

## Proposed Equivalent Safety Finding on CS 23.1311(a)(7) and 23.1545(b)(4) at Amendment 3

### ASI Flaps Marking on PFD - 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 Airspeed indicator as described in the previous section does not comply with requirements CS 23.1311(a)(7) and 23.1545 (b)(4), which states the following:

#### 23.1311 (a)(7) Airspeed indicator.

Incorporate visual display of instrument markings required by 23.1545 or visual display that alerts the pilot [..].

#### 23.1545 (b)(4) Airspeed indicator.

(b) The following markings must be made:

(3) For the normal operating range a green arc [..]

(4) For the flap operating range, a white arc with the lower limit at  $V_{S0}$  at the maximum weight, and the upper limit at the flaps extended speed  $V_{FE}$  established under 23.1511.

#### AC 23.1311-1C (17.11.2011 - aligned with FAR 23 Amdt 23-62).

§ 17.7.2 [..] incorporate the following awareness cues [..]:

- Red band from  $V_{S0}$  to 0
- Red band from  $V_{MO}$  to top of airspeed tape
- Green arc [..] is not required [..]
- Yellow band between  $V_{S0}$  to  $V_{S1}$  is optional [..]

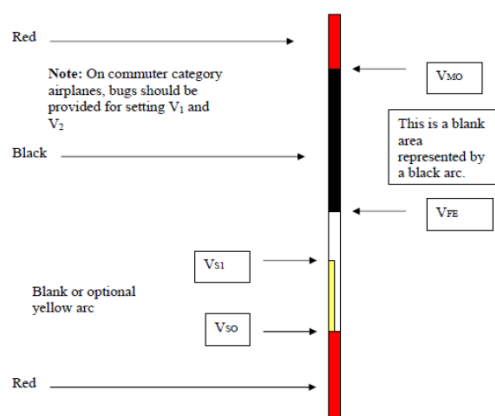


Figure 3. Low-Speed and High Speed Awareness for  $V_{MO}$  Airplanes

### Equivalent Safety Finding on CS 23.1311(a)(7) and 23.1545(b)(4) at Amendment 3

The Pilatus PC-24 aircraft is a commuter twin turbojet with capacity for 10 or more passengers, capable of IFR operations and having a highly integrated glass avionics suite and an electronic standby ESIS.

#### PFD

Primary flight information is indicated to the crew on the pilot's Primary Flight Display (PFD) and optionally the copilot's PFD. Airspeed is indicated to the crew by means of a moving vertical tape in combination with a rolling digit indicator on the left hand side of the ADI section of each pilot's PFD.

In accordance with guidance provided in FAA Advisory Circular AC 23.1311-1B, the APEX™ linear airspeed tape indicator includes airspeed awareness cues that are equivalent or superior to the cues provided by traditional round dial type indicators. These awareness cues include:

- Altitude dependent VMO/MMO airspeed limitation indication (barber pole bar).
- Aircraft configuration related airspeed constraints (red bar and speed bugs).
- Airspeed trend vector, indicating predicted airspeed with 6 seconds look ahead (white bar).
- Approach speed reference dynamic cue =  $f(\text{Mass, Accel.})$  - (green chevron  $\sim 1.3 \text{ VS}_0 / \text{S}_1$ )
- Aircraft configuration dependent low-speed awareness indication (red bar).

In addition to these awareness cues, the system also includes the following "attention getters" to alert the crew of imminent or actual alert conditions:

- "STALL" and "OVERSPEED" annunciations displayed on the ADI section of the PFD to alert the pilot of an imminent stall or speed exceedance condition.
- Color changes or emphasis of display elements (e.g. color change of digital airspeed readout).

