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AMC 20-28 Integrity & Continuity Concerns

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Statement of Issue

- Statement of issue:
  - The requirements for integrity and continuity in the published version of AMC 20-28 are more stringent than those in the NPA and are inconsistent with PBN and some FAA criteria.
  - There is a concern that dual systems will be required to operate approaches to LPV minima.

Statement of Issue

- EASA AMC 20-28:

6.4 Integrity

Presenting misleading lateral or vertical guidance is considered to be a hazardous failure condition.

Presenting misleading distance data is considered to be a major failure condition.

Note 1: Probability terms are defined in AMC 25.1309, FAA AC 23.1309-1( ), AC 27-1B or AC 29-2C.

Note 2: Where LPV approach capability is added to an aircraft having ILS capability, the integrity of the existing ILS display(s) or course deviation indicator(s) used for LPV approach operation are considered acceptable.

6.5 Continuity of function

Loss of the system that provides LPV approach capability is considered a major failure condition.

Statement of Issue

- PBN:

B.3.3.1.2 *Integrity*: Presenting misleading lateral guidance simultaneously with misleading vertical guidance and simultaneously with misleading distance data during an RNP APCH operation down to LP or LPV minima is considered to be a hazardous failure condition (extremely remote).

B.3.3.1.3 *Continuity*: Loss of approach capability is considered a minor failure condition if the operator can revert to a different navigation system and proceed to a suitable airport. For RNP APCH operation down to LP or LPV minima at least one system is required.

- FAA AC 20-138C (Integrity):

For LP/LPV and GNSS Category I approaches, presenting misleading information to the flight crew is considered to be a hazardous failure condition.

Statement of Issue

- FAA AC 20-138C (Continuity):

	Advisory Vertical Guidance	Enroute/ Terminal Area/ Nonprecision Approach (LNAV or RNP 0.3)	Nonprecision Approach with Vertical Guidance (LNAV/VNAV)	LP/LPV Approach	GNSS Precision Approach (Cat. I)
Loss of Navigation	No Effect	Major	Major	Major	Major
Misleading Information	Minor	Major	Major	Hazardous	Hazardous

Table 8. Typical Hazard Classifications

Note: For RNP values less than 0.3, losing RNP capability constitutes loss of navigation. Refer to appendix 2 for further RNP AR airworthiness information and AC 90-101 (latest revision) for complete guidance on RNP AR operations.

Note:

The FAA AC is somewhat ambiguous, as one needs to read the note on RNP < 0.3 to understand the context: Loss of Navigation means loss of all navigation.

Statement of Issue

- EASA Clarifications:
  - The publication of the AMC does not invalidate any previous airworthiness or operational approval.
  - Based on a technical assessment (details to follow), and the lack of any adverse comment from industry, the concerns raised do not appear to be an issue in the field.

Integrity

- EASA acknowledges that there is a difference between the wording in the PBN manual and the guidance in the AMC.
- EASA however considers the AMC to be fully in line with FAA AC 20-138C.
- Regulators make their own decisions with regards to safety and need not always follow ICAO guidance (ICAO sets the internationally agreed minimum standards).
- The amendment was made following a proposal by CAA-UK in their comments to the NPA.

Integrity

- PBN Manual and NPA state(d);
  - Presenting simultaneously, misleading lateral, vertical and distance data, during an LPV approach is considered to be a hazardous failure condition (extremely remote).
- AMC 20-28 states:
  - Presenting misleading lateral or vertical guidance is considered to be a hazardous failure condition.
  - Presenting misleading distance data is considered to be a major failure condition.

Integrity

- FAA AC 20-138C states:
  - For LP/LPV and GNSS Category I approaches, presenting misleading information to the flight crew is considered to be a hazardous failure condition.

Note that the FAA wording is in line with AMC 20-28 and could even be considered more stringent, as presenting erroneous distance would be considered hazardous as well.

