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Introduction

Micro (MEMS) and Nanotechnologies for Space, Defense, and Security is an exciting conference, having successfully completed its third year of operation within the Space Technologies and Operations track at SPIE's Defense and Security Symposium. The combined fields of MEMS and nanotechnologies continue to be a vibrant area of research, as you will see from the papers selected for publication in this volume. The key challenge remains how to effectively transition these new concepts from the laboratory to system-level applications. Invited speakers from Texas Instruments and NASA's Goddard Space Flight Center addressed the complex engineering issues involved in converting laboratory-proven concepts into systems that perform reliably in the field. The key insight they provided is that although MEMS and Nanotechnology are the enablers for these next-generation systems, they form only a small portion of the ultimate systems that are fielded. Technology developers need to be made aware of the requirements driven by system-level design for a particular application environment and the intricacies of seamless integration with other sub-components in order to create the final product.

This year, we were also fortunate to have two keynote speakers from DARPA and the Army Research Laboratory, who laid out the roadmaps being pursued by their organizations vis-à-vis MEMS and nanotechnology research and development. In order to achieve the overall goal of successful transition from the laboratory to working product, it is critical that all of the stakeholders, such as the researchers, system developers, and program managers, are fully engaged in the technology transition process.

Among the emerging technologies that we were proud to showcase at this conference were nanowire- and nanotube-based devices, Dip Pen nanolithography, ultra nano crystalline diamond materials, biosensors, plasmonic sensors, and adaptive optics. The novel research presented in these fields is a testament to the diversity of MEMS and nanotechnology and its ability to impact a broad range of applications.

Thomas George
Zhongyang Cheng

Nano-Enabled Defense Opportunities

D. L. Polla
Defense Advanced Research Projects Agency, 3701 North Fairfax Drive, Arlington, VA

MEMS/NEMS have entered a new era characterized by: 1) Insertion of enabling Nanotechnologies, and 2) Heterogeneous integration of multiple technology building blocks. In particular, true systems advantages of MEMS are now being realized - often times through the subtle insertion of nanotechnologies. For instance, ultra miniature chip scale gas analyzers are now being realized through the heterogeneous integration of micro and nano fabricated sub-components such as chemical pre-concentrators, gas chromatographs, and mass spectrometers. Nanotechnology has enabled all of these key sub-components with advances such as carbon nanotube functionalization of surfaces, nanoelectronic field emitters, and nanodetectors. This talk will focus on several nano-enabled MEMS themes of interest to the Department of Defense and representative of a new direction for MEMS at DARPA.