ing and displaying sound waves near rigid spheres, cylinders and constrained elastic plates. These methods are useful in underwater acoustics applications such as detecting and locating submarines.

Waterhouse received a PhD in physics from the Catholic University of America in 1959. From 1951 to 1959 he was a research physicist at the National Bureau of Standards. In 1963 he joined the faculty at American University, where he is now professor emeritus of physics. He received a DSc from Oxford University in 1983.

Also at the November meeting, Ivan Tolstoy was presented with the Pioneers of Underwater Acoustics Medal for his "innovative studies in oceanic, atmospheric and seismic wave propagation." Among his achievements was the 1963 publication of a generalized theory of wave propagation in stratified media, which "provided the starting point for most astrophysical models of the waves in Jovian atmospheres," the award citation said. Tolstoy has also contributed to the theory of forward scattering at rough surfaces.

After receiving a PhD in geophysics from Columbia University in 1950, Tolstoy joined Columbia's Hudson Laboratories. He was a professor of ocean engineering at Hudson Labs when they closed in 1968. After that he held professorships at Florida State University, the University of Leeds and the Naval Postgraduate School in Monterey, California. In 1978 Tolstoy left academia and moved to Knockvennie, Scotland, where he continues to do research on acoustics and the history of science.

David M. Green of the University of Florida was selected to receive the Silver Medal in Psychological and Physiological Acoustics for his "outstanding experimental and theoretical contributions to hearing research and its methodology." The award citation praised Green's wide range of research in psychoacoustics, including his work on the application of signal detection theory, which has had "a profound influence on the methodologies used in experimental psychology." Green's current research involves the detection of small changes in complex acoustic spectra.

Green earned a PhD in psychology from the University of Michigan in 1958. He then held positions at MIT; the University of Pennsylvania; University of California, San Diego; and Harvard University. In 1985 he became a graduate research professor in the psychology department at the University of Florida.

ASA presented Wesley L. Nyborg of the University of Vermont with the Silver Medal in Physical Acoustics and Bioresponse to Vibration for his "technical contributions in the application of physical acoustics to biology and medicine." Nyborg has studied the thermal and nonthermal mechanisms responsible for biological effects of ultrasound. Since 1980 he has headed scientific committee 66 of the National Council for Radiation Protection and Measurements, which prepared a report entitled "Biological Effects of Ultrasound Mechanisms and Clinical Implications" and is now working on guidelines for patient exposure to ultrasound. The citation called Nyborg's involvement with the committee "perhaps his greatest single service" to the field.

Nyborg received a PhD in physics from Pennsylvania State University in 1947. In 1950 he joined the faculty at Brown University, and in 1960 he became a professor of physics at Vermont.

The Acoustical Society also presented its Distinguished Service Citation to Murray Strasberg for "over four decades of devoted service to the society, particularly as its secretary." Strasberg was a member of the ASA executive council from 1969–72; president from 1974–75; and secretary from 1987 to the present. He has also served on the editorial board and several committees of the society and has represented ASA on the AIP governing board.

Strasberg, a specialist in underwater acoustics and hydrodynamic noise, received a PhD in physics from Catholic University in 1956. He is currently a senior research scientist at the David Taylor Research Center in Bethesda, Maryland.

AAS DIVISIONS APPLAUD NOTABLE CONTRIBUTIONS

The division for planetary sciences and the division on dynamical astronomy of the American Astronomical Society recently recognized several individuals for outstanding contributions.

At the October meeting of the division for planetary sciences, Victor S. Safronov of the Institute of the Physics of the Earth in Moscow accepted the Gerard P. Kuiper Prize, which recognizes a scientist who has greatly advanced the understanding of the field. Safronov studied quantitatively the main stages of evolution of the solar nebula and helped develop the basic theory for the formation and interaction of planetesimals and the subsequent growth of planets.

Safronov earned his doctoral degree in physical and mathematical sciences in 1948. He then began working in the department of the origin of the Earth at the Institute of the Physics of the Earth. He became the department's head in 1983.

Also at the planetary sciences division meeting, David J. Tholen of the University of Hawaii received the 1990 Harold C. Urey Prize, which recognizes achievement by a young scientist. Tholen developed a taxonomy based on the optical properties of asteroid spectra that is now widely used in physical studies of asteroids. He has also studied and made extensive high-precision photometric observations of the recently concluded six-year-long series of mutual eclipse and occultation phenomena of Pluto and its satellite Charon.

Tholen received a PhD in planetary sciences from the University of Arizona in 1984. Since 1983 he has worked at the University of Hawaii's Institute for Astronomy, where he is currently an associate astronomer.

The AAS division on dynamical astronomy has selected Donald Lynden-Bell of the University of Cambridge to receive the 1991 Dirk Brouwer Award. Lynden-Bell, who will receive the award at an upcoming meeting of the division, has been prominent in the study of stellar dynamics during the past three decades. One of his major contributions was to the black hole accretion disk theory of quasars; he was among the first to argue that very massive black holes are the power source for quasars, a concept that is now the standard model for quasars. More recently he has been studying the perturbations of the velocity field of elliptical galaxies.

Lynden-Bell received a PhD in theoretical astronomy from Cambridge in 1960. From 1965 to 1972 he was a principal scientific officer at the Royal Greenwich Observatory. In 1972 he became a professor of astrophysics at Cambridge.

