements are defined in Appendix 4.
KLM the response to comment #118 by Boeing on segment "B. Draft Decision - AMC 20-27: 6. RNP APCH Airworthiness Criteria - 6.5 Continuity of Function	The use of the RNP/ANP capability shall not be restricted to RNP AR approved operators only. Any RNP capable system should be allowed to be used for monitoring the RNP of the final approach. RNP AR is a very special case and not many operators will have this special approval, thus hampering all the other capable acft from using the capability for on board monitoring the final approach. The restriction has to be removed in order to acknowledge the capabilities of these systems instead of slowing down the progress that can be made when using this capability. Therefore re-word the note to read: NOTE 7: For aircraft and systems approved for RNP APCH or RNP AR operations, the crew alerting based upon RNP is an acceptable means for monitoring.	Not Accepted. As AMC 20-27 is for RNP APCH operations, the proposed wording for Note 7 is not applicable. However, the Agency recognises the usefulness of RNP alerts and in accordance with paragraph 7.1 item 18 permits their use as an Indication of the Loss Of Integrity (LOI) function provided the RNP alert reflects the loss of GNSS integrity.

KLM the response to comment #119 by Boeing on segment "B. Draft Decision - AMC 20-27: 7. Functional Criteria - 7.1 Required Function for RNP APCH"	The deleted text has to be re-worded to include credit for the use of F/D, A/P, see other comments on this issue. In the text clarification for the credit shall be given.	Not Accepted. Compliance with this AMC permits manual flight if a Vertical Deviation Indicator with a sufficient full scale deflection is installed. This does not prevent the use of autopilot or flight director which could lead to a lower FTE. Where approach procedures require a lower FTE approval, they will be subject to RNP APCH AR approval requirements.
KLM the response to comment #25 by KLM on segment "B. Draft Decision - AMC 20-27: 10. RNP APCH Operational Criteria	Rule is totally unacceptable and not workable for all operators. The requirements in 10.3 and appendix 2 have to be deleted from the AMC as totally unacceptable. The requirement goes beyond what is in the control and responsibility of an operator. Things are continuously changing and are not controlled by an operator. It is the State's responsibility to add safety margins when deemed necessary. The State has the responsibility to ensure a procedure designed as per PANS Ops and has all the information and means to judge how a procedure shall be designed.	Not Accepted. The Agency has reviewed this text and considers it to be acceptable and fully workable. This text iterates and reminds applicants of the requirements of Regulation (EC) 1899/2006 (EU-OPS).
KLM the response to comment #125 by Boeing on segment "B. Draft Decision - AMC 20-27: Appendix 2 - Operational Characteristics of the Procedure and its Operational Use"	The requirements in 10.3 and appendix are totally unacceptable and EASA can not judge on the burden this will cause to operators. The comments given here are justified and the proposed text is acceptable when the total requirement is not deleted from the AMC.	Not Accepted. The Agency has reviewed this text and considers it to be acceptable and fully workable. This text iterates and reminds applicants of the requirements of Regulation (EC) 1899/2006 (EU-OPS).

KLM the response to comment #27 by KLM on segment "B. Draft Decision - AMC 20-27: Appendix 4 - AFM Procedures"	The note is acceptable but should also be applicable for part F in the flightplanning phase and be rephrased to : RAIM is not required for flightplanning for multisensor equipped aircraft. This feature to monitor the RNP should make the RAIM check obsolete; what is the value of a check and that there is a period of outage, no flight will be cancelled because there is no satellite coverage while an aircraft remains capable to maintain the required accuracy which is monitored by the ANP. Backup by means of ultimately IRS/IRU still enables to stay within the required RNP and that is checked by means of the ANP. The whole RAIM prediction issue in the flightplanning phase triggers questions. what are you going to do with this RAIM prediction when equipped with a multi sensor system (or even RNP)? I don't think that that will work in a network system and we will not be the only one. It makes implementation of PBN not very popular.	Not Accepted. This requirement is only applicable to those GNSS systems that use RAIM for integrity monitoring. As RNP APCH is based on the assumption that GNSS is used as the primary navigation source, and if the loss of integrity is detected, the procedure must be discontinued. This requirement should therefore reduce the occurrences of discontinued approached due to the loss of GNSS integrity.
DSNA Draft Decision - AMC 20-27: Appendix 4 - AFM Procedures"	"Deviations above and below the vertical path must not exceed ±100 feet (It is recommended operating procedures align this figure with any other operating procedures that have a lower limit (e.g. RNP AR)). Pilots must execute a Missed Approach if the vertical deviation exceeds the criteria above, unless the pilot has in sight the visual references required to continue the approach." This requirement is no more consistent with PBN RNP APCH and PANS OPS which rely on a more	Accepted. The Agency recognises that the introduction of a ±100 ft deviation will impact safety with respect to ensuring obstacle clearance. This figure has therefore been adjusted to ±75 feet. This has the advantage of being identical to that required for RNP AR APCH and hence reducing the possibility of flight crew error for those operators that operate both RNP APCH and RNP AR APCH procedure. The use of ±75 feet has been shown to be compatible with PAN-OPS procedure

	stringent +100/-50 ft deviations control. The assessment of the additional 50 ft tolerance impacts safety impact, in allowing a -100ft control rather than a -50ft may now create difficulties to confirm that the PANS OPS surfaces are still protecting the users to the required safety levels.	design criteria. In reviewing this reaction, it was noted that the allowable VNAV equipment error quoted for 10000 ft-15000 ft in paragraph 6.3.2 b) was not in accordance with the PBN manual. As no reason is evident for this stricter value, it has been corrected to be in accordance with the PBN.