SAE Aerospace
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AEROSPACE INFORMATION REPORT

SAE AIR1151 | REV. A

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Superseding AIR1151

Flight Compartment Glare

RATIONALE

The SAE A20 committee has just released a new document, ARP6161, to supersede AIR1151. The newer document includes all of the relevant information from AIR1151 in substantially more depth rendering AIR1151 obsolete.

CANCELLATION NOTICE

This document has been declared "CANCELLED" as of December 2011 and has been superseded by ARP6161. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index noting that it is superseded by ARP6161.

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1. PURPOSE

To bring to the attention of the aircraft designer and user the problems that can result from the flight crew experiencing glare.

2. GOAL

To improve visibility conditions for the flight crew by minimizing conditions which contribute to glare.

3. BASIC CONCEPTS

3.1 Definitions:

3.1.1 Visibility: Visibility is the quality or state of being perceivable by the eye.

3.1.2 Glare: Glare is the sensation produced by brightnesses within the visual field that are sufficiently greater than the luminance to which the eyes are adapted to cause annoyance, discomfort, or loss in visual performance and visibility.

3.1.3 Direct Glare: Direct glare is glare resulting from high brightnesses or insufficiently shielded light sources in the field of view or from reflecting areas of high brightness. It usually is associated with bright areas, such as luminous ceilings and windows which are outside the visual task or region being viewed. However, small light sources may also contribute significant amounts of direct glare - for example, the sun from the exterior, visual signals, etc.

3.1.4 Reflected Glare: Reflected glare is glare resulting from specular reflections of high brightness in polished or glossy surfaces in the field of view. It usually is associated with reflections from within a visual task or areas in close proximity to the region being viewed.

3.1.5 Blinding Glare: Blinding glare is glare which is so intense that for an appreciable length of time no object can be seen.

3.1.6 Disability Glare: Disability glare is glare which reduces visual performance and visibility and often is accompanied by discomfort.

3.1.7 Discomfort Glare: Discomfort glare is glare which produces discomfort. It does not necessarily interfere with visual performance or visibility.

3.1.8 Veiling Brightness: Veiling brightness is a brightness superimposed on the retinal image which reduces its contrast. This veiling effect, produced by bright sources or areas in the visual field, results in decreased visual performance and visibility.

3.2 Result of Glare:

3.2.1 In essence, direct and reflected glare can be considered as negative light. In other words, with a source of glare in the field of vision, the visibility of the seeing task is reduced. In general, the amount of this reduction is dependent on:

(a) Background Brightness - A source of glare has more effect on vision when the background brightnesses are low.

(b) Brightness of Glare Source - The higher the brightness of the glare source, the greater the effect.

(c) Size of Glare Source - The larger the glare source, the greater the effect.

(d) Location of Source in Field of View - The nearer the glare source to the seeing task or to being in line with the seeing task, the greater the effect. In addition to reduction in visibility, glare sources in the field of view can also cause fatigue and reduction of seeing efficiency. Veiling brightness is the result of glare sources in the field of view.

(e) Number of Glare Sources - The greater the number of glare sources, the greater the effect. The obscuring effects from more than one glare source will be additive.

3.2.2 In addition to reducing visibility and visual performance, glare can cause annoyance, fatigue and discomfort (such as headaches). A rhythmic glare occurance, or flicker, of low frequency (8 to 12 hertz) such as reflected glare caused by scattered clouds, flashing lights, propellors, or helicopter blades, can have an irritating effect with possible extreme anxiety, vertigo, disorientation, or, in those so pathophysiologically predisposed, convulsions. Further, a low grade glare environment may reduce visibility and visual performance without operator awareness of degradation. Glare may also reduce the pilot's scan of required areas by his subconscious avoidance of the glare area.

4. SOURCES OF GLARE

In the aircraft flight compartment the major sources of glare are:

4.1 Windshield, Windows and Canopy: The orientation of these with respect to instrument panels and indicator systems may cause reflected glare conditions from the lighted instruments and panels and indicators.

4.2 Instrument and Panels: The instruments and panels can be sources of direct or reflected glare.

4.2.1 Forward and side mounted instruments may reflect light from internal and exterior sources or from light colored shirts and uniforms.

4.2.2 Overhead instruments and panels may reflect glare from internal and external light sources, from the nose of the aircraft or from bright clouds below the aircraft.

4.2.3 Pedestal instruments and panels may reflect glare from internal or external light sources or from bright clouds above the aircraft.

4.3 Surfaces: Structural and non-structural surfaces may be potential sources of reflected glare, depending on installed angles of the surfaces and the relative position of light sources.

4.3.1 Internal surfaces may be window trim, instrument glare shields, metal placards, control wheel fixtures, etc.

4.3.2 External surfaces may be window retaining structures, windshield wipers, inboard nacelles, aircraft nose etc.