

# Los Alamos Science

LOS ALAMOS NATIONAL LABORATORY



*This issue is dedicated  
to the memory of  
John Wheatley*

# Inside This Issue

It is appropriate that this issue, devoted to frontier topics in science, technology, and technology transfer, be dedicated to the memory of John Wheatley, one of the great scientists and technologists of the twentieth century. His untimely death at age fifty-nine occurred before he and his Los Alamos collaborators, Greg Swift and Al Migliori, had completed the article on natural heat engines that appears in this issue. Natural engines are a departure from traditional heat engines in that their design capitalizes on irreversible processes instead of trying to minimize them. These are engines with no moving parts whose simplicity and reliability make them ideal for applications in space. John loved them because they could be understood on the basis of classical thermodynamics and their design took full advantage of nature's way of doing things. He lived to see the successful operation of the liquid sodium acoustic engine and would have been enormously pleased that the article on his pet project includes some good solid data on this particular natural engine.

Our experience with John bore out his reputation for meticulous care, sound pedagogy, and stubbornness in doing things the "right" way—which meant his way. Although enthusiastic about the initial draft written by our staff writer Roger Eckhardt (with help from Greg and Al), John, as predicted, chose to spend an entire week rewriting the manuscript so that it would contain the "right" approach to understanding the thermodynamic principles underlying the operation of natural engines. We are honored to be publishing this superb and easily accessible article.

John Wheatley was an important presence wherever he went, and his passing was a shock to all who knew him. To provide our readers with a glimpse of John and his numerous contributions to low-temperature physics, we organized a round table, shortly after his death, among those of his close collaborators who were then at Los Alamos. The title of the discussion, "Pushing The Limits," sums up

John's approach to everything he did at work and at play. We hope the portrait that emerges will convey at least in part the impact of this inspired and inspiring man.

One of John's great contributions to technology was to push the low-temperature frontier down to a few thousandths of a degree above absolute zero. Another important technological frontier is defined by the shortest time scale on which events can be measured and controlled. An article by Bob Hammond, entitled "Photoconductivity and Picosecond Signals," describes the breakthrough being made with photoconductors in generating and measuring electronic signals on picosecond time scales and in tracking time-varying radiation with picosecond accuracy. The picosecond rise and fall times of photoconductivity were not known until photoconductors could be stimulated by ultrashort laser pulses. The rapid response of photoconductors is being exploited by the Electronics Division at Los Alamos in ultrafast power switches for generating accurately timed, short-rise-time, high-power electrical pulses and in ultrafast radiation detectors that can follow the rapidly varying signals from laser fusion experiments and nuclear weapons tests. Perhaps the most exciting new photoconductive device is one that can measure the performance of tiny segments of integrated circuits. Such a device enabled Bob Hammond and his colleagues to observe for the first time the picosecond phenomenon of carrier-velocity overshoot that had been predicted by theory. This phenomenon may provide a basis for even faster integrated circuits.

Frontiers defined by cultures provided almost as much of an adventure to John Wheatley as those defined by technology. He took his low-temperature work to the far reaches of Argentina and to the scientific community of Finland and made his technological innovations available worldwide through his founding of the SHE Corporation. In this issue we report on another type of adventure in tech-

nology transfer, this time in the Caribbean Basin and with economic rather than scientific goals in mind. Los Alamos is a center of research in geothermal energy and in energy resources planning and development. The Caribbean Basin project is designed to transfer that expertise to countries in Central America and the Caribbean Islands whose economic difficulties might be alleviated by the development of indigenous energy resources. Bob Hanold and Verne Loose, leaders of this unusual project, along with about thirty-five geologists, geochemists, geophysicists, and economists, have been traveling back and forth between the Laboratory and the Caribbean Basin. They are working with local professionals to evaluate economic and energy needs and to explore and develop the most promising natural resources. Accompanying Bob's and Verne's overview of this precedent-setting project are a series of short pieces that describe the technical work being accomplished by Los Alamos scientists in the jungles and cities of Central America.

This issue closes with a reminiscence by Herb Anderson in honor of Nick Metropolis on his sixtieth birthday. It concerns the early days of one of the most important frontiers of our time, the frontier of electronic computing. Herb's wonderful stories of Nick's innovative work on the MANIAC with his many illustrious collaborators is somehow a fitting end to an issue dedicated to the memory of John Wheatley. ■



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Cover photo by John Flower. Stainless steel plates used in a liquid-to-liquid heat exchanger for the liquid propylene Stirling engine, one of several novel heat engines studied at Los Alamos.