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Display Technologies and Applications for Defense, Security, and Avionics VIII; and Head- and Helmet-Mounted Displays XIX

Daniel D. Desjardins
Kalluri R. Sarma
Peter L. Marasco
Paul R. Havig
Michael P. Browne
James E. Melzer
Editors

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Introduction

Conference on Display Technologies and Applications for Defense, Security, and Avionics VIII

The Display Technologies and Applications conference addresses displays of all kinds, to include supporting technologies, with applications to defense, security, avionics (also vetronics and shipboard electronics) and space. We reach out to invite and welcome papers not only regarding visual displays, but also those regarding auditory and haptic systems used to implement the human-to-system interfaces. Associated display applications encompass the full range of military (land, sea, air, and space) platforms, man-portable and training functions, and include civilian aircraft, as well as land transport and security functions. User groups include warfighters, special operations personnel, command/control/surveillance, and unmanned vehicle controllers. The emphasis is both on systems delivered to the field and emerging science and technology associated with displays, including optics, materials science, and human factors design.

As per past years, this year's Defense, Security and Avionics Displays VIII conference was a forum for display related papers regarding a wide range of civil, Department of Defense, and Homeland Security systems. Proceedings Volume, 9086A, includes 11 papers presented in six sessions, to include: Simulation Visual Systems; 3D, Stereoscopic and Holographic Displays; Ergonomics and the Human Sensory System; Micro-Displays; Head-Up Displays; and, for individual papers on disparate subject areas, "Cornucopia."

Visual Systems for Simulation was a subject area long missing from recent past conferences. Barco USA addressed the pros/cons of LCOS vs. DLP projection technology used for high-fidelity night vision training, e.g., realistic night vision goggle stimulation, pointing up that while LCOS has higher contrast, DLP allows the addition of infrared LEDs providing effects that can compensate for the lack of inherent contrast. Rounding out the session, Visual Performance gave two papers, an invited one on proposed luminance requirements meeting user expectations, and another describing a process by which projection display requirements associated with need vs. cost challenges are identified, described, and rated. The luminance requirements paper pointed up that while LCD and DLP technology deliver significantly higher arc-lamp luminance (than the previous CRT technology), the higher luminance is typically short-lived. The paper outlined a comprehensive and defensible system luminance requirement that overtly accounts for the fall-off in arc-lamp luminance versus age. The second paper identified that while requirements documents typically call out some 40–50 design parameters, this number could be reduced to an approximate dozen parameters based on the use of six criteria identifying parameters most worthy of research attention.

Although 3D, stereoscopic and holographic displays have received much attention at past conferences, this year saw only two papers focused on this area. One from Air Force Research Lab (invited this year due to sequester cancellation in 2013) high-lighted a case study of the effects of stereo-deficiency on subjective evaluations of 3D displays—an important consideration in view of that service's planned use of a first-ever 3D display for the KC-46 boom operator station. A second paper by Honeywell Technology reviewed the attributes of, and significant progress by, stereoscopic and 3D display technologies for varied applications, including medical, industrial, and entertainment.

NanoQuantum Sciences lead off the session in Ergonomics and the Human Sensory System by reviewing attributes of the human visual system and the relevance of common standards for determining light source suitability. The main presentation; however, summarized a study of reflected and emitted light, presenting spectral data experimentally obtained from broad spectrum and special purpose light source illumination of a variety of terrestrial objects. The objective was to assess optimal lighting spectra for detection and identification. Great River Technology discussed several new architectures and capabilities associated with the 2013 release of ARINC 818-2, to include switching, stereo and 3D provisions, color sequential implementations, bi-directional communication, higher link rates, data-only transmissions, synchronization signals, and optical interface details. The paper discussed each of the new capabilities and the impact on avionics and display architectures. Yet a third paper by independent consultant Dan Desjardins presented a review of earlier papers by government, industry, and university authors on performance of the human eye-brain system with regard to resolution. A summary of clinical findings regarding visual resolution performance was reported, with consequent implications as to maximizing display system design.

Micro-Displays enjoyed three papers by two prominent private industry contributors long active in the field. Kopin gave two papers, both in regard to fire control systems. The first of these spoke to the development of a new, general purpose low power graphics controller with dual-path display driver electronics. Features of the graphics controller included a capability for multiple graphics layers, user configurable fonts and icons, and parameterized vector rendering. The second paper reviewed various approaches for integrating high brightness overlay displays (demonstrating luminance levels > 6,000 fL to the eye) with existing direct-view rifle sights and augmenting their precision aiming and targeting capability. In a last paper for this session, eMagine described the design and construction of a fully automated life test system that allows continuous monitoring and measuring of several display characteristics, including luminance vs. time, and simultaneous spectrum and color coordinates for multiple microdisplays that vary per resolution and driving schemes. Life test data for eMagine AMOLED microdisplays of various resolutions were presented.

The return of a previous paper from the Physical Engineering Department at the Universidad EAFIT (Columbia) regarding head-up displays for automotive

applications revealed advances made in deciding an appropriate manner of display integration, where additional advantages and risks are identified and analyzed. This invited paper in the Head-Up Displays session was followed by one from HOLOEYE Systems regarding approaches for design of a low-cost head-up display system. The steady increase in cost vs. increased performance for HUDs has apparently dictated a restricted market for civil applications, i.e., only some of the larger passenger and high-end business jets. This paper discussed techniques and approaches to reduce the physical volume and associated costs of HUDs, thereby making the operational and safety benefits available to a broader range of civil aircraft applications.

The final Cornucopia session was an unexpected case of the best saved for last, with a singular paper by Rockwell Collins on the current state of OLED technology for military avionics. Their 2012 paper on adapting a COTS 15 in. AMOLED display for rugged aerospace applications is here followed by one that summarizes life study results regarding OLED display optical and environmental performance. Performance gaps relative to required performance thresholds is critical to understanding where future research and development needs to be focused for this promising technology.

Best Paper: We would like to extend our sincere congratulations to Joe Tchon, T.J. Barnidge, Bruce Hufnagel, and Birendra Bahadur of Rockwell Collins, as winners of this year's Best Paper award: "Current state of OLED technology relative to military avionics requirements" (paper 9086-15). Please join us in congratulating Joe, T.J., Bruce, and Birendra on this fine achievement!

As a final note, we wish to express our sincere delight in seeing all who attended this year's conference. We have taken note of your views and opinions expressed for improving next year's conference, e.g., soliciting greater military attendance, recruiting papers from university authors, pursuing paper topics corresponding to the DSS13 Attendee Survey, and will take action on those recommendations. Please look for the Call which shall be issued in late June and be sure to alert your colleagues and co-workers. Thank you—and we look forward to seeing you again in 2015!

Daniel D. Desjardins
Kalluri R. Sarma