Continuity

- With regards to continuity, EASA acknowledges the inconsistency between AMC 20-28, PBN and AC 20-138C.
- EASA did consider the worst case where no other means of navigation ('reversion') would be available for the navigation accuracy required – this may be subject of a reassessment.
- However, we believe that the consequences are very limited due to:
  - Application of FAA AC 23-1309-1E criteria.
  - Design characteristics of the equipment.
  - Consideration is not exclusively given to quantitative probabilities, qualitative assessments apply just as well.

Continuity

- Application of FAA AC 23-1309-1E probabilities:

A/C Class	NSE	Minor	Major	Hazardous	Catastrophic
Class I SRE < 6000 Lbs.	No prob.	$<10^{-3}$ Note 1	$<10^{-4}$ Notes 1 and 4	$<10^{-5}$ Note 4	$<10^{-6}$
Class II MRE, STE, MTE < 6000 Lbs.	No prob.	$<10^{-3}$ Note 1	$<10^{-5}$ Notes 1 and 4	$<10^{-6}$ Note 4	$<10^{-7}$
Class III SRE, MRE, STE, MTE > 6000 Lbs.	No prob.	$<10^{-3}$ Note 1	$<10^{-5}$ Notes 1 and 4	$<10^{-7}$ Note 4	$<10^{-8}$
Class IV Commuter	No prob.	$<10^{-3}$ Note 1	$<10^{-5}$ Notes 1 and 4	$<10^{-7}$ Note 4	$<10^{-9}$

Note 1: Numerical values indicate an order of probability range and are provided here as a reference.

Note 4. Secondary System (S) may not be required to meet probability goals. If installed, S should meet stated criteria.

Continuity

- Design Characteristics:
  - Integrity requirement of ‘Hazardous’ drives more robust designs.
  - Multi-purpose functionality requires more robust designs (e.g. NAV+COM+TAWS in single unit).
  - Commercial interests drive more robust designs (Multi-Class / Equipment sales / MTBF).
  - Liability concerns drive more robust designs (conservatism).

Continuity

- Examples:

  The following are anonymised examples from various industry sources

  - Example 1 (Installation Manual): "Class I: Single GPS Radio, Class II, III & IV: Dual GPS Radios"
  - Example 2 (Declaration of Design and Performance): "Loss of Function: 3.10^{-7}."
  - Example 3 (Failure Hazard Assessment): "Annunciated loss of vertical WAAS precision approach guidance during precision final approach: FHA Major Hazardous Event".
  - Example 4 (Qualification Program): "Major failure condition for loss of function of approach localizer performance without vertical guidance (LP), and approach localizer performance with vertical guidance (LPV) navigation data"
  - Example 5 (Aircraft Level Certification Plan): "Loss of guidance during an LP or LPV approach is a Major hazard".

Conclusions

- DGAC/DSNA/CAA-UK/GSA/EC:
  - Today we can fly ILS cat I with a single system
  - Today we can fly LNAV/VNAV with a single system
  - Today we can fly LPV in the US with a single system
  - AMC 20-28 will require two systems both at MEL and dispatch.
    - This will create issues and loss of safety benefits for general aviation (due to increased cost/complexity), and lesser interest for other communities (due to dispatch conditions)
- EASA:
  - These conclusions are based on a misconception that a 'Hazardous' or 'Major' failure condition would automatically require the installation of dual systems.
  - The comments disregard the fact that industry has been designing their systems more conservatively than the AMC even requires.

Conclusions

- DGAC/DSNA/CAA-UK/GSA/EC:
  - What can be done to restore consistency of AMC 20-28 requirements with other equivalent systems and other regions?
- EASA:
  - In absence of any adverse comment or reported issue from industry, we do not see a need for immediate change.
  - EASA will reassess the continuity requirements when the contents of the AMC will be transferred into the new CS-ACNS (CS – Airborne Communication, Navigation & Surveillance - Expected NPA ~2014).

Thank you.