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AEROSPACE RECOMMENDED PRACTICE

ARP 450D

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FLIGHT DECK VISUAL, AUDIBLE, AND TACTILE SIGNALS

1. PURPOSE

This ARP sets forth design and operational recommendations relative to the integrated alerting system to be implemented on the flight deck. It is intended that through the adoption of the design objectives and recommendations incorporated herein, a consistent and effective industry standard will result.

1.2 General Philosophy: Safety of flight is greatly enhanced by an alerting system designed to provide early crew recognition of flight crew operational error as well as aircraft system or component status or malfunction. The alerting system therefore relates to aircraft configuration and flight regime as well as the aircraft systems. To fulfill this objective, the flight deck alerting system must attract the attention of the crew, must state with clarity the nature and location of the problem, must be highly reliable and thoroughly responsive to the operational requirements and environment. The system should incorporate careful design logic to assure that warning or caution signals never occur when operations are normal and always occur when required.

2. DESIGN OBJECTIVES

2.1 ø A master aural attention-getting sound (ATTENSON) shall be provided for urgency levels 1, 2, and 3, except as provided in 3.1.2. An additional master visual alert is optional. (Refer to Table I for definitions of urgency levels.)

2.2 One or more alpha numeric displays shall be provided. All aural alerts shall be accompanied by an explanatory visual message on the display.

2.3 ø The system should display potential configuration, flight regime, and systems discrepancies before they become critical. No attention-getting sound is necessary until such discrepancy requires crew awareness.

2.4 The system shall contain provisions to establish suitable priorities and to inhibit alerts under certain specific conditions.

2.5 Indications shall be automatically cleared from the system when fault conditions no longer exist.

2.6 Capability to cancel visual displays of uncorrected faults and to recall such cancelled displays shall be provided.

2.7 The system should avoid unnecessary alerts following an intentional action such as engine shutdown.

2.8 The design shall be such as to eliminate nuisance alerts.

2.9 The system should have the capability of varying the urgency level of a given alert depending on the flight regime and current aircraft condition and confirguration.

2.10 System test capability shall be provided that will give the crew maximum confidence with minimum crew work load.

2.11 The system shall accept new warnings, cautions, or advisories with a minimum of change.

3. SYSTEM DESCRIPTION

The fundamental characteristics of the Integrated Flight Deck Alerting System are described in Table I.

3.1 Aural Alerts:

3.1.1 ATTENSON: ATTENSON is a coined word intended to denote a unique sound selected for its "attention-getting" capability. The sound will be "unique" in that there will be no similar sound in the cockpit. A chime is one example. The development and selection of the specific sound will be the product of further study and the committee strongly recommends a common standard.

3.1.1.1 The ATTENSON shall be an effective but non-irritating sound.

3.1.1.2 The ATTENSON shall apply to urgency Levels 1, 2 and 3, and shall clearly announce the urgency by suitable means (for example, by means of one, two, or three repetitions, or by otherwise modifying the sound).

3.1.1.3 The ATTENSON should emanate from a flight deck speaker and, if desired, the crew headsets.

3.1.1.4 Ø The ATTENSON shall be self cancelling after one cycle when followed by a voice alert message. The ATTENSON shall be self cancelling after one or more cycles for all other conditions. Self cancellation is interpreted to include cancellation by correction of the fault.

3.1.1.5 The ATTENSON shall not activate when the visual display is recalled.

3.1.1.6 Automatic volume adjustment shall be provided to maintain ATTENSON volume at an appropriate level relative to cockpit ambient sound.

3.1.2 Discrete Aural Alerts: It is considered that the ATTENSON, together with voice alert messages, provide a warning superior to that of discrete aural alerts. Therefore, it is strongly recommended Ø that discrete aural alerts not be used in an integrated flight deck alerting system. If, however, familiarity and/or usage should make desirable the use of certain discrete aural alerts, they shall be limited to a maximum of four, and shall meet international standards to be agreed to.

Ø 3.1.2.1 A discrete aural alert shall not be combined with the ATTENSON.

Ø 3.1.2.2 A discrete aural alert shall not warn of more than one condition.

Ø 3.1.2.3 The sound associated with a stick shaker, shall be considered a discrete aural alert.

3.2 Visual Indications: Visual indications shall include the Allerting System Visual Display; and visual Ø signals consisting or warning lights, caution lights, advisory lights, flags, or electrode displays.

3.2.1 Alerting System Visual Display:

3.2.1.1 The Alerting System Visual Display shall be alpha numeric and shall be located on the forward instrument panel clearly visible to each pilot. When a third crew member is used, an Alerting System Visual Display must be clearly readable by the third crew member.

