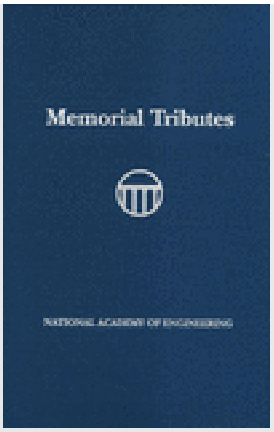

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FOREWORD

THIS IS THE EIGHTEENTH VOLUME in the *Memorial Tributes* series compiled by the National Academy of Engineering as a personal remembrance of the lives and outstanding achievements of its members and foreign members. These volumes are intended to stand as an enduring record of the many contributions of engineers and engineering to the benefit of humankind. In most cases, the authors of the tributes are contemporaries or colleagues who had personal knowledge of the interests and the engineering accomplishments of the deceased.

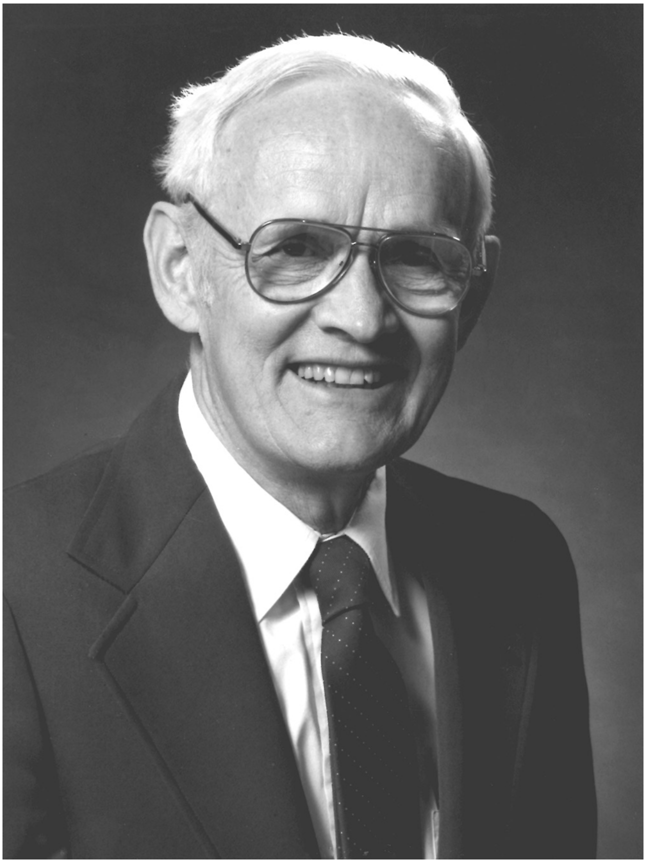
Through its members and foreign members, the Academy carries out the responsibilities for which it was established in 1964. Under the charter of the National Academy of Sciences, the National Academy of Engineering was formed as a parallel organization of outstanding engineers. Members are elected on the basis of significant contributions to engineering theory and practice and to the literature of engineering or on the basis of demonstrated unusual accomplishments in the pioneering of new and developing fields of technology.

The National Academies share a responsibility to advise the federal government on matters of science and technology. The expertise and credibility that the National Academy of Engineering brings to that task stem directly from the abilities, interests, and achievements of our members and foreign members, our colleagues and friends, whose special gifts we remember in these pages.

Thomas F. Budinger
Home Secretary

Memorial Tributes

NATIONAL ACADEMY OF ENGINEERING



John S. Anderson

JOHN E. ANDERSON

1929–2012

Elected in 1991

"For combining novel engineering concepts with combustion science to reduce atmospheric pollution and improve fuel efficiency in industrial combustion processes."

BY RAY ROBERGE AND SHO KOBAYASHI
SUBMITTED BY THE NAE HOME SECRETARY

JOHN ERLING ANDERSON, a leading high-temperature industrial process scientist and former senior corporate fellow of Praxair, Inc., died on November 4, 2012, at the age of 83.

John was born on March 12, 1929. Raised in Hingham, Massachusetts, he grew up in the same close-knit Swedish community as his wife Karin. Their fathers were immigrants who worked at the Fore River Shipyard in Quincy, Massachusetts. John's father did not have a formal higher education, but he had a love of mathematics that he shared with his son, making up mathematical games as they did chores together.

John received a scholarship to the Massachusetts Institute of Technology and graduated with a BS in chemical engineering in 1950. He went on to attend the Illinois Institute of Technology, where he received an MS in chemical engineering in 1951, then returned to MIT, where he received his ScD in 1955. He felt privileged to have E.R. Gilliland as his doctoral thesis advisor and to be a teaching assistant for "Doc" Lewis. He also felt that he benefited greatly from attending MIT with returning World War II veterans, who were serious about their studies and set high standards.

In 1954 John joined Linde Air Products Company, a division of Union Carbide and Carbon Corporation, in Tonawanda, New York, where he worked in the area of high-temperature chemistry and specializing in the properties of high-pressure (1 atm and up), high-current plasma arcs. In 1956 he transferred to the Linde Research Laboratory in Speedway, Indiana, and in the early 1960s invented a high-intensity light source by dynamically "squeezing" an arc in a quartz tube, attaining temperatures of 20,000–30,000°F. This technology was used in pumping early-generation solid state crystal (e.g., ruby lasers). His work also included an arc torch process for manufacturing acetylene, a laser welding process, and several arc welding processes.

In 1965 he transferred to the Linde Development Lab in Newark, New Jersey, where he concentrated on applied research and the development of commercially viable applications. He invented the PUROX municipal waste disposal process that pyrolyzed solid waste into fuel gas, liquid, and inert slag in a shaft furnace. This was the beginning of his pioneering work on high-temperature industrial combustion applications, and in 1974 he received *Chemical Engineering Magazine's* Merit Award for Personal Outstanding Achievement in recognition of the PUROX process.

In 1969 John was named a Union Carbide Corporate Fellow and moved with Gas Products Development to the new Technical Center in Tarrytown, NY. There he began working on the concept of using oxygen, instead of air, in high-temperature industrial furnaces to achieve fuel savings and reduce pollution. To overcome the problem of extremely high flame temperature and high NO_x emission of oxy-fuel combustion, he invented the "aspirator" burner, applying a novel engineering concept. The "A" burner had commercial applications in many industrial furnaces such as steel heating, aluminum melting, and glass melting.

Thanks to the successful application of the "A" burner technology for hazardous waste incinerators to clean up Superfund sites, Union Carbide received the 1989 Kirkpatrick Chemical Engineering Achievement Award. As a result of this work, John became a Union Carbide Senior Corporate Fellow in 1982, was named "Inventor of the Year" by the New York Intellectual Property Law Association in 1989, and was elected to the National Academy of Engineering in 1991.

John's later work explored high-velocity coherent jets and high-temperature turbulent jets. He found new applications utilizing unique jet properties, leading to the development and commercialization of the CoJet® coherent jet gas injection system, which is now the preferred method for injecting oxygen in electric arc furnace steelmaking—over 80 percent of these furnaces today use this technology. John also developed the hot oxygen burner that is now a platform technology with commercial applications in emission control, partial oxidation, and rapid burnout of various fuels.

In addition to his corporate work, in 1977 John gave a January course of four lectures at MIT on "Heat Transfer from Flames, Arcs, Lasers, and Electron Beams," which he enjoyed very much. After his retirement in 1999, he remained an active consultant to Praxair until 2001 when the Tarrytown laboratory closed. His desire to contribute through technical innovation was strong throughout his 47-year career at Union Carbide and Praxair (which was spun off from Union Carbide and became a separate company in 1992). He was the inventor or coinventor of 44 US patents and authored or coauthored numerous papers. He was a role model and mentor to many young engineers throughout his years at Praxair. He is greatly missed.

John loved the outdoors, especially camping and hiking with his family. He enjoyed books, music, and Broadway shows. He was an excellent bridge player.

He is survived by his wife Karin, their four children—Lynn Seirup, Kristin Sands, Claire Dunn, and Mark Anderson—eight grandchildren, and four great-grandchildren.

DAVID H. ARCHER

1928–2010

Elected in 1989

"For leadership in developing coal-based energy systems."

BY NADINE AUBRY

DAVID H. ARCHER, an influential engineer, talented musician, family man, and devout religious believer, passed away on June 24, 2010, at the age of 82.

David was born in 1928 in Pittsburgh, Pennsylvania, and grew up in the West View neighborhood. His father, who was of English descent and had earned a law degree from Duquesne Law School, was a distribution manager at the Pittsburgh *Post Gazette.* His mother, of German descent, received a degree in education and taught high school before their marriage. David attended West View High School where he distinguished himself as a top student who occasionally served as the substitute teacher when the teacher could not come to class. David won a Westinghouse fellowship to Carnegie Institute of Technology (Carnegie Tech, the precursor of Carnegie Mellon University) along with fellow Westinghouse scholar John Nash. At Carnegie Tech, David studied chemical engineering and mathematics and earned his bachelor's degree in 1948. He then attended graduate school at the University of Delaware, from which he received a doctorate degree in chemical engineering in 1953.

David met his wife, Justine Garnic Archer, at Carnegie Tech. It was customary in those days to post students' grades on a public board. When David saw Justine's name at the top of the female student list, he was determined to meet her and, as soon as he saw her, decided to marry her. They continued their relationship while earning their graduate degrees at different colleges and married when David was studying for his doctorate at the University of Delaware. Throughout David's career, Justine was a strong support to him, both personally and professionally.

After receiving his PhD, David returned to Carnegie Mellon University (CMU) in 1953 as an assistant, and then associate, professor in chemical, mechanical, and nuclear engineering. He taught numerous courses in metallurgy, thermodynamics, fluid flow, heat transfer, process control, engineering analysis, thermal systems analysis, energy conversion, and nuclear engineering. Justine also taught at Carnegie Tech for a short time before the birth of their first daughter.

In 1960 David left academia to join Westinghouse Electric Company, where he worked for more than 30 years. He became world-renowned for his leadership and contributions to the production of innovative equipment, systems, and services for practical applications in the areas of fuel (both fossil and nuclear) and energy production. From 1960 to 1970, he initiated and directed the fuel cell power plant development project, including the design of cells and production processes. He was awarded a 10-year, $6 million project from the US Office of Coal Research to support this program and raised additional funding from the US Department of Defense and National Aeronautics and Space Administration. Over the next 14 years (1970–1984), he initiated and directed novel work on fluidized bed combustion for which he received a 13-year, $10 million contract from the Environmental Protection Agency. He also initiated a project in coal gasification and directed the design, installation, staffing, and operation of a coal gasification pilot plant, a project for which he obtained a $45 million grant from the US Department of Energy (DOE). During that time, David also managed projects on uranium production, nuclear fuel manufacture, and nuclear waste disposal. Later (1984–1990), he made important contributions to alternative energy systems, such as the design and production of plants based on biomass gasification and solar power. In 1983 Westinghouse awarded him the Order of Merit, its highest corporate achievement award, in recognition of his work on fuel cell and coal gasification development. He retired from Westinghouse in 1990.

David had an extraordinary passion for research and teaching and returned to CMU in 1991 to enrich young minds and conduct research. He worked there full-time until his death. His CMU association involved both mechanical engineering and architecture, with his fundamental interest lying in the efficient and environmentally friendly use of energy. Until the time of his passing he worked very hard for many hours every day, teaching a fuel cell course in mechanical engineering and performing research at the Advanced Building System Integration Consortium in the School of Architecture to develop advanced energy supply systems for buildings. The Combined Heat and Power Laboratory supporting the Intelligent Workplace has since been designated the David Archer Laboratory in his honor. Throughout his career at both Westinghouse and CMU, David was a prolific scholar, producing more than 85 publications and 21 patents.

David was elected to the National Academy of Engineering in 1989 and participated in several of its advisory committees. One of these led to the establishment of the ENERGY STAR program, which strongly influences the efficiency of major household appliances; other committees addressed the disposal of chemical weapons. He served on the American Society of Mechanical Engineers (ASME) committee in preparation for the PTC 47 Integrated Gasification Combined Cycle Performance Test Code and PTC 50 Fuel Cell Power Systems, as well as the National Research Council committee that reviewed the US DOE/NETL (National Energy Technology Laboratory) Vision 21 Program, which was overseeing the destruction of the US Army's stockpile of chemical weapons. David was also a member of the American Institute of Chemical Engineers, American Chemical Society, American Association for the Advancement of Science, American Society for Engineering Education, Combustion Institute, and New York Academy of Sciences.

Throughout his life David's other vocation was music. He was as passionate about his music as he was about his scientific work. As a boy he studied piano at the Pittsburgh Musical Institute. When his interest shifted to the organ and sacred music, he milked cows on his grandfather's farm to raise money for organ lessons. While studying at the University of Delaware, he played the organ both at Newark Methodist Church and First Presbyterian Church in Newark. He recruited and worked with groups of guest brass and string musicians regularly during his 25 years as organist/choirmaster at Berkeley Hills Lutheran Church in Pittsburgh (1954–1979), a tradition he continued at Mt. Zion Evangelical Lutheran Church in Pittsburgh and Emanuel's Lutheran Church in Bellevue. During the summers of 1971–1978, he was honored to be the guest organist at Trinity Episcopal Cathedral in downtown Pittsburgh. At the time of his death, he was the organist/choirmaster at Emanuel's Lutheran Church. He had been a member of the American Guild of Organists for 60 years. His extensive collection of sacred music is housed in a library at the Lutheran Synod Office in Pittsburgh.

David's continued search for excellence in all areas was apparent throughout his life. As his pastor said at his funeral, "If David were alive, we would be singing all twelve verses of the hymn."

David Archer was a giant in the area of novel systems and equipment for fuel processing and energy production, and his passionate character and large impact on the field will be forever remembered. He is greatly missed.

