

Equivalent Safety Finding on CS 25.1303(a)(3) : Flight and navigation instruments

Applicable to Large Aeroplane

Introductory Note:

The hereby presented Equivalent Safety Finding has been classified as an important Equivalent Safety Finding and as such shall be subject to public consultation, in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) of which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

Statement of Issue:

The CS 25.1303(a)(3) requirement is literally mentioning the need of a non-stabilised magnetic compass visible from each pilot station.

The CS 25.1327 and CS 25.1547 requirements are also relevant to the same instrument.

While removing such an instrument, it is then needed to get the functionality achieved by the instrument replacing the non-stabilised magnetic compass, being able to comply with the same requirements.

For the designs implementing a direction indicator, not being a non-stabilised magnetic compass, the applicant will be required to demonstrate that the instrument installed in lieu of the non-stabilised magnetic compass (for instance an electronic standby direction indicator) provides an equivalent level of safety.

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EASA Proposal:

To meet the intent of the applicable requirements (CS 25.1303(a)(3) ; CS 25.1327 and CS 25.1547), the following compensating factors are proposed :

- 1) Independency from the primary and standby system (source and display of heading information) should be established in all foreseeable operating conditions. In normal conditions, each PFD uses the on side source for heading, and other sources may be used both as a backup to the PFD sources and to the electronic standby direction indicator. Hence, required independency may be compromised in the event that the same heading source is selected for the electronic standby direction indicator and on one PFD;

- 2) The applicant to provide assessment that the reliability of the electronic standby direction indicator is commensurate with the identified hazard level.
- 3) Additional availability assessments should be provided;
 - a) Direction indication should be available immediately following the loss of the primary dedicated navigation (heading data) source without additional crewmember action, and after any single failure or combination of failures. The alternative magnetic heading source must provide availability at least equivalent to the availability level offered by a traditional non-stabilized magnetic direction indicator.
 - b) Direction indication should not be adversely affected following a power interruption.
 - c) Operation during and after exposure to HIRF environment should be established.
 - d) Operation after exposure to indirect effect of lightning should be established.

EASA Safety Equivalency Demonstration:

CS 25.1303(a)(3) states that

The following flight and navigation instruments must be installed so that the instrument is visible from each pilot station:

(...)

(3) A direction indicator (non-stabilised magnetic compass).

This requirement is inherited from the design of past aircraft generations and from the regulation in place at that time. Indeed, at that time, Avionics were split in different mechanical instruments, each of them performing a single function. Nevertheless, the regulator intention was to request the display of an independent heading source which would not be affected by the failures of the main heading instruments or by the cause of these failures. This is recognized by AMC 25-11 Chapter 4 section 21 e. (10) 4 which is reproduced hereafter:

4 Heading. *The following table lists examples of safety objectives for heading related failure conditions.*

(aa) The standby heading may be provided by an independent integrated standby or the magnetic direction indicator.

(bb) The safety objectives listed below can be alleviated if it can be demonstrated that track information is available and correct.

Table 6
Example Safety Objectives for
Heading Failure Conditions

Failure Condition	Safety Objective
Loss of stabilised heading in the flight deck	Remote(2)
Loss of all heading displays in the flight deck	Extremely Improbable
Display of misleading heading information on both pilots' primary displays	Remote - Extremely Remote (1,2)
Display of misleading heading information on one primary display combined with a standby failure (loss of heading or incorrect heading)	Remote – Extremely Remote (1,2)

Notes

(1) System architecture and functional integration should be considered in determining the classification within this range. This failure may result in a sufficiently large reduction in safety margins to warrant a hazardous classification.

(2) This assumes the availability of an independent, nonstabilised heading required by CS 25.1303 (a)(3).

An equivalent safety to the original requirement is therefore achieved by the applicant demonstrating that

- the standby heading indication is independent from the main display indication (item 1), meeting the single failure requirement of 25.1309(b)(1)(ii) and the independence requirement of 25.1333 (a)
- the standby heading indication availability (item 2) is enough to meet the higher level objective for the loss of all heading indications in the cockpit assessed as being extremely improbable,
- no common external cause could affect simultaneously the standby and main heading display (item 3), such as power supply, HIRF or lightning.