Flat Panel Display Source Colour Helmet Mounted Display: Human-in-the-loop exploration of the image quality of a prototype

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Abstract

A research programme was performed to assess the image performance and quality of a prototype colour-capable helmet-mounted display (HMD) based on a miniature flat panel display source. Empirical data was gathered via psychometric and flight-simulator trials. The psychometric trials indicated that the resolution of the helmet display was the limiting factor instead of the colours and that the correction for geometric distortion clearly negatively influenced symbol legibility thresholds. The flight simulator trials indicated that the HMD had an adequate level of brightness for the simulation, but a too low level of display resolution. Colour coding was not judged very favourably. Further, several usability and comfort issues were reported.

Introduction

Helmet-mounted displays (HMD's) mainly consist of an image source (display), optics and a supporting structure. The image is displayed as an overlay to the outside world, so a pilot can view image (or symbols) and outside world simultaneously. Head motion can be used to control the view. HMD's are continuously in the line of sight of the pilot and allow the pilot to remain head-out of the cockpit for longer time periods while maintaining better situational awareness. HMD's offer military pilot's several advantages as pointing weapons and allow the capability to slew sensors. The ability to display multisensor imagery on the HMD further enhances situational awareness.

HMD's might be monocular, biocular and binocular and might have colour or monochrome options with specific visual and display resolutions. Monocular HMD's have only one display source. Biocular displays have separate displays and optics paths, but show only one image. Binocular displays provide stereoscopic viewing using two image generators. In all cases the HMD-optics is used to focus the image and project it across the field of view before the eye.

For a colour-capable HMD, specific requirements have to be set as the changing background of the real world may affect the perception of the displayed colours. In an explorative research programme some human factors aspects associated with the use of a prototype (miniature) flat panel colour-capable HMD within a fighter