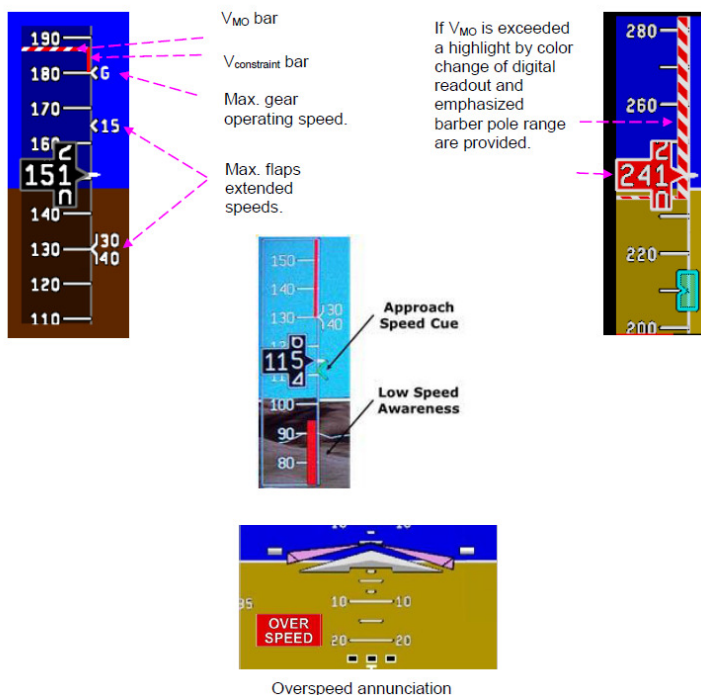
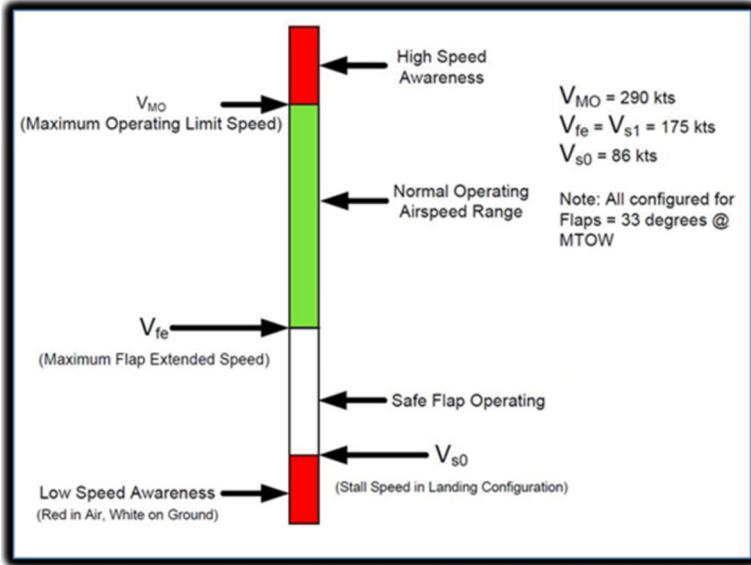


Figure 1 – Examples of airspeed awareness cues on the Apex system.

**ESIS**

The ESIS design incorporates all of the required airspeed marking and by enabling the red low speed awareness bar ( $V_{s0}=86\text{Kts}$  @ MTOM 1g Landing Flap) and the max flap extension speed ( $V_{fe}=175\text{Kts}$ ). The diagram below reflects the final ESIS configuration.



In conclusion, Pilatus & EASA believes that the design as summarized above is providing an acceptable equivalent level of safety to what is required by CS 23.1545 (b)(4) for the following reasons:

- The design provides awareness to the crew of the airspeed range (relative to the present airspeed) within which the flaps can be safely extended beyond the 0° setting.
- The implementation of the airspeed indicator follows the guidance provided in AC 23.1311-1B and provides airspeed awareness cues that are equivalent or superior to the traditional round dial type indicator.
- The airspeed indicator markings required by the rule are written with a round-dial type indicator in mind. Applying these markings to linear tape style airspeed indicators may under some circumstances lead to conflicts with other symbols. On the Apex™ system, such a conflict would exist between the Flaps operating range marking required by 14 CFR, Part 23, § 23.1545 (b)(4) and the airspeed trend vector, both of which have the appearance of a white bar alongside the airspeed tape.
- The Apex™ system displays speed constraints associated with flap and gear status configuration.

In addition, the following aircraft configuration dependent speed constraint symbols are displayed on the airspeed tape:

Condition	Speed constraint symbols
Landing gear in transit (extending or retracting).	Red speed constraint bar from $V_{MO}$ down to the landing gear operation speed bug.
Flaps extended position $nn^\circ$ .	Red speed constraint bar from $V_{MO}$ down to the flap extended position speed bug (xxx KCAS).

If the current airspeed exceeds a speed limit (as marked by the red speed constraint bar or the  $V_{MO}$  barber pole), the Primus Apex™ system will alert the crew by changing the color of the digital airspeed readout.

Finally, Pilatus has demonstrated through the Human Factors ground and flight test evaluations planned in the program that this design is effectively equivalent in safety, where the awareness of speed, speed dynamic behaviour in relation to the setting of the Flaps is ensured for all phase of flight under adverse flight conditions.