



Federal Aviation Administration

Memorandum

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To: See Distribution

From: Manager, Transport Airplane Directorate, Aircraft Certification Service,
ANM-100

Prepared by: Dr. John McConnell

Subject: Policy Statement on the Installation of Transport Category Airplane
Flightdeck Liquid Crystal Displays

Memo No.: ANM-03-111-18

Regulatory Reference: §§ 25.1301, 25.1303, 25.1305, 25.1309, 25.1316, 25.1321, 25.1322, AC
25-11

Summary

The purpose of this memorandum is to clarify Federal Aviation Administration (FAA) certification policy on the installation of liquid crystal displays (LCD) for use in the flightdeck of transport category airplanes. This memo addresses the lack of published approval criteria for flightdeck use of LCD technology and provides guidance on performance levels that have been found to be acceptable for LCDs used as pilot displays in the flightdeck of transport category airplanes.

Although LCDs may not be specifically referred to by regulation, the regulations or requirements that apply are identified below in italics. It is our intent that each method of compliance tie back clearly to the requirement.

Definition of Key Terms

In the policy statement below, the formatting (*italics*, plain text, or [square brackets]) and terms used (“must,” “should,” or “recommend”) have a specific meaning that is explained in Attachment 1.

Current Regulatory and Advisory Material

Section 25.1301 of 14 Code of Federal Regulations (CFR) Part 25 requires that *each item of installed equipment must:*

(a) *Be of a kind and design appropriate to its intended function;*

(b) Be labeled as to its identification, function, or operating limitations, or any applicable combination of these factors;

(c) Be installed according to limitations specified for that equipment; and

(d) Function properly when installed.

Sections 25.1303 and 25.1305 address specific requirements for Flight and Navigation, and for Powerplant instruments, respectively. Section 25.1309, in brief, requires that:

(a) The equipment, systems, and installations, whose functioning is required by this subchapter, must be designed to ensure that they perform their intended functions under any foreseeable operating condition.

(b) The airplane systems and associated components, considered separately and in relation to other systems, must be designed so that--

(1) The occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane is extremely improbable, and

(2) The occurrence of any other failure conditions which would reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions is improbable.

(c) Warning information must be provided to alert the crew to unsafe system operating conditions, and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed to minimize crew errors which could create additional hazards. ...

Sections 25.1321 and 25.1322 address requirements for the installation of airplane instrumentation, alerts and indications, and § 25.1431 addresses the installation of radio and miscellaneous electrical equipment, any of which may utilize LCD technology.

Advisory Circular (AC) 25-11, "Transport Category Airplane Electronic Display Systems," provides guidance for the certification of electronic display systems and was issued when Cathode Ray Tube (CRT) based electronic display systems were prevalent. As a result, AC 25-11 contains many references to criteria and industry standards that are unique to CRTs, but does not contain equivalent criteria and references to industry standards for LCDs.

Relevant Past Practice

The policy presented in this memorandum has been substantially utilized as a supplement to the guidance presented in AC 25-11 and has been previously communicated on various projects through the issue paper process. It is based on the industry standard offered in Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) 4256, "Design Objectives for Liquid Crystal Displays for Part 25 (Transport) Aircraft."

Policy

Advisory Circular 25-11 has proven to be acceptable guidance for installation of electronic displays in transport category airplanes. The FAA will continue to use this AC as installation guidance for electronic displays, including LCDs. In addition, as specific guidance for the installation of LCDs, SAE ARP 4256A should be referred to in lieu of SAE ARP 1874, "Design Objectives for CRT Displays for Part 25 (Transport) Aircraft." Specifically, for guidance on

LCD visual characteristics, the applicant should refer to SAE ARP 4256A rather than to SAE ARP 1874 in paragraphs 6a, 6b(4), and 6c of AC 25-11.

The quantitative criterion represented by Equation 5 in paragraph 4.2.6 of ARP 4256A is not considered a reliable predictor of acceptable specular reflectivity characteristics. Accordingly, this aspect of LCD performance should be specifically assessed via flight crew evaluation to establish that there are no internal or external reflections that can result in flight crew distraction or in erroneous interpretation of displayed information. These evaluations should be accomplished in conditions which would be likely to produce internal or external reflections.

With regard to the criteria for malfunction indication in paragraph 3.4 of ARP 4256A, the FAA has found that showing the fonts and symbols to be tolerant to the loss of a single column, line or element is an acceptable alternative to providing a malfunction indication. Proposed designs that do not use fonts and symbols that are tolerant to these faults can be found to be acceptable by meeting these criteria in ARP 4256A. As with any other equipment, LCD failures and malfunctions should be addressed in the system safety analyses per AC 25.1309-1A.

In addition, all references in AC 25-11 to CRT displays should be interpreted as also being applicable to LCDs, with the exception of paragraph 6b(4)(vi). Because the distinction between stroke and raster does not apply to LCDs, the following guidance should be used in lieu of AC 25-11 paragraph 6b(4)(vi) for approval of LCDs:

Displays or layers of displays with uniformly filled areas conveying information such as weather radar imagery should allow the area or layer to be independently adjustable in luminance from overlaid symbology. The range of luminance control should allow detection of color difference between adjacent small filled areas no larger than 5 milliradians in principal dimension; while at this setting, overlying map symbology, if present, should be discernible.

NOTE: The most recent revision of the reference SAE ARP documents should be considered. However, in the event of conflicting information between the SAE documents (e.g., SAE ARP 4256A) and AC 25-11, other than guidance specific to the use of LCDs, AC 25-11 takes precedence as guidance for the certification of transport category airplane installations.

Effect of Policy

The general policy stated in this document does not constitute a new regulation. The FAA individual who implements policy should follow this policy when it is applicable to a specific project. Whenever a proposed method of compliance is outside this established policy, that individual has to coordinate it with the policy issuing office using an issue paper. Similarly, if the implementing office becomes aware of reasons that an applicant's proposal, meeting this policy, should not be approved, the office must coordinate its response with the policy issuing office.

Applicants should expect that certificating officials would consider this information when making findings of compliance relevant to new certificate actions. In addition, as with all advisory material, this statement of policy identifies one means, but not the only means, of compliance.

Implementation

This policy discusses compliance methods that should be applied to type certificate, amended type certificate, supplemental type certificate, and amended supplemental type certification programs. The compliance methods apply to those programs with an application date that is on or after the effective date of the final policy. If the date of application precedes the effective date of the final policy, and the methods of compliance have already been coordinated with and approved by the FAA or its designee, the applicant may choose to either follow the previously acceptable methods of compliance or follow the guidance contained in this policy.

/s/

Ali Bahrami

Attachment: Definition of Key Terms

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Definition of Key Terms

Table A-1 defines the use of key terms in this policy statement. The table describes the intended functional impact, and the formatting used to highlight these items.

- The term “must” refers to a regulatory requirement that is mandatory for design approval. Text communicating a requirement is in *italics*.
- The term “should” refers to instructions for a particular method of compliance. If an applicant wants to deviate from these instructions, he has to coordinate the alternate method of compliance with the Transport Standards Staff using an issue paper. There is no special text formatting used for methods of compliance.
- The term “recommend” refers to a recommended practice that is optional. Enclose recommendations in [] brackets.

Table A-1 Definition of Key Terms

	Regulatory Requirements	Acceptable Methods of Compliance	Recommendations
Language	Must	Should	Recommend
Format	<i>Italics</i>	Regular text (No special formatting)	[Square brackets]
Functional Impact	No Design Approval if not met	Alternative has to be approved by issue paper.	None, because it is optional