David's wife Justine predeceased him in 1973. He is survived by his longtime friend and companion Myrna Rombach; sister Miriam (Mimi) Archer Jeske; his four daughters, Catherine Archer, Miriam (Mac) McCann, Amy Archer, and Marsi (Lance) Thrash; his grandchildren Charles, Andy, Justine, and Vivian McCann, and Jordan David, Tim, and Bailey Thrash; and six great-grandchildren.

RICHARD E. BALZHISER

1932–2012

Elected in 1994

"For leadership in the management of energy research and technological development."

BY KURT YEAGER
SUBMITTED BY THE NAE HOME SECRETARY

RICHARD E. BALZHISER, energy technology leader and former CEO of the Electric Power Research Institute (EPRI), died on December 23, 2012, at the age of 80 after a long battle with Alzheimer's disease.

Dick was born and raised in Wheaton, Illinois, where he was an outstanding student and a star athlete at Wheaton High School. He continued to excel in both the classroom and on the football field at the University of Michigan, where he received BS and PhD degrees in chemical engineering and an MS in nuclear engineering. In 1952 he became the university's first football player to earn first-team academic all-American honors, and two years later he was awarded the Big Ten Medal of Honor for his accomplishments in the classroom and on the football field. A brilliant and ambitious student, Dick graduated at the top of his engineering class.

Motivated by both a desire to give back to the university and an interest in public service, Dick joined the Michigan University Chemical Engineering Department in 1961 and became chair in 1970. He was also twice elected to the Ann Arbor City Council and was named an outstanding young leader in the state of Michigan. In 1967, he was selected as a White House Fellow; he served as an assistant to Secretary of Defense Robert McNamara and participated in a number of important assignments, including a comprehensive assessment of the nation's commitment to the Vietnam War that came to be known as the Pentagon Papers.

From 1971 to 1973 Dick was assistant director in the White House Office of Science and Technology, responsible for energy, environment, and natural resources. Under President Nixon, he directed a comprehensive study of energy technology following the first Energy Message. His leadership of these early deliberations led to the creation of the Federal Energy Administration, the Energy Research and Development Administration, and, later, the Department of Energy. He also chaired the US Energy Technology Committee that opened relations with the USSR in 1972–1973.

While serving in the Office of Science and Technology, Dick met Chauncey Starr, the commercial nuclear technology innovation leader who answered the call from Congress to create EPRI, an independent research and development organization, in 1972. Dick was very inspired by Dr. Starr, EPRI's first president, and the challenges and opportunities that the institute presented as the nonprofit public service organization managing a $500+ million/year collaborative research and development program on behalf of electric utilities nationwide and around the world.

Dr. Balzhiser joined EPRI in 1973 as the first technical director of the Fossil Fuels and Advanced Systems Division, and he and his family moved to Menlo Park, California, shortly thereafter. He then very effectively launched and developed EPRI's advanced fossil fuels electricity generation and environmental control development programs. Throughout his EPRI career, he recruited and inspired outstanding experts who made the institute a widely recognized world leader in electricity R&D. He became EPRI's vice president of research and development in 1979, executive vice president in 1987, and president in 1988. His tenure in this position coincided with a time of major pressure on EPRI due to federal and state electric utility policy and regulatory actions. He did an excellent job of maintaining EPRI's R&D leadership and funding during this difficult period, and actually grew its membership to include over 90 percent of the electricity generated and sold in the United States and in more than 30 countries worldwide.

After retiring from EPRI in 1996, Dick remained active as president emeritus while serving on the boards of Reliant Energy, Aerospace, Electrosource, and Nexant. Throughout his career he served on numerous scientific and technical advisory boards for government agencies, the National Academies, and universities; these included the National Academy of Sciences Academy-Industry Program, the University of Michigan College of Engineering National Advisory Committee, the Department of Energy's Energy Research Advisory Board, the Energy Systems and Policy Editorial Board, and the Forum for Applied Research and Public Policy Editorial Board. He was also a director of Houston Industries Inc. and trustee of the Aerospace Corp.

In addition, Dr. Balzhiser continued to serve as an expert on energy studies requested by the White House for the Presidential Committee of Science and Technology. And he was a member of the Woods Hole Oceanographic Institution advisory board, the University of Texas at Austin Natural Sciences Foundation advisory council, the technical advisory board of the Massachusetts Institute of Technology Energy Laboratory, the board of directors of the US Energy Association, the Council of Consortia CEOs, the Council on Competitiveness, and the Conference Board. He chaired the World Bank's Energy Technology Steering Committee in 1998–2001.

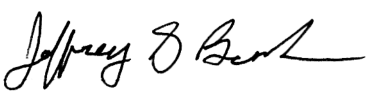
Dick received the University of Michigan Chemical Engineering Inaugural Alumni Society Merit Award in 1992 and in 1994 was elected to the National Academy of Engineering. In 1995, he was selected for the Eminent Engineer Award by Tau Beta Pi, the Engineering Honor Society, and the Bay Area Engineering Council. In 2002 he was inducted into the Verizon CoSIDA Academic All-America Hall of Fame, in a ceremony at the New York Hilton Hotel, to recognize his "accomplishments in academics, athletics, professional career, and community service." This was a particularly memorable event for him, his wife Christine (who sadly passed away in

2007), and his children and grandchildren who were able to attend and share in the recognition. Finally, he was honored to receive the Lifetime Achievement Award from the University of Michigan for his distinguished contributions both to the university and to society at large.

He authored two prominent text books on thermodynamics, spoke and lectured frequently to utilities, universities, and public groups, and wrote numerous technical and policy papers on energy-related subjects. He is featured in *Who's Who in America* and *Who's Who in Science and Technology.*

Even after the onset of Alzheimer's disease, Dick remained quite active for some time and continued to play golf with close friends and former colleagues.

He is survived by daughters Michele and Patti, sons Bob and Gary, grandchildren Jeffrey, Kristin, Gregory, Lacey, Lindsey, and Megan, and great-grandson Brayden. His love and commitment to family will be remembered by all of them. A memorial service was held on January 22, 2013, at the Valley Presbyterian Church in Portola Valley, California, where many of Dick's personal and professional friends honored him and gave his family their deepest sympathy.



JEFFREY S. BECK

1962–2012

Elected in 2011

"For discovery and commercialization of selective, environmentally beneficial catalytic routes to major petrochemicals and for leadership in industrial engineering."

BY JOSÉ G. SANTIESTEBAN AND MICHAEL P. RAMAGE

JEFFREY SCOTT ("Jeff") BECK, recognized as an outstanding industrial researcher and leader who made seminal contributions to both industrial and academic scientific communities, passed away on April 7, 2012, in Houston, Texas, with his wife, family, and close friends at his side.

Born on October 23, 1962, in Brooklyn, New York, to Irwin and Leila Beck, Jeff grew up in Queens, NY. From a very early age, he was a "ball of fire" who displayed a dedication to science and discovery. He earned a BS degree in chemistry at State University of New York at Binghamton in 1984 and, true to his high school yearbook's prediction, a PhD in inorganic chemistry, from the University of Pennsylvania in 1989.

Jeff was blessed with an amazing combination of scientific, engineering, and business skills. He had a tremendous capacity to make breakthroughs at the forefront of science, the engineering skills to translate science into profit for the company, and the visionary leadership to manage a worldwide marketing organization. His career in ExxonMobil advanced rapidly, and he had significant potential to advance to senior management positions in the company.

Jeff's professional career began at Mobil's Central Research Laboratory, in Pennington, New Jersey, immediately after he received his PhD. He loved to be in the laboratory doing the experiments himself, shoulder-to-shoulder with his technicians. In the first eight years of his professional career he made scientific and technical contributions that most researchers do not achieve in a lifetime.

His groundbreaking research on liquid crystal templating was key to the discovery of an entirely new class of tunable mesoporous materials, MCM-41S, with pore sizes in the range of 16 to 100 Å. For his part in the discovery of these materials, a major innovation in nanotechnology as well as in the fields of mesoporous and self-assembled materials, he received, together with collaborators Charles Kresge, James Vartuli, Wieslaw Roth, and Michael Leonowicz, the 1994 Donald W. Breck Award of the International Zeolite Association. His work spawned a new field of materials chemistry and has led to the discovery of hundreds of related materials with applications in catalysis, separation science, and nanotechnology.

Jeff coauthored two seminal articles describing the scientific basis that led to the discovery of mesoporous materials: "Ordered Mesoporous Molecular-Sieves Synthesized by a Liquid-Crystal Template Mechanism," *Nature,* 1992, 359(6397): 710–712; and "A New Family of Mesoporous Molecular-Sieves Prepared with Liquid-Crystal Templates," *Journal of the American Chemical Society*, 1992, 114(27): 10834–10843. The thousands of citations (>13,500, Science Citation Index) of these papers by academic and industrial scientists testify to the impact of this breakthrough discovery in the scientific community.

Many colleagues described Jeff as "a tireless leader of bridging emerging science and technology with practical applications." His research in "molecular engineering" of zeolites and the interplay between reaction pathways, kinetics, and mass transport in microporous materials led to several commercial processes for the selective production of paraxylene. His fundamental studies enabled him to tailor the diffusion properties of catalysts by using novel surface modification techniques. He also conducted detailed kinetic and mechanistic studies to establish the performance of catalysts during scale-up and commercialization efforts.

Some of the commercial technologies based on Jeff's work are PxMax™ (toluene to paraxylene) and XyMax™, which are considered landmark technical achievements and the world's most selective processes for production of paraxylene. They have been deployed worldwide in more than 20 units, with more planned, and have been recognized not just for their rather significant economic impact but also for their environmental benefits—in reducing the energy required to produce paraxylene—and their societal benefits—in enabling the lower-cost production of the key component used in the production of polyethyleneterephthelate (PET), one of the world's most widely used polymers. Jeff and his colleagues were recognized for their outstanding contributions with the 2003 Thomas Alva Edison Award of the New Jersey Research and Development Council, the American Chemical Society 2007 Heroes of Chemistry Award, and the North American Catalysis Society 2009 Eugene J. Houdry Award in Applied Catalysis.

Immediately after the merger of Exxon and Mobil in 2000, Jeff became director of catalyst technology and led efforts to merge the catalyst R&D technologies of the two companies to address refining and chemical products manufacturing needs. In 2004 he transferred to ExxonMobil Baytown Refinery in Texas and held the position of refinery technical manager. His leadership and communication skills were instrumental in improving both the synergies between refinery and chemicals plant and the profitability of the largest refinery in the United States.

Jeff talked vividly about his two-year assignment in the refinery and his respect for the commitment to excellence of engineers, chemists, and operators working in the manufacturing sites. He was proud of how well he worked with the refinery personnel during the preparation for Hurricane Rita and the subsequent disaster recovery efforts.

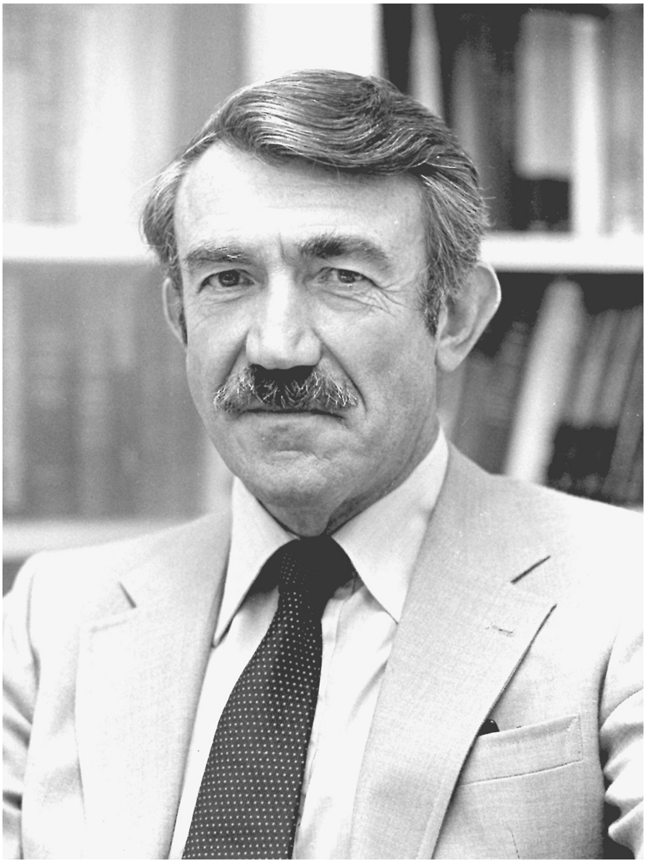
After two years in Texas, Jeff landed his dream job as manager of ExxonMobil's prestigious Corporate Strategic Research, in Annandale, New Jersey, where he directed the technical efforts of over 250 scientists, engineers, and technicians in broad areas of energy and petrochemical science critical to the company's worldwide Downstream, Chemical, and Upstream businesses. He was instrumental in setting the direction of research programs on renewable energy and the reduction of carbon emissions.

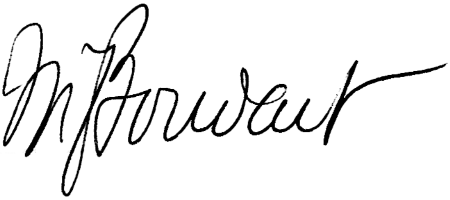
His last assignment was as polyethylene global marketing manager at ExxonMobil Chemical Company in Houston, where he led strategic marketing projects and spearheaded efforts aimed at the sustainability of chemical products.

Jeff was well known worldwide for his contributions to catalysis and materials science. He was named as inventor or coinventor on more than 60 US patents, and authored or coauthored 46 refereed journal articles and 3 book chapters. He frequently delivered invited lectures at US and international universities and conferences. Among the numerous awards he received, he was particularly proud of his election to the National Academy of Engineering. He was among the youngest ever elected to the NAE.

