

PHOTONICS AND ELECTRO-OPTICS

The combined 1995 Photonics and Electro-optics (PEO) Thrust Area started in 1991 and 1992 as separate thrust areas in photonics and electro-optics. Each group recognized the importance of optical components and optical signal processing to current and future Department of Defense and civilian needs. As separate areas, the photonics activity centered attention on optical materials and devices, with some work in signal processing at the device level. Projects included devices with application in tactical missile guidance, strategic surveillance, laboratory test and evaluation, biomedical imaging, and assembly-line parts inspection. Particular attention was paid to the development of passive visible and infrared sensors and active microwave sensors for both imaging and non-imaging applications. The group devoted to electro-optics concerned itself with the broader picture of communications and signal processing at the systems level. Emphasis was placed on the capability first to encode optical signals using appropriate system or sensor sources and then to transmit these signals over selected optical paths and fibers. Projects included encryption, communication system component and subsystem development, direct chip-to-fiber coupling, and fiber-to-fiber communications.

As the programs evolved, the synergy between optical materials and devices and their end-use in communications, signal processing, and detection applications was recognized. The potential mutual benefits led to joint management in fiscal 1994 and then to the merging of the two thrust areas for fiscal 1995.

Fiscal 1994 efforts included applications of vanadium oxide, quantum wave effect studies, signal processing for coherent laser radars, multilevel quantum well interconnects, a laser Doppler velocimeter, microwave optical networks, holographic filters, and a reliability evaluation for active optical components. As the program evolved for 1995, we have stressed the interweaving of individual tasks or subprojects into major projects with critical mass funding. The combined PEO Thrust Area has identified two major projects for fiscal 1995: the Materials and Devices Project and the Signal Processing and Detection Project. Each will have three subprojects or tasks. The Materials and Devices Project consists of tasks on photo-refractive narrowband filters, aluminum gallium nitride solar blinds, and infrared photon sensing devices. The Signal Processing and Detection Project is divided into tasks on coherent laser radar, optical detection of flexible cable shapes, and detection of solder joints through time-resolved infrared radiometry.

The PEO Thrust Area and its precursors have made significant progress. Many interesting materials, devices, subsystem components, and systems have been developed. The work has led to follow-on sponsor-based funding in several areas, including photon encryption, microwave-optical signal distribution, and laser-based detection, modulation, and communications schemes. Many of the projects also have led to important results in the direct application of optics and optical techniques to APL hardware systems. Notable examples include results from studies of radiation susceptibility of optical fibers, reliability of optical components in stringent environments, and optical distribution of microwave signals, as well as several techniques for the modulation and detection of laser signals.

The PEO Thrust Area is an active, integrated program aimed at accelerating the use of optics, optical devices, and optical/electronic signals in APL systems. For 1995 alone, more than 15 projects, spanning the full range of optical techniques and applications, have been submitted to the program. Such projects, although not all may be appropriate for thrust area funding, indicate the strength and vitality of electro-optics at APL—a strength and vitality due, in part, to our Independent Research and Development Program.

THE AUTHOR



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for his technical achievements. Dr. Charles is President of ISHM—The Microelectronics Society. He has been the chair of the Electro-optics Thrust Area since its inception.