



Federal Aviation Administration

Memorandum

Date: July 17, 2009

To: Manager, Fort Worth Airplane Certification Office, ASW-150

From: Manager, Airplane and Flight Crew Interface, ANM-111

Prepared by: Dr. Ingrid D. Knox, ASW-150

Subject: **Review and Concurrence, Equivalent Level of Safety Finding for Indication of Direction of Flight**

Memo No.: ST0757AK-T-S-1

Reg. Ref.: §§ 21.21(b), 25.1321(c)(4)

The purpose of this memorandum is to inform the Aircraft Certification Office of an evaluation made by the Transport Airplane Directorate on the establishment of an equivalent level of safety finding for the Cessna Citation Model 500, 550, S550, 560, 560XL and 551 aircraft.

Background

Chelton has proposed an installation of their FlightLogic system in several models of the Cessna Citation business jets. While this system has been certified in several Title 14 Code of Federal Regulation (14 CFR) 23 airplanes (including a Citation I), this will be the first certification of a transport category airplane. The FlightLogic system consists of a primary flight display (PFD) and a multifunction display (MFD).

Applicable regulation(s):

Section 25.1321(c)(4) states the following:

(c) The flight instruments required by Sec. 25.1303 must be grouped on the instrument panel and centered as nearly as practicable about the vertical plane of the pilot's forward vision. In addition—

...

(4) The instrument that most effectively indicates direction of flight must be adjacent to and directly below the instrument in the top center position.”

Regulation(s) requiring an ELOS

14 CFR 21.21(b) and 25.1321(c)(4)

Description of compensating design features or alternative standards which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

The original “T” layout was a successful first step to standardize the pilot’s scan between different aircraft and different avionics systems. The development and evolution of electronics systems over the past several decades has led to the evolution of avionics devices from single-purpose mechanical indicators into integrated displays. These integrated displays allow for a greater amount of information to be presented to the pilot in a clear and concise manner. Two integrated avionics display examples are Electronic Flight Information System (EFIS) displays and Head-Up Displays (HUDs).

EFIS displays are intended to integrate the traditional independent “round-dial” flight instruments into a single, consolidated display. They have been designed using the existing rules for flight instruments as much as practical. For example, the “basic T” arrangement, as defined in 25.1321(b), has dictated the layout of the instrument panel for decades. This “T” locates the attitude indicator top-center, with the airspeed indicator top-left, the altitude indicator top-right, and the heading indicator bottom-center. This mandate has been used in the design of current EFIS displays since the initial EFIS certification. The heading information is still presented below the PFD or at the bottom of the PFD.

Head-Up Displays (HUDs) have been used by the military for decades and are now installed on civil airplanes. HUDs allow the pilot to “see” essential flight information displayed on a clear medium while looking out the front window because the outside is seen through the display. Most HUDs locate the heading on top of the display so the heading information doesn’t distract the pilot’s visibility down towards the ground.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

A synthesis of these two concepts has led Chelton Flight Systems to develop a panel-mounted EFIS that present terrain and landmark information in the background where before there was only blue and brown shading divided by a horizontal line, as on a typical attitude indicator. In many ways, the Chelton Flight Systems EFIS PFD resembles a HUD more than the original instrument designs of the past. Therefore, the same rationale for locating the heading information at the top of the display has been applied to these integrated displays.

Like a typical EFIS display, the Chelton Flight Systems PFD display presents all the information critical to flying the airplane without forcing the pilot to scan. In the Chelton Flight Systems EFIS, additional information is presented at the bottom edges of the PFD. This information is relatively stationary and leaves the center open to display ground reference objects such as towers, airports, and terrain, which improves situational awareness to the pilot. In contrast to typical EFIS displays, the Chelton Flight Systems

EFIS displays the heading information on the top of the Primary Flight Display (PFD). The top of the display is left open so the background offers better contrast for the heading tape and its related symbology, making it easy for the pilot to see. On condensed EFIS displays, it is just as safe and easy for the pilot to use heading at the top of the display because the pilot sees heading information whenever looking at the primary attitude, airspeed and altitude.

FAA approval and documentation of the ELOS

The FAA has approved the aforementioned Equivalent Level of Safety Finding in issue paper S-1. This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The Transport Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the limitations and conditions section of the STC Certificate. [E.g. An Equivalent Safety Findings has been made for the following regulation: § 25.1321(c)(4) “Arrangement and Visibility,” (documented in TAD ELOS Memo ST0757AK-T-S-1)]

<i>Originally Signed by Robert C. Jones</i>	<i>July 17, 2009</i>
Transport Airplane Directorate Aircraft Certification Service	Date

ELOS Originated by Fort Worth Airplane Certification Office	Name Dr. Ingrid Knox	Routing Symbol ASW-150
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