In addition to being a creative and prolific scientist, an inspirational leader, and a renowned inventor and innovator in his field, Jeff was a passionate speaker and an engaging storyteller with a great sense of humor. And while he enjoyed the thrill of discovery and commercialization, he was also a wonderful negotiator who looked for the "win-win" in every deal. This was as true in his dealings with companies he collaborated with as in his approach to deals concerning his art and furniture collections.

Jeff was a devoted husband and friend. The loves of his life were his wife Lisa, his sister Shari, and his dogs Pharaoh and Monty. Though he was taken from this world too soon, his loved ones can take comfort in knowing that he lived his life fully and the way he wanted. He demanded excellence, did not tolerate mediocrity, and inspired all who were fortunate enough to know him. His family, friends, and colleagues will remember him as a remarkable individual. We feel blessed to have had him with us. Jeff is survived by his wife Lisa, parents Irwin and Leila, sister Shari, and brother Richard.





MICHEL BOUDART

1924–2012

Elected in 1979

"For contributions to structure, catalysis and chemical reactions surfaces."

BY ANDREW MYERS
Printed with the permission of the
Stanford University School of Engineering
SUBMITTED BY THE NAE HOME SECRETARY

MICHEL BOUDART, a professor emeritus of chemical engineering at Stanford University and for five decades one of the world's leading experts in catalysis, died May 2, 2012, at an assisted living center in Palo Alto of multiple organ failure. He was 87.

Boudart played a crucial role in establishing the reputation of Stanford's Chemical Engineering Department. The central theme of his research was the catalytic properties of metals, particularly small metal particles. Catalysis is the study of chemical processes by which one substance, the catalyst, promotes a reaction among other substances without itself changing. Boudart essentially brought catalysis, as a science, to chemical engineering in the United States and was an international ambassador for the field throughout his career.

"Michel Boudart was a world-renowned and influential expert in the field of catalysis who brought Stanford University chemical engineering to prominence and trained several decades of students," said Andreas Acrivos, a fellow professor at Stanford and now professor emeritus at Stanford and City College of the City University of New York. "He left a legacy that would be difficult to replicate."

As a professor, Boudart supervised what was consistently one of the larger groups of PhD candidates in the department, eventually guiding more than 70 doctoral candidates to their degrees and mentoring over 100 postdoctoral researchers and visiting scientists. The diaspora of his former students went on to lead and shape the field.

Top Student and World Traveler

Boudart was born June 18, 1924, in Brussels, Belgium. He was 16 when Hitler's Panzer divisions attacked his homeland in 1940. He had been accepted to the University of Louvain, but the university was closed because of the war. To avoid being drafted or sent to German factories, he worked as a volunteer stretcher-bearer for the Red Cross.

During the war Boudart had private tutoring to prepare for Louvain. When the university reopened, he graduated in three years at the top of every class, save mathematics, where he was outdone only by his dear friend, the late Professor René de Vogelaere of the University of California, Berkeley. He earned his bachelor's degree in 1944 and his master of science in 1947. He then left Belgium to attend Princeton University, where he took his PhD in chemistry in 1950.

Boudart held faculty positions at Princeton until 1961 and, for three years, at Berkeley before joining the Stanford faculty in 1964. He chaired Stanford's Department of Chemical Engineering from 1975 to 1978 and also held visiting professorships at universities in Louvain, Rio de Janeiro, Tokyo, and Paris. He became professor emeritus in 1994.

An avid international traveler, Boudart and his wife, Marina, boasted friends across the world. His office sported Japanese shoji screens, abstract prints, overstuffed sofas and—occupying one entire wall—an immense periodic table of the elements printed in Russian, which he read with ease. He was described as a "gentleman scientist."

He cited as his personal philosophy a quote from French literary theorist Roland Barthes that loosely translates as "No power, a little knowledge, a little wisdom, and as much flavor as possible."

Guiding Force

In the post–World War II era, the United States became the acknowledged leader in catalysis, mostly owing to advances flowing from American academia and industry. Boudart was at the center of it all. In a published interview, he laid out his case: Without catalysis, he said, “Our satellites could not be maneuvered, our autos would pour out all the noxious chemicals we’ve spent years guarding against, our telephone links with the rest of the world would be seriously impeded.”

In 1974, in the wake of the first oil crisis, Boudart and two associates founded Catalytica in Santa Clara, California. The company worked on highly complex catalytic problems for petrochemical, chemical, and pharmaceutical firms as well as government agencies. “[Catalytica] started in the catalysis consulting field, a service made clearly necessary by the oil crisis,” Boudart said at the time. “One of the critical areas was in synthetic fuels.” The company grew over the following three decades into a number of subsidiaries.

Prolific Author

Boudart authored or coauthored more than 280 journal articles and served on the editorial boards of at least 10 journals. His book *Kinetics of Chemical Processes* (1991) is a standard reference and was translated into Japanese, Spanish, and French, and *Kinetics of Heterogeneous Catalytic Processes* (prepared with contributor Gérald Djéga-Mariadassou) was published in French in 1982 and translated to English in 1984. He was coeditor in chief of *Catalysis Science and Technology,* a series of 11 volumes. He held four patents.

Recognized Leader

Accolades and awards were showered on Boudart throughout his life, but particularly in the later years of his career, when the scale of his impact became clear. In 1985 the University of Utah hosted a 5-day symposium on catalysis in his honor. In 2005 the *Journal of Physical Chemistry* dedicated an entire issue to his legacy. And in 2006 the Danish company Haldor Topsøe sponsored the Michel Boudart Award for the Advancement of Catalysis, which is administered jointly by the North American Catalysis Society and the European Federation of Catalysis Societies.

His election to both the National Academy of Sciences and the National Academy of Engineering reflected his leadership and scientific merit. He was also a fellow of the American Association for the Advancement of Science, the American Academy of Arts and Sciences, and the California Academy of Sciences, and a foreign member of the Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgique and its Royal Belgian Academy Council for Applied Sciences.

He received honorary doctorates from the University of Liège, the University of Notre Dame, the University of Ghent, and the Institut National Polytechnique de Lorraine.

Boudart is survived by a daughter, Iris Harris, of Whittier; three sons: Marc of Aptos, Baudouin of Atherton, and Philip of Palo Alto; and grandchildren Marina and Clint Harris and Jesse, Louise, and Noella Boudart. His wife, Marina d'Haese Boudart, died in 2009. A second daughter, Dominique, died in childhood.

HARRY E. BOVAY JR.

1914–2011

Elected in 1978

"For contributions to expansion of knowledge in the energy field including power generation and utilization, and leadership in petrochemical plant development."

BY RONALD R. KLINE
SUBMITTED BY THE NAE HOME SECRETARY

I met Harry Bovay in 1988, shortly after I arrived at Cornell's College of Engineering as an assistant professor in the history of technology. The dean of the College, Bill Streett, asked me when I was hired if I would teach a class on engineering ethics because there was an alumnus, Harry Bovay, class of '36, who wanted to support engineering ethics at Cornell. I replied that I was happy to develop such a course by supplementing my historical research on codes of engineering ethics by working with the Ethics and Public Life Program at Cornell, then headed by Henry Shue, and the Science, Technology, and Society Program, then headed by Walter Lynn, who taught engineering ethics to masters of engineering students in civil engineering.

When Harry came for a visit in 1988, I met him at the Statler Hotel with Walter, who had known Harry for some time. At first I did not know what to make of this friendly, rather folksy old engineer and CEO, until we started talking about engineering ethics. Then I realized the intelligence and sharp wit of Harry Bovay and that he had a real passion for this topic, having served as president of the National Society for Professional Engineering in the 1970s.

During my first years at Cornell, Harry visited regularly, often accompanied by his wife Sue and by Mike Stevens, his lawyer and friend. What struck me was that Harry was genuinely interested in how engineering students engaged with tough issues in my course on engineering ethics and how to better present and analyze real-life cases. He loved to sit in on the courses and commented in detail on our annual reports.

When in the mid-1990s Harry gave his first endowment to support the teaching of engineering ethics at Cornell and Texas A&M he agreed to call the endeavor the Bovay Program in History and Ethics of Professional Engineering at both universities, even though only the Cornell program had a historian. This showed me the breadth of Harry's vision for engineering ethics and his strong belief that both programs would benefit by cooperating with each other. That was always his main advice—that staff from the two programs should visit and cooperate with each other. Although we used different approaches at the two universities—at Cornell teaching ethics across the curriculum in the Engineering College by combining history, sociology, and philosophy; and at Texas A&M coteaching a required engineering ethics course by an engineering professor (Michael Rabins) and a philosopher (Ed Harris)—visiting each other's programs, at Harry's insistence, led to several good outcomes: new teaching methods, common topics and speakers for the Annual Bovay Lecture at each school, and new research in the field of engineering ethics.

Harry also supported engineering ethics with the endowment of chairs at Cornell and Texas A&M and the establishment of an ethics position at the National Academy of Engineering. Again, his and Mike's site visits proved crucial to fostering the program here at Cornell and enabling cooperation among the three programs.

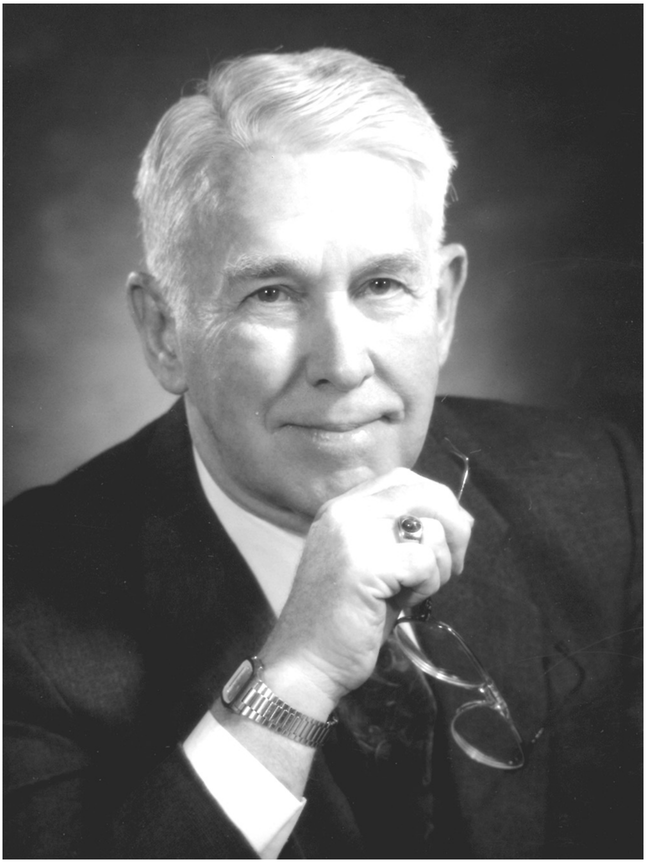
The most memorable occasion of such cooperation was when Harry invited us to his ranch in Texas after a special session held to honor him at the February 2008 annual meeting of the Association for Professional and Practical Ethics, in San Antonio. In the beautiful and relaxing setting of Harry's ranch, Ed Harris and I, chairs of the Texas A&M and Cornell programs;

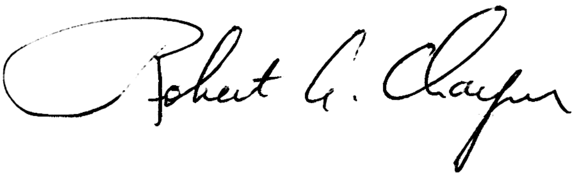
Rachelle Hollander, head of the NAE engineering ethics effort; and Jimmie Smith of Texas Tech spent a fruitful time talking about our different programs and how to cooperate. Harry and Mike Patrick, his chief business partner and friend, mostly listened while we talked shop. They had much more to say when the talk turned toward policy and gave good advice on how to advance Harry's broad vision of promoting ethics at engineering colleges and professional organizations. That was the last time I saw Harry. He was in good health and as sharp as ever.

On a personal note, I asked him what his middle initial "E" stood for. He said it stood for "Elmo," that his father had been named after a novel, *St. Elmo* (1866), written by Augusta Jane Evans. I later learned that the book, a romance, was one of the most popular novels of the 19th century and that towns, hotels, steamboats, and boys by the score were named Elmo in the late 19th century. Harry apparently didn't much like the name until he read an old copy of the book that I sent him. He wrote back that he thought it was rather flowery but enjoyed reading it and finding out something new about his past. That is how I remember Harry, open to learning something new while remaining true to and promoting his ideals, especially about the importance of ethics in engineering.

His niece Peggy Kelly wrote that her uncle

> was an outdoorsman, he loved hunting and fishing and was never happier than when he was entertaining friends and family at his ranch. He was never at a loss for words and he always included a joke or two. He was a philanthropist who contributed to causes that he believed in such as the Boy Scouts, the engineering profession, and the small rural communities where he operated businesses. His good work will continue through the efforts of the Harry E. Bovay, Jr. Foundation. He is survived by more friends and family than can be mentioned and his spirit is an inspiration to us all.





ROBERT A. CHARPIE

1925–2011

Elected in 1975

"For contributions to nuclear, electronic, photographic, and energy-related enterprises."

BY DAVID V. RAGONE
SUBMITTED BY THE NAE HOME SECRETARY

ROBERT A. CHARPIE, former CEO of Cabot Corporation, died on October 13, 2011, at the age of 86, just 25 days after the loss of his beloved wife of 64 years, Elizabeth. He was renowned, nationally and internationally, for his scientific, industrial, and educational leadership in harnessing technology and innovation for the benefit of society.

Bob, as he was generally called, was born in Cleveland, Ohio, on September 9, 1925. Raised on Cleveland's East Side, he was recognized early in life as a remarkable scholar. At the age of 12, he joined a series of classes for gifted students where he met his future wife and best friend for life. Beth was so impressed by the program that she majored in education in college and then taught exceptional students in Cleveland's Major Work classes.