OBITUARIES

Robert N. Noyce

Robert Noyce died suddenly on 3 June 1990 at his home in Austin, Texas, where he had lived since becoming president of Sematech two years ago. His career as a physicist, inventor and entrepreneur was closely tied to the development of the semiconductor industry.

Noyce was born in 1927 in Burlington, Iowa. He received his undergraduate education at Grinnell College and got his PhD in physical electronics in 1953 under Wayne B. Nottingham at MIT. Upon graduating he began work on germanium transistor development at the Philco Corporation. There he formulated a technique for the controlled etching of very thin regions in a germanium crystal, thus facilitating the production of high-frequency transistors.

In 1956 Noyce joined the recently founded Shockley Semiconductor Laboratory, a Palo Alto subsidiary of Beckman Instruments. There he worked on the physics of silicon devices and the technology necessary for their production. His paper on space-charge-generated currents in silicon p–n junctions, written with William Shockley and Chih Tang Sah, gave the first explanation of the voltage–current characteristics of junctions in silicon and was an important foundation for the further development of transistors and related devices. Noyce left Shockley Semiconductor in 1957 and became one of the founders of Fairchild Semiconductor Corporation (which in 1959 became the semiconductor division of Fairchild Camera and Instrument Corporation).

In 1959, while director of research and development at Fairchild, Noyce conceived a way to build a practical integrated circuit. Noyce realized that by adding to a silicon wafer extra junctions to isolate transistors, diodes and resistors from one another, and then interconnecting these circuit elements using metal films insulated by a silicon oxide layer, one could produce a monolithic structure that performed a complete circuit function—the integrated circuit. Shortly thereafter, Texas Instruments announced that Jack Kilby had built a circuit containing several elements in a germanium crystal. Generally Noyce and Kilby are credited as coinventors of the integrated circuit, although their work was completely independent and very different in detail.

In 1959 Noyce became the general manager of Fairchild, giving him the opportunity to guide the corporation in exploiting his invention. Fairchild soon became the leading producer of integrated circuits, and it remained so during much of the 1960s. Throughout this period Fairchild continued to make contributions to technology and business development. Fairchild scientists attained an understanding of the silicon–silicon oxide interface that enabled the corporation to make stable MOS devices. They also invented CMOS circuitry, came up with

Robert N. Noyce

the idea of gate arrays for the economical production of small quantities of logic functions, and designed a host of digital and analog circuits.

The early market for integrated circuits was slow to develop. So Noyce, who appreciated the potential price elasticity of integrated circuits, announced that Fairchild would sell the chips at a price lower than the sum of the costs of the individual components that would be necessary to make an equivalent circuit. This policy helped trigger the explosion of the integrated circuit market.

In 1968 Noyce left Fairchild and cofounded Intel Corporation to pursue opportunities in large-scale integration. He was Intel's president and chief executive officer until 1975. During his period at Intel, the company introduced the principal semiconductor memory types—DRAM, SRAM and EPROM—as well as the microprocessor.

Once Noyce had turned over the day-to-day management of Intel, his broader interests in the electronics industry and its relation to government and society consumed an increasing portion of his time. By offering his technical and business advice, he nurtured a number of technology-based companies in Silicon Valley. He was among the first to appreciate the increasing importance of foreign competition in electronics and the weaknesses of American companies in that competition. He dedicated much of the last dozen years of his career trying to improve the competitiveness of US-based industry. Noyce was a familiar and effective figure in Washington, a founder of the Semiconductor Industry Association and a tireless advocate of change—in education, capital formation, the tort system and other areas—aimed at removing impediments to US competitiveness.

He was on the board of trustees of Grinnell College from 1962 until his death, and served as its chairman from 1966 to 1970. He was also a regent of the University of California.

Noyce played a prominent role in the formation of Sematech, which represented a unique attempt to foster cooperation among semiconductor companies and the US government in an effort to increase competitiveness in manufacturing. When the search committee (of which Noyce was chairman) could not identify someone to be Sematech's first chief executive officer, Noyce responded to the urging of his colleagues in the industry and agreed to take on the responsibility himself. As he put it, "It was just too important a job to leave to others."

Although Noyce's technical contributions to the integrated circuit are what earned him his long list of prizes and fellowships, his many friends best remember him as someone who was always approachable, always interested in their problems and ideas, and always ready with suggestions—often involving innovative and unusual approaches at odds with conventional wisdom. In my 34 years of association with Noyce, many of his suggestions proved invaluable in helping my work along.

Noyce was totally involved in living. He was a good athlete—a champion diver in college and an excellent skier—and he loved scuba diving, hang gliding and piloting his airplanes, which ranged from an ancient Seabee to a private jet. In fact, he was scheduled to leave Austin to pick up his new jet the very afternoon he died. It was a plane that would be able to fly nonstop from Austin to either Washington, DC, or Silicon Valley.

GORDON E. MOORE
Intel Corporation
Santa Clara, California

John M. Eggleston III

The news that John Eggleston, 34 years old and at the height of his career, had been killed in an automobile accident on 28 January 1989 near Stevens Pass, Washington, came as a shock to the laser community.

John received an MS in electrical engineering in 1981 and a PhD in applied physics in 1983, both from Stanford University. His doctoral dissertation, "Theoretical and Experimental Studies of Slab Geometry Lasers," started the resurgence in the use of zigzag slabs for high-power solid-state lasers. While at Stanford,