3.2.1.2 Ø If the function of the Alerting System Visual Display is to direct attention to an indicator or control device at another location, a supplemental visual indication shall be provided at that location either within the indicator or control device or in close proximity thereto.

3.2.1.3 Color coding of the Alerting System Visual Display to annunciate urgency level is preferred.

3.2.1.4 The Alerting System Visual Display shall be used for Levels 3, 2, and 1. However, selected Level 0 (Zero) information may be displayed.

3.2.1.5 Alpha numeric readouts shall be self-cancelling for corrected faults.

3.2.1.6 Capability to cancel Level 0, 1, or 2 indications for uncorrected faults shall be provided.

3.2.1.7 Capability shall be provided to recall readouts of uncorrected faults cancelled manually.

3.2.1.8 Provision shall be made for pilot selection of contrast level which will be automatically maintained throughout varying levels of flight station ambient lighting.

3.2.1.9 A dimming feature shall not be capable of completely shutting off the light to the Alerting System Visual Display or remotely located visual indications.

3.2.2 Visual Signals: May consist of lights (with or without transilluminated nomenclature), warning flags, or electronic displays. (See Table I) For the case of flight instrument indications, total removal of the pertinent instrument display constitutes an acceptable visual signal.

3.2.2.1 Signal Lights: (See Table I)

3.2.2.2 Flags: Mechanically or electrically actuated signal devices used to alert the crew of an unsafe setting or malfunction of instruments or mechanical devices.

Flags will provide a clear, unmistakable warning that the condition to be warned of has occurred.

In the case of flight instruments, a flag should obscure the function indications for which the al rt is pertinent. If this is not possible, the flag shall be not less than 1/4 inch in width, nor less than 1/4 square inch in area. Where they are so used, the flag signal will be an integral part of the instrument or device.

3.2.3 Color Code:

3.2.3.1 Signal Lights: The functions and colors of signal lights are defined in Table I.

3.2.3.2 Flags: Where flags are used internally in instruments, the color should be red or yellow as required ø for proper level alerting, with black wording thereon, if required (Reference AS 269). If wording is not required, the yellow flag may have black diagonal stripes applied.

3.2.4 Intensity of Signal Lights: (See AS 264)

3.2.4.1 Intensity Control: The dimming feature when used may be accomplished either electrically or mechanically. If a switch is used the switch motion will comply with the requirements of ARP 268. The dimming feature shall not be capable of completely shutting off the light.

3.2.5 Reliability of Visual Signals:

3.2.5.1 Signal Lights (other than electronic displays): Will be of the multiple bulb type so that failure of a ø single bulb will not result in an inoperative condition of the signal. A means shall be provided within the device so that it is obvious to the crew when one of the bulbs has failed.

If light covers with transilluminated nomenclature are used, it must be impossible to transpose these covers on to improper locations (e.g., captive).

3.2.5.2 Signal Lights Testing: Provisions for testing signal lights, such as the "push-to-test" feature, will be provided. The push-to-test circuit will be such that a short or failure of a bulb(s), bulb socket, or switch device will in no way create or cause a malfunction in the system in which such a light is used.

3.2.5.3 Lamp Removal Method and Safety: Provisions shall be made for rapid and conv nient lamp removal from the front of the signal lights described herein, preferably without the use of tools and with power applied.

3.3 Voice Alert Message System: A Voice Alert Message System shall be employed to supplement the ATTENSON and the visual display for Level 3 alerts, and may be selectively applied for all other urgency levels.

3.3.1 Voice alert messages should be preceded by an ATTENSON, except for Level 0.

3.3.2 Voice alert messages should be easily differentiated from normal voice radio communications.

3.3.3 Ø Voice alert messages should consist of short phrases or polysyllabic words proven to be easily recognizable in the flight deck environment.

3.3.4 Voice alert messages should be consistent with the readout on the alpha-numeric visual display.

3.3.5 Voice alert messages should employ commonly used aviation terminology where practicable.

3.3.6 Automatic volume adjustment shall be provided to maintain voice alert message volume at an appropriate level relative to cockpit ambient sound.

3.3.7 Voice alert messages for Levels 1 and 2 shall be self-cancelling after one or more cycles. Voice alert messages for Level 3 shall be cancelled only by correction of the associated fault except where manual cancellation or self cancellation after a period of time is found to be desirable for specific cases.

3.4 Ø Tactile Warning: Tactile warnings are generally not recommended. A tactile warning supplemented by aural and visual alerts, as described in Table I, is considered acceptable.

4. NOTES

4.1 Marginal Indicia: The phi (Ø) symbol is used to indicate technical changes from the previous issue of this ARP.

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