In 1943 Bob was one of ten high school students nationwide honored as a Westinghouse Scholar and received a full scholarship to Carnegie Institute of Technology, which he entered at age 17. Grateful for the opportunity, he later created the Charpie Scholars program, enabling students who demonstrate strong leadership skills to attend his alma mater.

After his first year of college, he was inducted into the US Army in January 1944 and served as a machine gunner in the Tenth Infantry Division. After his service he returned to the Carnegie Institute of Technology and graduated with an honors BS in 1948, an MS in 1949, and a DSc in theoretical physics in 1950.

Upon graduation, Bob joined the Oak Ridge National Laboratory (ORNL) as a physicist. He was appointed assistant director in 1955, and in the same year received the United States Junior Chamber of Commerce award as one of America's Ten Outstanding Young Men. In 1958 he was named director of the ORNL Reactor Division. During his 11-year tenure at ORNL, he was a pioneer in the development of civilian nuclear energy and an international leader in the peaceful uses of atomic energy. He served as deputy US delegate to the United Nations Advisory Committee on Atomic Energy in 1954, scientific secretary for the first International Conference on the Peaceful Uses of Atomic Energy in 1955, and secretary to the General Advisory Committee for the Atomic Energy Commission from 1959 to 1963.

Bob's contributions to public policy and technology extend well beyond his work in nuclear energy. In 1965–1967 he chaired an important panel for the US Department of Commerce that focused on the importance of technological change for economic growth in the United States and presaged today's debate about productivity in the American economy and the country's competitive position abroad. For his intellectual leadership, the resulting widely read document became known as "the Charpie Report."

Bob also had an impact on national discussions in other critical areas as a member of the American Academy of Arts and Sciences and the National Advisory Commission for Oceans and Atmospheres in the early and mid-70s. He was one of three persons named to a special study of the high costs and technical difficulties of the then troubled space shuttle program in 1979. This study, which was presented to President Carter, resulted in administrative changes in the space program and its subsequent improvement in meeting scheduled target dates.

Concurrent with his public service, Bob compiled a very successful record as an industrial leader. In 1961, he left ORNL to join Union Carbide, where he rose to become president of the company's electronics division. In March 1968 he became president of Bell & Howell and in May 1969 he joined Cabot Corporation as president and CEO. During his tenure Cabot realized almost a tenfold increase in size, to become one of the 300 largest industrial corporations in the United States.

Bob served as a board member at Arch Coal, Ashland Coal, Bell & Howell, Cabot Corporation, Champion International Corporation, Federated Department Stores, First National Bank of Boston, General Cinema Corporation, Honeywell, Northwest Airlines, Schlumberger Limited, and Sprague Electric Company. He was also on the board of the MITRE Corporation, serving the US military.

As an expression of his interest in innovation and the development of new ideas, Bob was deeply committed to the importance of education at many levels. He was vice chair of the Oak Ridge Board of Education in Tennessee from 1957 to 1961, president of the Byram Hills Central School District in New York from 1966 to 1968, and a trustee of the Carnegie Institute of Technology and its successor, Carnegie Mellon University, and of Wellesley College. He also served on visiting committees at MIT (for the Departments of Nuclear Engineering and Mathematics, and the Committee for Sponsored Programs) and at Harvard (for the JFK School of Government and the School of Public Health). In 1969 he was nominated by President Nixon to the National Science Board of the National Science Foundation, on which he served until 1976.

He held fellowships in the American Physical Society and American Nuclear Society, and memberships in the New York Academy of Sciences and the Science Research Society of America. He was a member of the Commerce Technical Advisory Board, the Research Advisory Committee of the US Agency for International Development, the Research Society of America, and Tau Beta Pi, Sigma Xi, and Pi Mu Epsilon. He received honorary doctorates from Denison University, Alderson-Broaddus College, Marietta College, and Boston College.

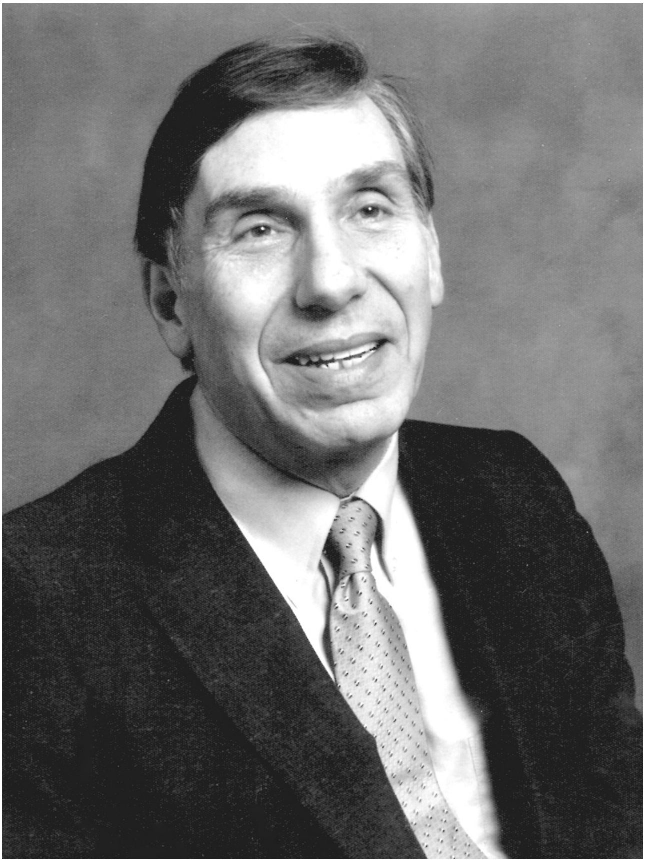
Bob retired as chairman of the Cabot Corporation in 1988 and, pursuing his interests in innovation, joined the Ampersand Venture Management Company as its chairman. During this phase of his life, he devoted much of his free time to his favorite hobby—great food and wine. As president of the International Wine and Food Society, he introduced people around the world to the pleasures of fine wines. When guests at his home viewed the family's extensive, thoughtfully selected wine cellar many congratulated him on the fine collection. Bob would remark, "We don't collect wine; we drink it," and then pour glasses all around.

Bob was a remarkably generous man who shared his intellect, good spirit, home, and experience with his extended family and many friends. As a member of the greatest generation, he demonstrated that hard work—and making your own luck—can lead to remarkable achievements. He is deeply missed.

His daughter Carol wrote that, even as

> a national and international figure, [her father] remained a down-to-earth man who put his family first. Bob and Beth worked together on their house and in their garden, often with children, grandchildren, and dogs alongside. Education, integrity, and hard work were the basis of living their lives as well as raising their family. Bob had incredible energy and was as focused with his family as he was with his work. He believed in blending work with play, however, and games were an important part of learning, spending time together, and demonstrating luck, intellect, and good sportsmanship. The Charpie children and grandchildren shared card games, board games, sports, and puzzles with Bob and Beth and with each other.

Bob is survived by his four loving children: Richard Charpie and his wife Sally (Ward), Carol McMullen and her husband Sean Rush, David Charpie and his wife Joanne (Condakes), and John Charpie and his wife Kathy (Pate). He is also survived by his sister Edith Fickenscher, 12 grandchildren, and 8 nieces and nephews.



BERNARD L. COHEN

1924–2012

Elected in 2003

"For fundamental contributions to our understanding of low-level radiation."

BY GERALD D. HOLDER
SUBMITTED BY THE NAE HOME SECRETARY

BERNARD L. COHEN, one of the nation's first nuclear engineering scholars, who also memorably challenged activist Ralph Nader to a plutonium vs. caffeine duel, died March 17, 2012, at age 87.

Dr. Cohen was a Pittsburgh native who like many of his generation entered World War II before attending college. He served as an engineering officer in the US Navy in the Pacific theater. Upon his return, he earned his bachelor's degree at Case Institute of Technology (now Case Western), followed by a master's degree from the University of Pittsburgh and a PhD from the Carnegie Institute of Technology (now Carnegie Mellon University). His dissertation was "Experimental Studies of High Energy Nuclear Reactions."

He spent the next eight years, until 1958, as group leader for cyclotron research at Oak Ridge National Laboratory. At that time, Pittsburgh was becoming the center of not only the world's steel industry but also nuclear research. Bettis Atomic Laboratory in nearby West Mifflin developed Oak Ridge's original design of the pressurized water reactor and the first US nuclear submarine engines; and the Shippingport Atomic Power Station, the first full-scale nuclear power plant devoted to peacetime use, was built just north in Beaver County.

It was at this time that Dr. Cohen began a long and storied career at the University of Pittsburgh. He joined the faculty in 1958 as associate professor of physics and chemistry, and helped to lay the groundwork for some of the university's strongest science and engineering programs. Named a full professor in 1961, he held numerous adjunct appointments in chemical and petroleum engineering, radiation health, and environmental and occupational health, and admirably served as director of the university's Scaife Nuclear Laboratory from 1965 to 1978.

He was elected to chair the American Physical Society's Division of Nuclear Physics (1974–1975) and in 1981 his extensive nuclear research at Pitt earned him the APS Tom W. Bonner Prize in Nuclear Physics.

During the 1970s Dr. Cohen's research moved from the application of nuclear energy to health, society, and the environment. Most notably during this period, research had begun to focus on sources of indoor radon, and in 1984 an incident on the other side of Pennsylvania at the Limerick Nuclear Power Plant brought radon to the forefront of public awareness. Only five years after the events at Three Mile Island, a worker at Limerick was setting off radiation detectors; it turned out that this was because of radon in his home, not radiation at the nuclear plant. Dr. Cohen focused his research on better radon detection techniques as well as correlation/causation studies of radon in 350,000 homes.

An author of six books, more than 300 journal publications, and about 80 magazine articles, Dr. Cohen was sought out by energy committees and advisory boards as well as national journalists including William F. Buckley and Barbara Walters. In recognition of his outreach he received in 1984 the American Nuclear Society (ANS) Public Information Award (now the Landis Public Communication and Education Award), and in 2008 he was selected for the ANS W. Bennett Lewis Award, which recognizes "persons who have made major lifetime contributions in nuclear science and engineering towards minimizing environmental footprint, attaining long-term global sustainable energy and development, and having shown great foresight in elucidating these goals as recorded in archival publications."

He was well regarded not only for his knowledge of nuclear energy and research but also for his outspokenness and willingness to challenge the media's interpretations of dangers facing humanity. In a 1985 article, "The Myth of Plutonium Toxicity,"[1] he reported his challenge to Ralph Nader's take on plutonium (Pu): "I offered to eat as much plutonium as he would eat of caffeine, which my paper shows is comparably dangerous, or, given reasonable TV coverage, personally inhale 1,000 times as much plutonium as he says would be fatal." (Nader did not accept the challenge.) At the end of the article Dr. Cohen revealed his passion for research versus the media's need for a headline-grabbing story, presciently describing today's 24/7 news cycle:

> It is often argued that there is a great deal we do not know about Pu toxicity. While this may be true, one would be hard-pressed to name another public health issue that is as well understood and controlled. Surely it would not be air pollution from burning coal, which is a million times more serious a problem. Surely it is not food additives or insecticides or such (the dangers from these have also been greatly exaggerated) that may well be doing real harm to our health. Pu hazards are far better understood than any of these, and the one fatality per 300 years they may someday cause is truly trivial by comparison.
>
> In spite of the facts we have cited here, facts well known in the scientific community, the myth of Pu toxicity lingers on. The news media ignore us, and prefer to continue scaring the public at every opportunity. They don't recognize the difference between political issues on which everyone is equally entitled to an opinion, and scientific issues, which are susceptible to scientific investigation and proof. The myth may linger forever.

[1] The article was published in *Nuclear Energy: A Sensible Alternative* (1985, Springer-Verlag US), ed. Karl O. Ott and Bernard I. Spinrad, pp. 355–365.

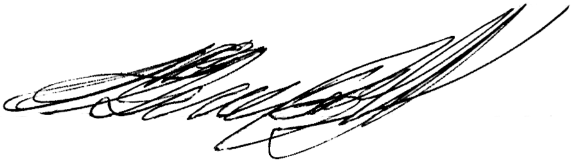
In 1992 Dr. Cohen received the Health Physics Society Distinguished Scientific Achievement Award, and in 2003 he was elected to the National Academy of Engineering "for fundamental contributions to our understanding of low-level radiation."

He retired from the University of Pittsburgh as professor emeritus of physics in 1994. He inspired his students as well as his academic colleagues with a dedication to research and an insatiable appetite for truth, and he was never shy to answer his critics or challenge those who did not approach scientific study with such rigor. His wit and determined intelligence are a loss both to the University of Pittsburgh and to academe.

His daughter Judith wrote:

> For all of his achievements he was a humble man who did not want a lot of attention for himself. He was practical, simple, down to earth and modest.
>
> Few people in their last moments look back and think, "I'm proud of my professional accomplishments" or "I wish I had gotten one more grant." I believe that the most meaningful measure of a person's life is how they treated other people. You might assume from the above description that my father was primarily dedicated to his career and left the parenting primarily to his wife, as was common in their generation. But from our perspective, my father's life was devoted to us.
>
> Throughout my brothers' and my lives my father was always a supportive presence, providing unconditional love. He always said that the best time of his life was when his kids were growing up. Many nights when my mother was working, my father would be in the living room with us. My brothers would be playing ball or watching TV in the living room and my father would be writing a book. In those days he really wrote a book, by hand with a pencil and a lined pad of paper. Far from ignoring us, my dad would join in the fun, not minding at all being interrupted or distracted. He [also] loved to play golf and all of his life looked back with joy on the summers he spent playing golf.
>
> He was loving and supportive of his own family and my mother's family, providing moral and financial support for his extended family. He had a wonderful, happy life filled with love given and received.

Dr. Cohen was preceded in death by his wife of 48 years, Dr. Anna Foner Cohen (who received a PhD in physics from Carnegie Institute of Technology the same year as her husband). He is survived by his children Donald, Judith, Fred, and Ernie Cohen; ten grandchildren; two great-grandchildren; and his partner, Ann Ungar.



