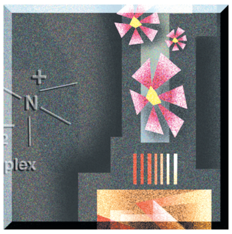

Sensor Development and Application at APL: Guest Editor's Introduction

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This *Technical Digest* is the second issue devoted to research and development on sensors and sensor systems. The previous issue on advanced sensors, Volume **16**(3), featured articles on acoustic, magnetic, optical, and chemical sensors as well as microelectromechanical systems. Our objectives for this issue are to broaden the coverage of sensor topics that are being developed at APL and present advances in their applications. Also featured is a representative set of sensor developments that highlight operational sensor applications in biomedicine.

Webster's dictionary defines a sensor as "a device that responds to a physical stimulus (as heat, light, sound, pressure, magnetism, or a particular motion) and transmits a resulting impulse." The articles in this issue give credence to that definition by exploring the use of sensors to measure magnetic, optical, chemical, and electromagnetic stimuli.

Two articles, by Spisz et al. and Iannuzzelli et al., report on the use of sensors in medical diagnostic work. They describe improved visualization tools for DNA and magnetic resonance imaging studies, and discuss sensing methods that could have a significant impact on medical research.

The next series of articles presents advances made in optical sensors and sensor systems. Bythrow and Oursler give an account of a sensor operating in a specific wavelength of the optical spectrum (589 nm). The authors developed this innovative optical sensor to detect exhaust gases generated by rockets, which enabled them to catalogue the characteristics of rocket burns. The work of Terry et al. discusses the authors' development of a long-wave mercury-cadmium-telluride camera to determine the surface temperature of sapphire. Their technique will help engineers fashion sapphire windows for infrared seekers. Finally in the series, the article by Le et al. features the design of a small spaceflight optical imager and addresses some of the engineering challenges faced by researchers to develop high-quality sensors in times of "faster, cheaper, better" programs.

Advances made in the development of a new type of magnetometer, originally invented at APL, are explored by Oursler et al. This xylophone magnetometer demonstrates great potential for the measurement of magnetic fields in space as well as for terrestrial applications. Its accuracy and resolution appear to be compatible with those of more conventional magnetic sensors (e.g., flux gate magnetometers) while being smaller in size.

The article by Arnold et al. presents a novel concept for chemical sensing using luminescence spectroscopy with optical fibers. The small size of this device and its high sensitivity look promising for the detection of chemical and biological agents. Next, Uy et al. report on the actual use of miniature quartz crystal microbalances for the detection of spaceborne contaminants. Their sensor successfully operated on the APL-developed MSX spacecraft, and the technology has led to major advances in the field of contamination sensors.

The last article, by Dumont et al., highlights the development of a new controller area network–based telemetry and command system that finds application in the control of scientific instruments and sensors onboard spacecraft. The authors' implementation of this technology on a small Air Force scientific satellite will yield the required spaceflight experience for future sensor data acquisition systems and lead to further reductions in size and power for future satellite use.

Obviously, research and development on sensors and sensor systems at APL covers many different disciplines. Hence, it was a challenge for the editors to select a representative set of articles from among the many sensor development efforts. The goal of this *Technical Digest* is to present a cross section of the multidisciplinary sensor development work at the Laboratory, with an emphasis on the stage of maturity of these achievements. Sensor research promises to create many additional opportunities for APL in arenas such as basic science research and development and technology transfer.

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