Multisensor & Spectral Image Fusion & Mining:
Neural Systems for Fused Night Vision & Image Analyst Tools

Allen Waxman, Ph.D.
Director, Cognitive Fusion Technology
Fusion Technology & Systems Division
BAE Systems, Advanced Information Technologies
Burlington, MA 01803
allen.waxman@baesystem.com

This talk will summarize our methods for the fusion of multisensor imagery based on concepts derived from neural models of visual processing and pattern learning & recognition. These methods have been applied to real-time fusion of night vision sensors in the field (VNIR, SWIR, MWIR, LWIR, LADAR), airborne multispectral and hyperspectral imaging systems, and space-based multi-platform multi-modality imaging sensors. The methods enable color fused visualization, as well as interactive exploitation and data mining in the form of human-guided machine learning & search for targets and cultural features. This technology has been demonstrated in the field for Army & Air Force Special Operations Forces, Marines during Urban Warrior, and evaluated on space-based imagery for the National Geospatial-Intelligence Agency. We have incorporated it into a commercial software platform widely utilized for imagery exploitation. A demonstration of these image fusion & mining methods will be given on a laptop computer. The neural networks employed in these methods emulate a multispectral IR retina and pattern learning circuit, are being implemented in a real-time fusion processor, and are well suited for implementation in compact, low-power, 3D mixed analog/digital integrated circuits.

Allen M. Waxman is Director of Cognitive Fusion Technology within the Fusion Technology & Systems Division of BAE Systems Advanced Information Technologies. His group conducts research and technology development involving neural network models of vision, memory and learning, as applied to multisensor imagery, radar and information fusion & mining. During 2001 he established and directed the CNS Technology Laboratory in the Cognitive & Neural Systems Department of Boston University, where he had been an adjunct professor since 1990. From 1989–2001 he served as a Senior Staff Member of the Sensor Exploitation Group at MIT Lincoln Laboratory directing research on target recognition, night vision and image fusion. Dr. Waxman received the B.S. degree in Physics from the City College of New York in 1973, and the Ph.D. degree in Astrophysics from the University of Chicago in 1978. He has conducted research at MIT, the University of Maryland, the Weizmann Institute of Science (Israel), the Royal Institute of Technology (Sweden), MIT Lincoln Laboratory and Boston University.

Dr. Waxman's research has culminated in various night vision, image fusion and exploitation systems demonstrated in the field with U.S. Army Special Forces, Air Force Special Operations Command, the Marines, and at the National Imagery and Mapping Agency. Dr. Waxman now serves on the editorial board of the new e-journal of the International Society of Information Fusion *Journal of Advances in Information Fusion*, served for ten years as an action editor for the journal *Neural Networks* and was the guest editor of the 1995 special issue on *Automatic Target Recognition.* He holds three patents on image fusion, night vision, and adaptive image processing, and has authored over one-hundred publications. Dr. Waxman has organized invited day-sessions on the theme of *Image Fusion & Exploitation* for the annual *International Conference on Information Fusion (2000 - 2004),* and organized the AFOSR Info Fusion sessions at *Fusion 2002 & Fusion 2004.*.