W. GENE CORLEY

1935–2013

Elected in 2000

"For leadership in raising the standards of the engineering profession for construction of buildings and bridges."

BY METE SOZEN

On March 1, 2013, one of the most brilliant minds in structural engineering, that had delivered its promise over and over again through a long and successful career, was lost. That was the day WILLIAM GENE CORLEY closed his eyes for the last time.

Gene was born in Shelbyville, Illinois, a small town south of Decatur, to Clarence W. and Mary Douthit Corley in 1935. Upon finishing high school in 1954, he attended the University of Illinois, Urbana, where he obtained his BS in civil engineering in 1958. While there he was a member of the ROTC and served as president of the Varsity Men's Glee Club. His sustained success as a student earned him a place on the Bronze Tablet of 1958, limited to the top 3 percent of the graduating class. Encouraged by the civil engineering faculty to continue his education at the university, he earned his MS in 1960—the year after he married Lynd Wertheim—and his PhD in 1961. During that time he also produced two works that have stood the test of time: a simple and effective solution for time-dependent deflections of reinforced concrete beams, and a new perspective that expanded the application domain of the equivalent-frame analysis for reinforced concrete slabs.

In 1961 Gene joined the US Army Corps of Engineers at Fort Belvoir, Virginia, where he earned the rank of captain. In 1964 he took the position of research engineer with the Portland

Cement Association (PCA) in Skokie, Illinois. When PCA incorporated Construction Technology Laboratories (CTL Group) as a separate entity in 1987, he became CTL's vice president.

At CTL Gene became one of the outstanding forensic engineers of his time. His interests and talents were multidimensional. He sang with his wife in the Chicago Symphony Orchestra Chorus, and served as president of the board of directors of Association House, chairman of the District School Board Caucus, and a member of the board of directors for the mid-America chapter of the American Red Cross. He was also a member of the Columbian Society and the Chicago Museum of Science and Industry. Always loyal to his alma mater, he was a member of the University of Illinois President's Council and Civil Engineering Alumni Association (1988–1994), serving as the association's president in 1993–1994.

He was eminently successful in his professional work. In 1995 he cochaired the team of select engineers that produced the investigation report of the Murrah Federal Building in Oklahoma City after it was damaged by a bomb. He was an advisor on the investigation of the fatal fire (2001) at the Branch Davidian complex in Waco, Texas. He led the investigative team for the two World Trade Center Buildings that collapsed in 2001 as a result of aircraft impact.

He also served selflessly and effectively on committees of the American Society of Civil Engineers (ASCE), American Concrete Institute (ACI), Building Seismic Safety Council, Chicago Committee on High-Rise Buildings, Earthquake Engineering Research Institute, Illinois Building Commission, Illinois Seismic Safety Task Force, Institute for Business and Home Safety, International Standards Organization, Mid-America Earthquake Center, National Association for Railroad Safety, National Council of Examiners for Engineering and Surveying, RILEM, Post-Tensioning Institute, Structural Engineers World Congress, and Illinois Governor's Earthquake Preparedness Task Force.

He was elected to the National Academy of Engineering in 2000, and became an honorary member of ASCE in 2001 and of ACI in 2003. Professional associations recognized his contributions through dozens of awards, including the ASCE's Opal and T.Y. Lin awards; the ACI's Alfred E. Lindau Award, Delmar L. Bloem Distinguished Service Award, Arthur J. Boase Award, Henry C. Turner Medal, and Wason Medal for Materials Research; the John F. Parmer Award of the Structural Engineers Association of Illinois; and the Martin P. Korn Award of the Precast/Prestressed Concrete Institute. The University of Illinois recognized him as Civil Engineering Distinguished Alumnus (1995), College of Engineering Distinguished Alumnus (2001), and Chicago Illini of the Year (2004).

Looking back it appears phenomenal that among his myriad professional activities he found time to develop deep and warm relationships with a large circle of friends. Gene was a loving husband to Lynd, a doting father to their children Anne, Bob, and Scott, and remained close to their nine grandchildren.

He was so good in so many things that it is difficult to choose one of his accomplishments as the best. But his chairmanship of the ACI Building Code Committee is a good example. The committee is a tough debating society that is often the scene of the clash of corporate, academic, and personal goals. Many who assumed the chairmanship with good intentions found themselves taking sides and alienating believers in one cause or the other. During his six-year stint as chair, Gene led the committee to notable achievements and managed to arrive at satisfactory compromises while creating lasting friendships among those with differing views. He was a born leader as well as a wonderful and charming person.

In closing, the writer cannot help but paraphrase the Bard, "Here was William Gene Corley! When comes such another?"

DALE R. CORSON

1914–2012

Elected in 1981

"For leadership in evaluation of engineering enterprises vital to the national welfare; contributor to vital military electronic developments; leadership in engineering education."

BY FRANK H.T. RHODES and J. ROBERT COOKE
SUBMITTED BY THE NAE HOME SECRETARY

DALE RAYMOND CORSON (April 5, 1914–March 31, 2012) lived an exemplary life. His scientific achievements won him rare dual recognition in the form of the Arthur M. Beuche Award from the National Academy of Engineering and the Public Welfare Medal from the National Academy of Sciences. His bright mind, coupled with his reputation for humility and personal integrity, enabled him to deal with complex, politically charged matters, and these characteristics were vital to his success when he became president of Cornell University during a period of unprecedented campus turbulence. His habit of carefully recording details in his notebook during his physics experiments carried over to his leadership roles. When Dale made a commitment he kept it, down to the last detail.

As a child in rural Kansas, Dale was attracted to physics as both an intellectual pursuit and a career. He pursued that vision through the grim years of the Great Depression, earning degrees at the College of Emporia (AB), University of Kansas (MA), and University of California at Berkeley (PhD). As a postdoctoral fellow at Berkeley he participated in the creation and use of a particle accelerator. Within two years of his PhD, he and associates Ken MacKenzie and Emilio Segrè had placed a new element, astatine (At), on the periodic table.

As World War II engulfed Europe, Ernest Lawrence summoned Dale to join the MIT Radiation Lab to work on a top secret military project, development of airborne radar systems. Dale worked on operational deployment of radar technology, which played a crucial role in winning the war. He was assigned to continue that work as a military advisor in the newly built Pentagon. From there he went to Los Alamos, where he led the creation of Sandia National Laboratory, now one of the largest of the US national laboratories. After the launch of Sputnik, he served on the National Advisory Committee on Aeronautics, which recommended the creation of NASA.

Dale was among a group of physicists, including Hans Bethe and Robert Wilson, to join the Cornell faculty after WWII. His first assignment was the design and early operation of the 300-MeV synchrotron, Cornell's first post-WWII electron accelerator. It was one of the first synchrotrons to operate successfully and a precursor to Cornell's famous Wilson Synchrotron Laboratory.

Dale became a full professor in 1952 and in 1956 chair of the physics department, with the support and confidence of both the nuclear and theoretical physicists and the low-temperature/solid state group. Three years later he became dean of engineering. Such rapid advancement can make people imperious, but Dale stayed true to his sensible Midwestern roots. He was aware, for example, that some college faculty members questioned whether he even qualified as a "real" engineer—and he conceded the point. "There was no logic at all to my choice as the dean of the Engineering College," he said. "I was a last minute substitute after the prime candidate, whom I had helped recruit, withdrew."

Dale became university provost in 1963, during the administration of James Perkins, and in that capacity he addressed a wide range of issues, from the library system to the Arecibo telescope in Puerto Rico. He also gathered the biological science programs, which were widely dispersed among multiple colleges, to form the Division of Biological Sciences, thereby fostering greater synergy among the departments at Cornell.

President Perkins assigned Dale the task of increasing diversity at Cornell. Against a backdrop of volatile national political debates over issues such as the Vietnam War and civil rights, Cornell rapidly increased its enrollment of students of color. These students brought with them a commitment to making their voices heard in the academic community and a sense of urgency about doing it—and they encountered faculty and other groups just as committed to changing the campus more gradually by consensus and leadership. The rapidly heating climate led to the takeover in 1969 of Cornell's student union by African American students. President Perkins resigned shortly afterward.

The task of settling the differences and restoring peace fell to Dale, first as interim president and then as president. He is widely credited with holding the campus together with his calm and capable leadership. In later years Dale would reflect on that period with wry good humor: "I was never actually inaugurated. Instead there was an investiture at commencement following my first year in office.… There were demonstrations and disruptions and two attempts to take over the microphone. [Professor] Morris Bishop made international news when he bent the [ceremonial university mace] jabbing the protestors in the ribs. Those were the days!"

It was Cornell's good fortune that the new president was a universally trusted leader. Dale patiently consulted with all sides and made it clear that he understood what was said. John Marcham, editor of the Cornell Alumni News, observed in July 1977 that Dale "was known…as someone who could figure out the real end result and price of carrying out a flowery educational principle. Not only had he thought it out in his head, but he probably also made note of it in the little notebook he always seemed to have with him. As a consequence, when he said something was possible, members of the university community knew it was in fact possible.… [F]actions that distrusted one another would allow his administration the time to knit back together the fabric of a torn institution."

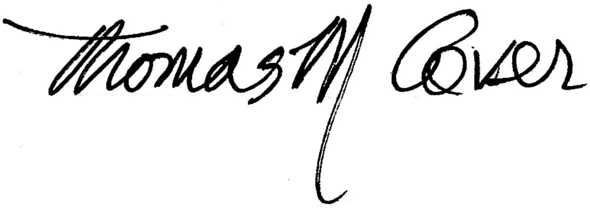
Dale served Cornell as president from 1969 to 1977. During his tenure he was acutely aware of the need to balance the university's budget, even in a period of high inflation. The record shows that it was he who insisted on dispensing with a formal inauguration in favor of a much less costly investiture. Perhaps because of his own appreciation of the value of access to higher education, he worked hard to keep Cornell financially affordable.

He also nurtured fundamental programmatic changes, working with William Gordon to create Cornell's Center for Radio Physics and Space Research, with Don Greenberg to enter the emerging field of computer graphics, and with Henri Sack, Robert Sproull, and James Krumhansl to form what is now the Cornell Center for Materials Research, a highly successful and widely copied model for university-based multidisciplinary research. In addition, Dale provided institutional support for Africana studies, water resources, women's studies, and the humanities in general.

Dale retired from the presidency in 1977 but agreed to stay on as chancellor, much to the delight of his successor. The Cornell Medical College, located in New York City, was experiencing financial and administrative difficulties, and Dale concentrated on sorting them out, freeing the new president to focus on the Ithaca campus. Also during those two years he prepared a thoughtful analysis of long-term issues facing higher education.

From 1982 to 1994 he served on several National Academy/National Research Council committees. He was inaugural chair of the Government-University-Industry Research Roundtable, which promoted communication among national leaders, and he helped organize a workshop on international higher education exchanges between the United States and Japan. In the early 1980s he headed a panel on Scientific Communication and National Security that averted restrictions on the publication of unclassified university research. NAS President Frank Press said of Dale's service, "The nation is in your debt."

Dale enjoyed excellent health and was mentally alert to the end of his nearly 98 years, facts that he attributed to good family genetics. He was married to Nellie Griswold Corson for more than 73 years and together they raised four talented and accomplished children. In their senior years Dale and Nellie lived in Kendal at Ithaca, a continuing care facility that Dale had helped to establish and which is adorned by many of his professional-quality photographs. Dale also continued to meet with colleagues from the campus, staying closely in touch with the university to which he devoted his life.



THOMAS M. COVER

1938–2012

Elected in 1995

"For contributions to the theory and practice of pattern recognition, information theory, and communications."

BY ROBERT M. GRAY

THOMAS M. COVER, one of the past half-century's most brilliant and prolific contributors to information and communications theory, pattern recognition and learning, and the analysis of gambling and investment strategies, died on March 26, 2012, at the age of 73.

Tom was born on August 7, 1938, in San Bernardino in California's "Inland Empire." His interest in sports and games developed early; he played champion-level tennis and little league baseball, including a trip to the 1951 Little League World Series (where his team came in fourth). In high school his interests expanded to nonathletic games and probability, and he learned to play poker. These interests presaged a lifelong love of sports and his eventual interest in the statistical analysis of games and sports and in algorithms for predicting and betting on random phenomena.

Tom received his BS in physics from MIT in 1960 and then moved to Stanford for an MS in 1961 and a PhD in 1964 (under Norm Abramson), both degrees in electrical engineering. While a graduate student he became interested in statistics and the theory of games. Perhaps as a practical application, he and several friends learned the counting technique for playing blackjack from a preview copy of Edward Thorp's book *Beat* *the Dealer: A Winning Strategy for the Game of Twenty-One.* They became sufficiently adept to become officially unwelcome in Nevada casinos. This anecdote highlights Tom's early and deep expertise in probability theory and its application, and his interest in algorithms for winning at stochastic games.

In 1964 he joined the faculty of Stanford University as an assistant professor of electrical engineering (EE), in 1967 he became a tenured associate professor, and in 1971 was awarded a joint appointment in EE and statistics. He remained at Stanford for his entire career, becoming the endowed Kwoh-Ting Li Professor of Engineering, Electrical Engineering, and Statistics in 1994. He also had visiting appointments at MIT and Harvard and served as a consultant to SRI, the RAND Corporation, AT&T Bell Labs, and the California State Lottery.

His dissertation, and subsequent early career work on systems of linear inequalities describing networks of linear threshold devices, laid a foundation for the study of artificial neural networks and their application to pattern recognition. A specific concern, described in his dissertation abstract, was the ability of such systems "to generalize with respect to past data"; this later became known as statistical or machine learning.

His work with his first PhD student, Peter Hart, yielded a widely acknowledged classic paper on nearest neighbor pattern classification, demonstrating that the simple nearest neighbor rules fundamental to communications and statistics provided performance close to the optimal detectors. This technique remains one of the simplest and most powerful approaches to pattern recognition, classification, detection, and learning in engineering systems and other applications making inferences based on data.

