

Proposed Equivalent Safety Finding on CS 23.1303 (c) at Amendment 3

Flight Deck without Whisky Compass - Applicable to Pilatus PC-24

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.), 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 PC-24 is a Part 23 commuter Jet with capacity for 10 or more passengers, capable of IFR operations and having a highly integrated glass avionic suite. Per CS 23.1303 (c) Amdt 3, the aircraft should be equipped with

...(c) a non-stabilized magnetic direction indicator

interpreted as being a "whisky compass".

FAR 23.1303(c) Amendment 23-62 removed this prescriptive requirement and offers the potential to remove completely Mechanical Magnetic Compass and replace them with electronic magnetometers. CS 23.1311(a)(5) require an "independent magnetic direction indicator" as backup for electronic displays (PFDs, MFDs).

"Whiskey" compass had the advantage to be the last independent defence barrier, because they are not connected to any electrical system except for very low power night lighting. Their disadvantages are their sensitivity to electromagnetic fields (i.e. generated by windshield heaters, radio transmissions), their sensitivity to accelerations or their limited accuracy.

Traditionally, a non-stabilized compass used for direction indication requires no electrical power. The use of an electric-only direction indicator places a premium on availability of electrical power. So whiskey compass are not subject to the same failure modes.

The design architecture of the PC-24 is such that compliance to 23.1303 (c) is literally not directly met as a traditional mechanical magnetic compass (whisky compass) is not installed. However, the standby function is taken over by the ESIS L3 ESI-1000 interfaced with an L3 MAG-3100 magnetometer.

Therefore, an Equivalent Level of Safety is necessary against the CS 23.1303(c) Amdt 3 and an equivalent level of safety will be shown by design.

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The PC-24 design is not installing a traditional Mechanical Magnetic Compass. The standby function is taken over by the ESIS L3 ESI-1000 interfaced with an L3 MAG-3100 magnetometer.

- Pilatus agrees to meet the accuracy requirements of AC23.1311-1C for Magnetic Heading; (Section 8.8.3), Magnetic Gyroscopically Stabilized Direction Indicator.

- Pilatus agrees that the ESIS display of heading meets the reliability requirements for its intended function (10-E-5).
- However Pilatus does not intend to show any power independence for the ESIS display therefore the magnetic direction indicator. CS 23-1311(a)(5) states:
“[...] an independent magnetic direction indicator and an independent secondary mechanical altimeter, airspeed indicator, magnetic direction indicator, and attitude instrument, or individual electronic display indicators for the altimeter, airspeed, and attitude that are independent from the airplane’s primary electrical power system.”

It does not implicitly state that the independent magnetic direction indicator must have power independency.”

Additionally AC 23.1311-1C provides for the following Means of Compliance for electrical power; Section 8.7 Display of Altitude, Airspeed, and Magnetic Compass Information:

“Section 23.1311(a)(5), as amended by Amendment 23-62, requires an independent magnetic direction indicator and either an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument or electronic display parameters for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system. Primary altitude or airspeed displays that require electrical power are acceptable if means are provided for their continued operation upon loss of the airplane’s primary electrical power, or if pneumatically driven instruments are available for the pilot’s use. A standby or reversionary integrated display of altitude, attitude, and airspeed, instead of individual electronic display indicators for airspeed altitude and attitude, is acceptable under one condition. The condition is that the standby or reversionary integrated display and the primary display are powered such that at least one integrated display with attitude, altitude, and airspeed is available after failure of any power source or distribution path.”

PC-24 CSFL architecture continues to use the primary display of information after loss of the aircraft primary electrical system. Pilatus’ position is to use the display of primary display of Magnetic Direction provided in the architecture for that emergency condition (Pilot PFD and IRS).

In conclusion, Pilatus will use the Means of Compliance in AC23.1311-1C as highlighted above for removal of the mechanical magnetic compass. Therefore, an Equivalent Level of Safety against the CS 23.1303(c) Amdt 3 is achieved.

The direction indicator is part of the primary flight indications in this PC-24 integration. In consideration of the “all-in-one” provision of the primary flight indications across the flight deck, getting now a certain agility between the ESIS and the PFDs, EASA can accept the equivalence safety proposal from Pilatus given that ESIS loss is an extremely rare occurrence (10^{-8}).

Besides that, equivalent conditions has been EASA accepted through FAA ELOS ACE 09-07.