Deviation request #63 for an ETSO approval for CS-ETSO applicable to Airborne Multipurpose Electronic Displays (ETSO-113) complemented by SAE ARP4256A for Liquid Crystal Displays for Part 25 (Transport) Aircraft Consultation Paper

1. Introductory note

The hereby presented deviation request shall be subject to public consultation, in accordance with EASA Management Board Decision No 7-2004[1] products certification procedure dated 30 March 2004, 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."

2. ETSO-C113#3 – Airborne Multipurpose Electronic Displays

Deviate from ETSO-C113 §3.1.1 which references SAE AS8034 (Airborne Multipurpose Electronic Displays) to adapt some assessment means of referenced requirements in SAE ARP4256A for Liquid Crystal Displays for Part 25 (Transport) Aircraft.

Requirement:
Deviate from SAE ARP4256A §4.2.3.2 for the assessment of High Ambient Contrast Ratio.

Industry:
Human factors tests in the flight simulator have been used instead of SAE ARP4256A §4.2.3.2 criteria in order to assess High Ambient Contrast and other specific requirements for the installation. These human factor tests concluded that the contrast in high ambient conditions was satisfactory. These tests assessed horizontal and vertical viewing angles as well as onside- and cross-cockpit readability for the display. Additionally, the human factors tests also concluded that there were no reflections or distracting glare.

EASA:
SAE ARP4256A measures the luminance ratio of black and white in order to evaluate contrast. However, such a measure does not consider a colour display or the colour contrast. Two parts of a visual field can be of equal luminance but their chromaticity can be very different, thus discernable. Moreover, minimising reflection drastically improves the view-ability of the LCD in bright environments. This property was successfully assessed in the simulator ("white shirt effect") for this display. The end perception also depends on the text, the character size, the character style and the character spacing. Furthermore, it has been shown that the contrast ratio has little effect on flight crew response time when subjected to high luminance forward field environments[2]. On the other hand, another study[3] found a steady decreasing response time relationship with increasing character luminance level with the greatest effect at the highest forward field

[1] Cf. EASA Web: http://www.easa.europa.eu/ws_prod/g/doc/About_EASA/Manag_Board/2004/mb_decision_0704.pdf
[2] Cf. R. Smith-Gillespie and J. Cicinelli "Fixed Format Liquid Crystal Display Readability in Bright Ambient Environments." AIAA/IEEE 13th Digital Avionics Systems Conference. October 1994
[3] Cf. "Development of a high contrast, high luminance, transflective liquid crystal display", http://www.e3displays.com/Resource%20Papers/ALI_96B.pdf

luminance levels. This display indeed exceeds the minimum levels for maximum luminance by 34,5% for mean luminance and by 58,4 % for minimum luminance per SAE ARP4256A criteria. It is recognised that the human factors integration criteria cannot be determined at the equipment level (ETSO). The overall human factors performance will have to be assessed in detail for the complete cockpit installation. The conclusion of this alternate assessment method is better tailored to an installation while being totally dependent on the specific installation. Lastly, since the assessment of high ambient contrast has been performed with a precise set of messages with specified colours in a particular cockpit, any change will have to be re-assessed in the same particular cockpit.

For all those reasons, we agree to the requested deviation. A limitation will be indicated in the Declaration of Design and Performance “for installation on <specific installation>”. The deviation to SAE ARP4256A §4.2.3.2 assessment method and the re-assessment constraint in case of change will also be clearly indicated in the Declaration of Design and Performance.