His paper "Broadcast Channels," published in 1972, announced a new direction for his work and spawned a widespread shift in emphasis of Shannon information theory from the classic single-user point-to-point communications systems to multiuser systems. In 1949 Claude Shannon had revolutionized the theory and eventual practice of electronic communications by quantifying the optimal performance of probabilistic models of communication systems; these results led decades later to the modern digital communication revolution.

Although Shannon emphasized single-user systems, he introduced the idea of the more general systems that would be required in networks of users—but he did not extend his basic results to such systems. Nearly a quarter-century later, Cover's broadcast channel was the first major breakthrough in this area, providing theoretical performance bounds and actual constructions for good codes in a system involving a single transmitter with multiple receivers. As in Shannon's original work, it was clearly demonstrated that sophisticated coding could provide better performance than naïvely applying traditional methods. Tom's award-winning paper is a classic both in Shannon information theory and in the theory and practice of multiuser communication systems, such as wireless and satellite. The simple model provided a good fit for certain practical systems and inspired many extensions and variations suitable for modern communication systems.

Tom's next major shift in direction began soon after, with his interest in Kolmogorov/Chaitin/Solomonoff complexity as a complement to Shannon information theory and the implications for universal coding and universal gambling schemes, algorithms with predictable and nearly optimal performance in incompletely known statistical environments. It should be emphasized that as Tom moved into new areas, his contributions to his earlier interests continued with new insight and a historical appreciation of the development of the fields. As an illustrative example, his 1979 paper with Abbas El Gamal on capacity theorems for the relay channel became his second most cited paper. The next year he published with El Gamal the highly cited survey "Multiple User Information Theory" in the *Proceedings of the IEEE* (reprinted in *Multiple Access Communications: Foundations for Emerging Technologies,* 1993, ed. Norm Abramson). Tom became and remained a primary expositor of open problems in information theory.

In the late 1970s, Tom and his students published papers on sports statistics and on applications of gambling ideas to the estimation of random phenomena. In 1980 he and his collaborators began a series of publications applying variations of these ideas to investment portfolios, building on the obvious similarity between gambling and investing.

In 1982 Tom, again working with El Gamal, published the foundational results of multiple description coding. These are codes designed for communication systems such as packet networks where information is spread in pieces over many channels and the receiver must reconstruct signals based on some of the pieces (e.g., packets that are not lost). Again, Tom's work involved elegant models and analysis and proved seminal to a new field of theory and application of fundamental importance to the emerging area of network communications.

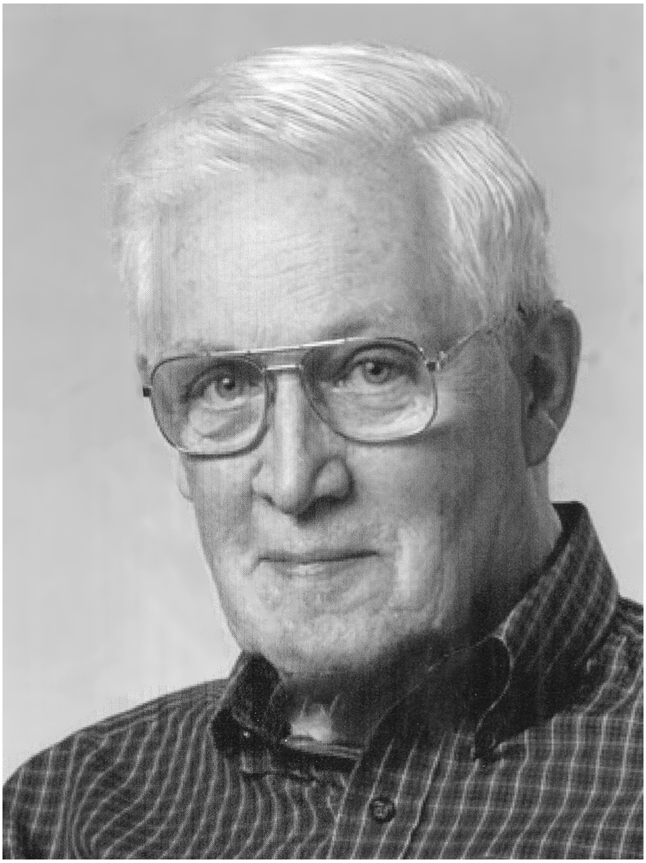
Tom put his expertise in the theory of gambling and his skills in statistics to practical use as a contract statistician for the California State Lottery from 1986 to 1994, designing tests for lottery balls and wheels, analyzing the payoff structure, and seeking vulnerabilities to fraud.

Throughout his career, Tom developed many new simple proofs for famous results, both on his own and in collaboration with others. The associated papers were marvels of pedagogy, enhancing the understanding and appreciation of many tools of information theory and more general probabilistic analysis. His pedagogical talents reached their apex in his 1991 book *Elements of Information Theory*, coauthored with Joy A. Thomas, a book that quickly became and remains the best-selling text by far on the subject.

Tom's list of professional awards began in 1974 with the IEEE Information Theory Group Outstanding Paper Award for "Broadcast Channels." He became a Fellow of the IEEE (1974), Institute of Mathematical Statistics (1981), and American Association for the Advancement of Science (1991). In 1990 he was selected as the IEEE Claude E. Shannon Lecturer, considered the highest honor for contributions to information theory, and in 1997 he received the IEEE Richard W. Hamming Medal "for fundamental contributions to information and communication theory, statistics and pattern recognition." He was elected to the National Academy of Engineering in 1995 and served on the organizing committee for the National Research Council's Workshop on Statistical Analysis of Networks, the Committee on Applied and Theoretical Statistics, and a joint Academies Briefing Panel on Pattern Recognition. In 2003 he was elected to the American Academy of Arts and Sciences.

Tom was a natural raconteur who enjoyed sports both as a participant and as a spectator. His wit was famous and his laughter infectious. His ability to grasp the essence of an issue was as evident in nontechnical conversations and committee meetings as it was in his mathematics, and his humor had the added advantage in committees of speeding convergence and smoothing the path. His talks were thoughtful and thought provoking, his lectures informative, popular, and entertaining. His many students became outstanding engineers, statisticians, and teachers and Tom's reputation as a mentor and fount of ideas is unequaled in his professional sphere. His loss was shockingly sudden to us all, and leaves a large hole in the lives of those who knew him. He was unique.

Tom is survived by his wife Karen, son Bill, daughter Cindy Black; brothers Bill, Chuck, and John; and grandchildren Carolina, Gabriella ("Gailie"), Marina, Jon, Brian, and Laura.



CHARLES A. DESOER

1926–2010

Elected in 1977

"For contributions to control and system theory, and for innovation in engineering education."

BY SANJIT K. MITRA

CHARLES A. DESOER, professor emeritus of electrical engineering and computer sciences at the University of California, Berkeley, died November 1, 2010, in Oakland, California, at the age of 84, of complications from a stroke.

Charlie, as he was known universally, was born on January 11, 1926, in Brussels. He fought with the Belgian Resistance during the German occupation in World War II and joined the Belgian Army after the liberation. He obtained a degree as a radio engineer from the University of Liège in 1949 and an ScD in electrical engineering at the Massachusetts Institute of Technology in 1953. He then went to work at Bell Laboratories in Murray Hill, New Jersey, until 1958, when he left to join UC Berkeley as a professor of electrical engineering and computer sciences. He continued to serve the campus as professor emeritus after his retirement in 1993.

Charlie was a world-renowned researcher, research supervisor, and dedicated educator. His research focused on the analysis, design, and control of linear and nonlinear circuits and systems that contributed to the burgeoning growth in control applications and benefited the aerospace, transportation, process control, and other essential industry sectors.

He was an exceptionally gifted teacher, with a style that emphasized clarity of thought and elegance of presentation, both of which were evident in his seminal textbooks on circuit theory, linear systems theory, and feedback control. Some of his texts are still considered the most authoritative references on circuits, systems, and control, and "widely regarded as classics in the field [that] have set a high standard for their clarity of thought and presentation, as well as a deep commitment to intellectual elegance," said Shankar Sastry, former PhD student of Desoer and now Dean of Engineering at UC Berkeley.

I met Charlie in the fall of 1958 when I joined the Department of Electrical Engineering at UC Berkeley as a graduate student and took his upper division course "Linear Systems." He was an inspiring teacher and encouraged his students to think and solve homework problems using different approaches. I had planned to study computer engineering, but after taking the course with Desoer I switched to circuits and systems and decided to work on my master's thesis under his supervision. The project involved developing a computer-based approach to design analog filters with lossy inductors and capacitors. Charlie also taught me how to write technical articles—he accepted my thesis after six revisions (it was then published as a paper in the *IEEE Transactions on Circuit Theory* with very little change). According to him, an MS thesis was not to be more than 30 pages and a PhD thesis less than 100 pages.

A much-loved colleague in the Department of Electrical Engineering and Computer Sciences, Charlie was known for his sharp repartee, yet he always had kind words for his colleagues. Former students and junior colleagues remember him for his dedicated mentoring and his strong emphasis on excellence in teaching. Ernest S. Kuh, professor emeritus and a former colleague of Charlie's at UC Berkeley and Bell Laboratories, recalls: "Charlie Desoer was a true scholar who was dedicated to learning the fundamentals on any subject he encountered and then formulated the problems in an elegant way to solve them. Over the years I learned a lot from him. On teaching, his clarity of thought helped him to present every subject material clearly. His impact on students was significant. On writing, I was most fortunate to have coauthored with him two textbooks which greatly influenced professors, researchers, industrial workers, and students all over the world."

Charlie graduated 42 PhD students, many of whom have established themselves as leaders in their fields in both academia and industry, a testimonial to his inspirational teaching and mentorship. Robert Newcomb, Charlie's first PhD student and now a professor of electrical and computer engineering at University of Maryland, College Park, wrote: "It was one of the great pleasures of my life to have been a doctoral student of Charles A. Desoer. Fortunately for me Charles wanted to learn about network synthesis, which was the topic I wanted to pursue for my doctorate, having taken courses on the topic under Professors David F. Tuttle at Stanford and Hendryk J. Oorthuys at Purdue. Since Charles had just come from Bell Laboratories he was aware of the papers by Brockway McMillan on n-port synthesis so we met once a week to go through McMillan's papers, from which I learned of Charles' scholarly approach to a new topic."

Frank Callier, professor of mathematics at the University of Namur, Belgium, recalls that "Charlie was very generous to his PhD students, as I experienced firsthand as one of them. Over the years I observed how humble Charlie was in his interactions with others, and how gentlemanly he was in handling even undeserved criticisms, letting time prove him right. I have also become more and more cognizant of his care for students to climb the ladder of learning."

Shinzo Kodama, former PhD student and professor emeritus of Osaka University, Japan, mentions that Charlie's ever inquisitive curiosity and strong desire to pursue the essence of a subject and his engineering viewpoint with an extensive mathematical background have continued to influence him and other PhD students long after they left Berkeley. He also says that he "was most impressed by his rare sense concerning the direction of research where significant findings lie. It makes me proud whenever I tell my students that I was one of the students of Professor Desoer."

Professor M. Vidyasagar of the University of Texas at Dallas observes that, "While Charlie took his own research seriously, he was just as serious encouraging the next generation of researchers. In 1970 I naïvely mailed a copy of a paper to Charlie, requesting his comments. He promptly responded and made several constructive suggestions. It is difficult to imagine, in this day and age, anyone of his stature reading a paper from an unknown person and taking the time to suggest thoughtful comments." He adds, "It was my privilege to have coauthored a book with Charlie. He had written the bulk of the book by mid-1973 but could not find the time to finish it. So he invited me to spend some time at Berkeley so that we could revise what he had written and write some new chapters. I was just 25 but he treated me as an equal partner in the writing enterprise."

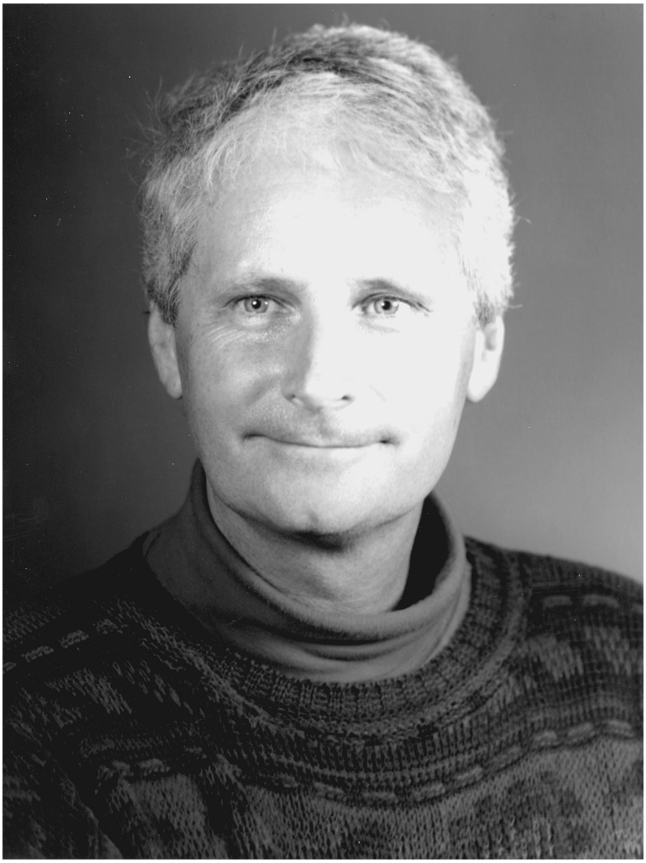
George Oster, professor of molecular and cell biology at UC Berkeley, remarked that, "Although I wrote but three papers with Charles, the process of writing them taught me one of the most important lessons of my scientific career: How to think clearly and express ideas precisely. The papers were written when I was a postdoc and subsequently a new assistant professor. I had inherited from my physics and engineering training a mode of thinking that Charles considered fuzzy and imprecise—and he was oh, so right! In my subsequent career, however, I fear that I have drifted a considerable way from Charles's ideal. My excuse has been that biological modeling has not yet reached the precision of physics, or even of engineering. Nevertheless, his lessons always remind me that seeking clarity in writing leads to clarity in thought—not necessarily the other way round."

