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**Research and Evaluation
of Emerging Weapon System Technologies
(5-20457 & 5-20458)**

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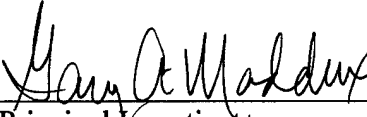
This technical report was prepared by the staff of the Research Institute, The University of Alabama in Huntsville. The purpose of this report is to provide documentation of the work performed and results obtained under Delivery Order 38 of AMCOM Contract No. DAAH01-98-D-R001. Mr. Gary Maddux was the principal investigator. Ms. Sherry Starling and Ms. Angie Cornelius served as lead technicians. Mr. Daron Holderfield, Systems Engineering and Production Directorate, Research, Development, and Engineering Center, U.S. Army Aviation & Missile Command, provided technical coordination. Mr. William Pittman, Missile Guidance Directorate, U.S. Army Aviation and Missile Command, provided technical expertise and insights in emerging technologies.

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Prepared for: Commander
U.S. Army Aviation & Missile Command
Redstone Arsenal, AL 35898

I have reviewed this report, dated October 1999 and the report contains no classified information.



Principal Investigator

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1.0 Introduction

The Research, Development and Engineering Center (RDEC), U.S. Army Aviation and Missile Command (AMCOM) has the mission and function for investigating emerging technologies for weapon systems that should have positive impacts on the producibility, operations and support of future aviation and missile designs. During FY99 the RDEC is focusing on technology areas of Electronic, Photonic, Electro-Optical and Electro-Magnetic Materials; Multispectral Sensors Modeling and Simulation; and Applications of Nanotechnology to Tactical Missile Systems.

The Systems Engineering and Production Directorate, RDEC, AMCOM has the mission and function of evaluating new technologies and determining the impacts of same on the producibility and supportability of AMCOM missile systems. Contractor support was required to augment MRDEC sponsored workshops to investigate emerging applications in these technology areas. The Systems Management and Production Laboratory at The University of Alabama in Huntsville (UAH) Research Institute (RI) was tasked to provide this engineering support and analytical capability.

2.0 Objective

The objective of this research task was to research and identify organizations and experts working within the above technology areas, facilitate interactions with the RDEC in the form of technical papers/briefings, and develop knowledge bases that could be disseminated throughout the DoD and incorporated in the appropriate weapon systems. UAH conducted research to identify and categorize these technologies based on the potential for DoD weapons applications and manufacturing technology maturity.

3.0 Statement of Work

The statement of work, as outlined in delivery order 38, was as follows:

UAH shall provide the personnel, resources, expertise and materials required to perform the following efforts:

- 3.1** UAH shall conduct research into Electronic, Photonic, Electro-Optical and Electro-Magnetic Materials. This research shall include computation design and predictive properties of materials, characterization of materials, high temperature superconducting materials, tunable optical polymers and holographic materials, uncooled infrared detector materials, electro-magnetic windows, fiber optics and integrated optics, MEMS/MOEMS, Mercury Cadmium Telluride, and device hardening.
- 3.2** UAH shall conduct research into Multispectral Sensors Modeling and Simulation. This research shall include sensor fusion, automatic target recognition,

performance metrics, millimeter infrared, laser-infrared, polarimetric sensing and processing, signal processing, and image analysis.

3.3 UAH shall conduct research into Applications of Nanotechnology to Tactical Missile Systems. This research shall include military and industrial base efforts to apply Nanotechnology to missile system applications of other related product areas.

3.4 UAH shall solicit inputs from the defense, industrial and academic community on the subjects in Paragraphs 3.1, 3.2 and 3.3. Independent analysis shall be conducted to establish knowledge bases to represent technology areas, emerging technologies including manufacturing process details, and associated organization/expert data. Data shall be requested in electronic format and transferred to the Government for appropriate distribution.

4.0 Description of Workshop

The work performed on this task led directly to the *Workshop on Electronic, Photonic, Electro-Optical, and Electro-Magnetic Materials* on October 6 & 7, 1999 at the Sparkman Center, Redstone Arsenal, Alabama. The objective of this workshop was to provide a forum for reviewing progress and identifying research gaps in electronics and electro-optical materials essential for achieving DOD goals in air platforms and missiles. Key smart weapons and air platforms hardware technologies are strongly dependent on a strong research base in electronics and electro-optical and electro-magnetic materials including integrated optics, fiber optics, detector materials, window materials optoelectronic devices, integrated microwave and millimeter wave integrated circuits and others.

5.0 Conclusion and Recommendations

During the time frame allocated by the delivery order, members of the UAH Applied Research Program, with the cooperation of representatives from AMCOM SEPD and Missile Guidance, performed an analysis and evaluation of emerging technologies that could be incorporated into weapon system design. Results of these efforts were presented at a locally held workshop. Detailed findings can be found in the proceedings of that workshop, which was compiled by UAH and delivered under separate cover.