Charlie received numerous honors and awards during his career, including a Guggenheim Fellowship (1970), the Medal of the University of Liège (1970), the UC Berkeley Distinguished Teaching Award (1971), the Prix George Montefiore from the Belgian Association of Electrical Engineers (1975), the James H. Mulligan Jr. Education Award from the Institute of Electrical and Electronics Engineers (IEEE; 1975), the American Automatic Control Council Education Award (1983), the IEEE Control

Systems Society Field Award (1986), the UC Berkeley Citation (1991), and the IEEE Gustav Robert Kirchhoff Award (2011) presented posthumously in recognition of his fundamental research in circuits and systems. He received an honorary doctorate degree from the University of Liège in 1976. He was a life fellow of the IEEE, a member of the National Academy of Engineering, and a fellow of the American Association for the Advancement of Science.

Charlie read widely on the history and philosophy of science, economics, and epistemology. And, according to his daughter Michele, he was a connoisseur of fine food and good music and loved to travel.

He is survived by his wife Jacqueline Desoer, of Berkeley, and three children, all in California: Marc Desoer of Thousand Oaks, Michele Desoer of Oakland, and Craig Desoer of Walnut Creek; and two granddaughters. He is also survived by a sister, Monique Bastiné-Desoer, and brother, Jean-François Desoer, as well as several nieces, great-nieces, and great-nephews, all of Belgium.



ANTHONY G. EVANS

1942–2009

Elected in 1997

"For contributions in the development and understanding of structural materials."

BY ROBERT M. McMEEKING

ANTHONY G. EVANS, materials engineer and materials scientist, founding chair of the Materials Department at the University of California, Santa Barbara (UCSB), and the most highly cited materials scientist in the world, died on September 9, 2009, at the age of 66. He was one of the most influential materials engineers and materials scientists of his time.

Tony had no rivals when it came to grasping the fundamentals of materials behavior. Coupled with his extraordinary ability to generate, inspire, and lead collaborative efforts, he achieved tremendous advances in the understanding and exploitation of advanced materials. He was a leading contributor to the successful use of brittle materials in a wide variety of applications such as space shuttle tiles, jet engines, silicon chips, and vehicle armor. In addition to his work and the 650 or so papers he authored, his legacy lives on in the legion of colleagues, students, scientists, and research engineers whom he influenced and who will take forward his ideas, concepts, and collaborative way of doing research, ensuring that he will continue to have a great impact for years to come.

Tony was born in Porthcawl, Wales, on December 4, 1942, the younger son of William Glyn and Annie-May Evans. He was educated at nearby Bridgend Boys Grammar School, and from 1961 read metallurgy at Imperial College, London, where he earned a BSc with first class honors in 1964, the year he also married Trisha Cross. He went on to complete his PhD in metallurgy in 1967 at Imperial, under the supervision of Peter Pratt, and won the Matthey Prize upon graduation. His graduate research concerned plastic deformation and dislocation activity in single crystal calcium fluoride, introducing him to the emerging field of modern structural ceramics.

His first position was at the Atomic Energy Research Establishment (near Harwell, Oxfordshire), at the time one of Europe's most prestigious and best-equipped laboratories, focused on the emerging need for advanced materials for nuclear power. There he studied the mechanical behavior of engineering ceramics such as silicon nitride, then a recently developed high-tech material. He became a pioneer in the application of fracture mechanics to ceramics, developing concepts that are important in harnessing the brittle nature of such materials and enabling their reliable use.

After a sabbatical at UCLA, Tony immigrated to the United States in 1971 and joined the National Bureau of Standards (now the National Institute of Standards and Technology) in Gaithersburg, Maryland, where he worked on glass fracture. His outcomes had an enormous impact on the structural ceramics community; for example, his proof test for assessing the reliability of glass and ceramics was widely used in the US space program.

In 1974 he moved to the Rockwell International Science Center in Thousand Oaks, California, to establish a group devoted to structural ceramics. His research there encompassed indentation fracture mechanics for ceramics, associated with hardness measurements for materials that crack when loaded by an indenter. From this work his group developed an important standard indentation test for measuring the fracture properties of brittle ceramics and glasses.

Tony then committed himself to academia, taking a position in the Department of Materials Science and Mineral Engineering at UC Berkeley in 1978. He remained in academia for the rest of his career, but continued to have influence in industry through consulting activity, mainly for the aerospace and electronics industries. These interactions yielded many of the important problems he studied throughout his life, and he in turn had a profound impact on the research and development efforts of the companies for which he consulted.

At Berkeley he continued research on brittle materials, focusing on the mechanisms of ceramics and processing to make them more durable, robust, and tough. Because mechanical stress plays such a large role in these questions, his efforts incorporated applied mechanics, an emphasis that grew over the years.

In the first of several moves in academia that were eventually to bring him full circle, Tony joined UC Santa Barbara in 1985 to establish and chair the Materials Department. Under his leadership the foundations were laid for the rapid development of the department, which experienced a spectacular rise to prominence to become one of the leading materials science and engineering departments in the world. The early directions he set—a focus on collaborative interdisciplinary research, interaction with industry, and open-mindedness about the disciplines and topics that can be important in materials research—remain today. In recognition of his achievements, he was appointed UCSB's first Alcoa Professor of Materials.

His research exhibited increasing attention to high-temperature composite materials, including ceramics and metals reinforced by ceramic fibers. His pioneering work in this area enabled the deployment of brittle composite materials in severe environments of stress and temperature, and is revolutionizing the design and performance of diverse systems, including aircraft and space vehicles.

This stage of Tony's career also saw an evolution in his style to emphasize the leadership of large multi-investigator, multi-institutional research projects, mixing academic, industrial, and government engineers and scientists. His active participation in every aspect of the endeavor was integral to the high degree of success and impact of these programs, and his skill at assembling, inspiring, and leading such large interdisciplinary teams was legendary and awe inspiring. In addition, he actively sought industrial and government input and criticism of the approach, direction, and outcomes of these research programs, efforts that further ensured their effectiveness and influence. It was entertaining and stimulating to watch Tony summarize and defend these programs and pronounce on their future directions in front of a critical but good-natured audience at the end of the famous weeklong annual UCSB study groups. These gatherings of about 100 researchers became a notable feature of the coordination, integration, planning, and socialization of the large collaborative, multiyear projects he led.

Tony's work on ceramic- and metal-matrix composites included emphases on thin film and interface mechanics, and then evolved to include thermal barrier coatings, metallic foams, morphing structures, aerospace materials with tailored thermomechanical properties, lightweight lattice materials, and structural materials with superior blast and ballistic resistance. His reach was such that he also did successful work on biological materials, including bone, nacre, and the cell cytoskeleton.

He continued his research on these topics when he moved to Harvard to become the Gordon McKay Professor of Materials Engineering in 1994 (he retained a partial appointment at UCSB until 1997). An offer to become Gordon Wu Professor of Mechanical and Aerospace Engineering took him to Princeton University in 1998, where he became director of the Princeton Materials Institute. UCSB attracted him back in 2002 to become Alcoa Professor of Materials once more.

Tony's professional activities were concentrated mainly on two organizations: the American Ceramic Society (ACerS), which he served for a term as vice president, and the Defense Sciences Research Council (DSRC, previously known as the Materials Research Council), which he chaired for four years and of which he was the longest-serving member (1974–2006). DSRC provides support to the Defense Advanced Research Projects Agency (DARPA) of the Department of Defense and thus has input into the most ambitious and important research projects sponsored by DOD, including those that led the development of modern advanced materials in the years when Tony had great influence in DSRC and at DARPA.

Tony's published work has been cited more than 35,000 times, giving him an h-factor of 101. He received numerous honors throughout his career, including all the major prizes awarded by ACerS, which made him a Distinguished Life Member in 2000. He won the Griffith Medal and Prize of the Institute of Materials in 1994, the 2000 David Turnbull Lectureship of the Materials Research Society, the American Society of Mechanical Engineers Nadai Medal in 2003, and, in 2006, the Gold Medal of the American Society for Metals. In addition to being a member of both the National Academy of Engineering and the National Academy of Sciences, he was a fellow of the American Academy of Arts and Sciences, the Royal Society of London, and the Royal Academy of Engineering. He was especially proud and pleased in 2008 to be made a fellow of Imperial College, the highest honor bestowed by his alma mater.

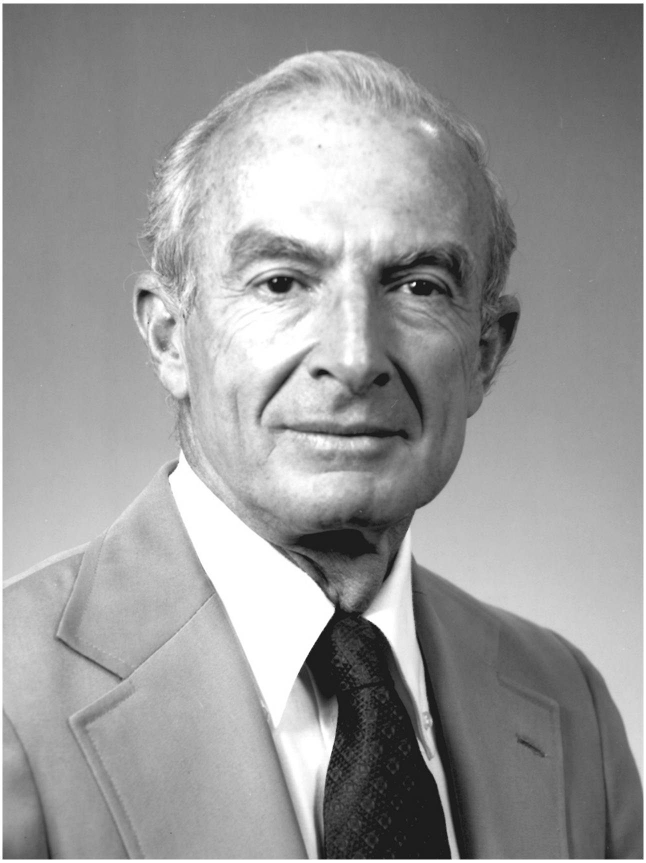
The synergy between Tony's grasp of theory and his insightful exploitation of experiment, his ability to focus on the critical issues, his nose for important problems, and his evident love of his subject were enormous strengths in his approach to his work. That he was a masterful organizer and leader of people and a delightful and amusing colleague set him apart as a true materials phenomenon.

He is survived by his wife Trisha, who writes:

> Tony had a tremendous joy for life, regarding each new day as an adventure. No matter how busy he was, he always found time for others. He was kind, loving, and generous.
>
> On the weekends, he and [I] loved to coach daughters Pollyanna and Jemina in soccer, softball, and he even took up skiing with his daughters. One of the joys of returning to Santa Barbara was his love of nature and he would like to spend time hiking the Santa Barbara trails. Additionally he loved to run around the lagoon and beach at UCSB as it cleared his head and helped him solve problems. It was a great honor when his IT and PhD students arranged a 5K run in his memory.

He enjoyed going to the theatre and the museums whether at home or abroad and was an avid fan of Welsh Rugby and of Chelsea Football Club. His friends all knew of his love for good food and especially great wines! He is greatly missed.

He is survived by his wife, three daughters, and several grandchildren.



SHELDON K. FRIEDLANDER

1927–2007

Elected in 1975

"Contributions to the understanding of the origin and control of pollution by particulate matter."

BY HAROLD G. MONBOUQUETTE
SUBMITTED BY THE NAE HOME SECRETARY

SHELDON K. FRIEDLANDER, UCLA Ralph M. Parsons Foundation Professor of Chemical Engineering and director of the Air Quality/Aerosol Technology Laboratory, passed away on February 9, 2007, at his home in Pacific Palisades, California. He is considered a father of aerosol science and technology, which he promoted as an "enabling discipline."

Shel is widely known for his research on the various pollutants in smog and their quantification by source, and he championed the important goal of waste minimization in the chemical process industries—the conception, design, and operation of chemical processes that produce little or no waste. His great scientific and technological impact stems from a career of seminal contributions to aerosol research (the study of particles suspended in gases) that broadly advanced understanding of environmental aerosol and laid the foundation for the use of aerosol technology in chemical manufacturing. Further, he attracted a number of leading scientists to the field and profoundly influenced them.

Born November 17, 1927, in New York City, Shel was the only child of Irving Friedlander, a paper box manufacturer, and his milliner wife, Rose. He interrupted his undergraduate studies at Columbia University to serve in the Army just after World War II but returned to earn a BS in chemical engineering in 1949 and an MS from the Massachusetts Institute of Technology in 1951. In 1950 he was hired as a research fellow by the Harvard School of Public Health on an Atomic Energy Commission contract; his research on the escape of radioactive particles from nuclear reactors sparked his academic interest in aerosols. He then joined the research group of H.F. Johnstone, who was known for aerosol research, and in 1954 earned his PhD in chemical engineering at the University of Illinois at Urbana-Champaign.

Working with Johnstone, Shel first applied the concept of "stopping distance" to the problem of transport of particles in turbulent flow to surfaces. He continued research in this area while an assistant professor of chemical engineering at Columbia (1954–1957) and during his subsequent appointments at Johns Hopkins (1957–1964) and Caltech (1964–1978). The concept has since been used routinely in descriptions of pollutant transport to soil, crops, trees, and large aquatic bodies by many environmental scientists throughout the world and, combined with his subsequent contributions on diffusion of particles to collection objects, forms the foundation of much modern work on particle removal from gases and liquids. In addition, his early research on aerosol deposition in the lung led to the development by others of methods to deliver therapeutic drugs directly to the lung.

As a young professor at Johns Hopkins, Shel also began publishing on self-preserving particle size distributions, which is considered one of the most elegant research works in aerosol science. He and his students discovered that size distributions of coagulating particles approach an asymptotic form independent of the initial distribution. This discovery has had a profound effect on understanding of particle coagulation in gases and liquids and most recently in gelation theory. It has enhanced knowledge of fly ash formation during coal combustion and has facilitated the design process for production of both particulate commodities (e.g., carbon black, titania) and sophisticated nanomaterials (e.g., catalysts, sensors, and biomaterials). While at Johns Hopkins, Shel was recognized with the Allan P. Colburn Award, given annually by the American Institute of Chemical Engineers (AIChE) to a professor under the age of 36 for excellence in publications.

After moving to Caltech in 1964, Shel invented the "chemical element balance method," one of the most revolutionary contributions to both aerosol science and air pollution engineering and one that greatly influences current government policy and air quality management practice in general. Using this method, the origins of an atmospheric aerosol can be unraveled by relating its chemical makeup to the composition of emissions from various sources. He and his colleagues applied the method first to the fragmentary data then available on the Los Angeles aerosol. Shel was a key participant in the 1972 Aerosol Characterization Experiment, the first large-scale study of atmospheric aerosol funded by the California Air Resources Board. He and coworkers showed the importance of automobile and secondary emissions and the relative unimportance of the marine aerosol, contrary to a common belief at the time. Since this early study, the chemical element balance method has been applied to many city environments around the world and has contributed importantly to a new branch of environmental research known as "receptor modeling," since properties of pollutants are measured at a given point in the environment, the so-called receptor site. Receptor modeling is now applied over much larger scales than it was originally; regional-scale receptor models have been developed for source attribution for acid rain and arctic haze as well as for the regulation of transportation.

Shel moved to UCLA in 1978 as a founding member of its Chemical Engineering Department and chaired the department from 1984 to 1988. In 1982, he also helped found the American Association for Aerosol Research (AAAR). In the mid-1980s, his research group was searching for easier and cheaper ways to trap smokestack emissions and prevent pollution. Shel insisted, "We must find ways to control toxic wastes before they are produced, rather than ways of disposing of them afterward." In 1987 he secured a grant from the National Science Foundation to establish the nation's first Engineering

Research Center devoted to solving the problem of hazardous waste generation and management. He served as the Center's director for several years. Through this center and the AAAR he led a pioneering effort focused on the conception, design, and operation of chemical processes that produce minimal waste. The concept of waste minimization remains central to the efforts of engineers and scientists seeking to ensure a sustainable, environmentally friendly future for the chemical processing industry.

At UCLA, Shel brought rigorous science to the field of aerosol reactor engineering, and he and his students made important contributions to the design of aerosol reactors that are used today in the manufacture of various particulate materials. He also contributed significantly to understanding of the role of nanoparticles in the properties of materials. In 1996, while investigating how tiny particles are produced in coal combustion, Shel became aware that one of the biggest unknowns was the behavior of particles consisting of about 100 to 1,000 molecules. His group focused initially on the generation of titania particles and found that they band together to form chains that could be stretched and would retract upon stress release. This discovery suggested that such particle chains could be used to produce ceramic materials with some of the properties of rubber. The dynamics of strained nanoparticle chain aggregates developed into a new research direction of great importance both to understanding of the role of nanoparticle fillers such as carbon black in tires and to the synthesis of new high-performance nanocomposite materials.

Shel's remarkably fertile mind and unusual passion for research were always evident to those who worked with him—his faculty colleagues and the many students, postdoctoral fellows, and visiting scholars who spent time in his lab. He was a committed and generous mentor who took great pride in the accomplishments of his former students and postdocs. His enthusiasm for research carried over naturally to the classroom, and he created new courses in mass transfer, air pollution, nanoparticles, and aerosol technology. He also authored the classic text *Smoke, Dust and Haze: Fundamentals of Aerosol Dynamics* (1977), now in its second edition.

Throughout his career, he received numerous distinctions for his seminal contributions and pioneering work in the field of aerosol science and technology, including a Fulbright Scholarship (1960); a Guggenheim Fellowship (1969); and five AIChE awards: the Allan P. Colburn Award for Excellence in Publications by a Young Member of the Institute (1959), Alpha Chi Sigma Award for Chemical Engineering Research (1974), William H. Walker Award for Excellence in Contributions to Chemical Engineering Literature (1979), Lawrence K. Cecil Award in Environmental Chemical Engineering (1995), and Lifetime Achievement Award of the Particle Technology Forum (2001).

Shel was elected to the National Academy of Engineering in 1975 in recognition of his work on the origin and control of particulate pollution. He also received the Humboldt Senior Scientist Award from the West German Government in 1984–1985. Most notably he was the first recipient of three international awards—the Fuchs Memorial Award (1990) of the International Aerosol Research Assembly, the highest honor in the field of aerosols; the Junge Memorial Award (2000) of the European Aerosol Association; and the Aurel Stodola Medal (2004) of ETH Zurich—as well as many honorary lectureships. In 1997, AAAR established an award in his honor for the best PhD thesis in the field.

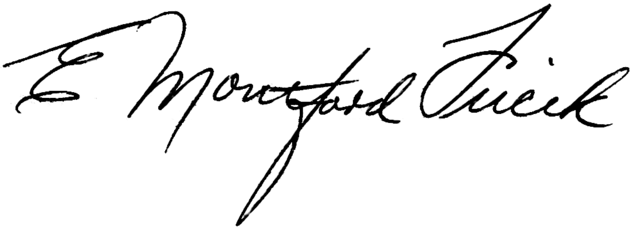
Shel gave generously of his time and energy in service to his profession and the nation. He served on the EPA Science Advisory Board and was a member of the National Academies' Board on Environmental Studies and Toxicology, Technology and the Environment Steering Committee, and Committees on Industrial Ecology and Environmentally Preferable Innovation, on Shipboard Pollution Control, and on Protecting Occupants of DoD Buildings from Chemical or Biological Release. Given his record of research, education, and service, his family, friends, and colleagues were surprised to find his name on a list of enemies during the administration of President Nixon.

Shel had diverse personal interests. He delighted both in trout fishing in small streams in the Angeles National Forest and in attending lectures at the Getty Museum. He also collected stamps, Persian rugs, and tile-top tables.

In addition to his beloved wife Marjorie, he is survived by four children: Eva Friedlander, Amelie Yehros (Ilan), Zoe Friedlander (Barry Greenberg), Josiah Friedlander (Katrinka Wolfson); and eight grandchildren: Zach and Lena White; Isaiah, Sam, and Ella Yehros; and Aaron, Rose, and Jack Greenberg.

Author's Note

The author is grateful for helpful comments and input from S. Pratsinis, R. Flagan, L. Mädler, D. Allen, and the Friedlander family, and for information from biographies written by P. Biswas (www.iara.org/AerosolPioneers.htm) and G. Hidy (*Aerosol Science and Technology: History and Reviews,* D.S. Ensor, ed., RTI Press, 2011).



E. MONTFORD FUCIK

1914–2010

Elected in 1974

"For leadership in the development of soil mechanics, water resources, and hydroelectric engineering."

BY ALAN KRAUSE
SUBMITTED BY THE NAE HOME SECRETARY

E. MONTFORD (ED) FUCIK, a dedicated leader in the water industry and former chairman and president of Harza Engineering Company, died on April 6, 2010, at the age of 96.

Ed was born in Chicago in 1914 to Edward James and Agnes Montford Fucik. He received a BS in civil engineering from Princeton University in 1935, graduating Phi Beta Kappa, and an MS in engineering from Harvard University in 1937. He met Leroy Harza in 1936, while he was at Harvard. They first worked together on the Santee-Cooper project near Charleston, South Carolina. During World War II Ed served proudly in the US Navy in the Panama Canal Zone, retiring with the rank of lieutenant commander.

After World War II he and Harza formed a partnership, handwritten on a sheet of paper, that became the Harza Engineering Company, a Chicago-based energy, water, and infrastructure company. This was the start of their joint lifelong commitment to the private practice of civil engineering. Ed worked at Harza Engineering (now MWH Global) from 1945 on, and was president and chair of the organization in 1963–1979.

He was proud that the top managers and administrators at Harza were also its principal technical consultants. He said, "We never thought, 'That hasn't been done before so we'd better not consider it.' We were always looking for new ideas, better ways to do things, and we were willing to take responsibility for making those ideas work. It's one thing to have a good idea; it's another thing to make it work. Engineers have to do both—think and act."

Throughout his career, Ed was esteemed by the engineering industry. He served as vice president and president of the Chicago post of the Society of American Military Engineers (SAME) and as national director of the American Society of Civil Engineers (ASCE), and was elected to the National Academy of Engineering in 1974 "for leadership in the development of soil mechanics, water resources, and hydroelectric engineering." In 1976 he was named ASCE Civil Engineer of the Year (Illinois Section), and in 1979 he was awarded both the prestigious Goethals Medal from SAME for distinguished performance in the field of engineering, design, or construction and ASCE's Rickey Medal for meritorious contributions to the science and progress of hydroelectric engineering. In 1953 he won ASCE's Thomas Fitch Rowland Prize for papers that provide valuable contributions to construction engineering. He belonged to the Western Society of Engineers, the National Society of Professional Engineers, the Consulting Engineers Council, and the United States Committee on Large Dams.

Ed worked on some of the largest and most important dam, hydropower, and water resource projects in the world, such as the Bath County Pumped Storage project in Virginia; the Wanapum, Priest Rapids, and Mossyrock Dams in Washington; and the Tarbela/Mangla Spillway in Pakistan. He was intimately involved with the planning, design, and construction of the Guri Hydroelectric Project in Venezuela from the late 1950s to the completion of the final-stage dam raising and expansion in 1983, including eight years on the Engineering Board of Consultants. He was also involved in Chicago's Deep Tunnel and Reservoir Plan (TARP) and the Rayburn Outlet Works and Powerhouse for the US Army Corps of Engineers. He served as chief geotechnical engineer for the Panama Canal, where he directed studies of new locks to be built in the event of a war action against the Canal.

Fortunately, the threat never materialized, but the unfinished "third locks excavation" can still be seen, although it is slowly being erased as the MWH-designed Panama Canal Expansion Project is constructed.

Ed's dedication and leadership led to Harza Engineering's emergence as an internationally preeminent engineering firm. His legacy lives on in some of the largest, most complex wet infrastructure projects in the world and his loss is felt by the entire engineering community.

Ed Fucik is survived by his beloved wife of 67 years, Margaret Reinig Fucik, and by daughters Margaret A. Fucik (Steve Praissman), Jane Fucik Allendorph (George), and daughter-in-law Susan S. Fucik; grandchildren Carolyn Fucik Wilkerson, Jennifer Fucik Slota (Ben), Kathryn C. Fucik, G.P. Allendorph, and Margaret Allendorph Hoover (Alex); and six great-grandchildren. He was preceded in death by his son Edward M. Fucik Jr. and his brother and sister-in-law, Frank M. and Ruth F. Fucik.

Tasuku Fuwa

TASUKU FUWA

1915–2013

Elected in 1979

"For contributions in the field of metallurgy and leadership in the profession."

BY MERTON FLEMINGS

TASUKU FUWA, professor, Tohoku University, and executive advisor, Nippon Steel Company, died on November 23, 2013 at the age of 98. He was an international leader in the physical chemistry of molten iron, steel and slags. He was the first Japanese elected to membership in the National Academy of Engineering.

Professor Fuwa was born in Kumamoto Prefecture as the fifth of six children. His family stems from the upper-class Hosokawa clan. He went to Higher School No. 5 in Kumamoto, where he began medical studies, with German as his first foreign language.

Although his father died when he was ten years old, all six children were able to attend university through the support of the Hosokawa family. Fuwa attended Tohoku Imperial University, receiving his undergraduate degree from the Department of Metallurgy, Faculty of Engineering, in December 1941. He entered graduate school at Tohoku in 1942 and became research associate, special research scholar, lecturer, and then assistant professor in 1946.

In 1954 Professor Fuwa was sent by his university to MIT, where he studied under John Chipman until 1957, receiving his doctorate in 1958. After retuning to Tohoku he was promoted

*With assistance from two distinguished Japanese Metallurgists, Professor T. Koseki and Dr. T. Matsumiya, and through them from Professor Fuwa's daughter, Mrs. Hikari Takuma.

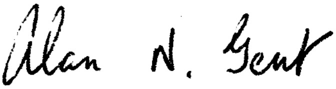
to professor in 1962 and remained at the university until he retired in 1979, when he joined Nippon Steel Corporation as executive advisor.

Professor Fuwa was elected a Fellow of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) in 1974. He was awarded the Nishiyama Medal of the Iron and Steel Institute of Japan in 1976. He was president of the Japan Institute of Metals in 1979–1980. He became Honorary Member of both the Japan Institute of Metals and the Japan Iron and Steel Institute in 1982, and a Distinguished Member of AIME in 1984, when he also received the Honda Memorial Prize. He was elected the first Japanese member of the Chinese Academy of Engineering in 1996. In 1997 he was awarded the Gold Medal of the Japan Institute of Metals, and in 1995 the Tawara Gold Medal of the Iron and Steel Institute of Japan.

In 1974 Fuwa led the establishment and initiation of the Matoba Memorial Kawatabi Seminar on Iron and Steelmaking for researchers and engineers in industries and universities. This seminar continues to be held once a year—the 39th seminar was held in 2013—and has contributed much to the development of the steel industry in Japan.

At Nippon Steel Corporation, he attended all internal company symposia of researchers and engineers on steelmaking, with insightful comments and advice. He visited steelworks and advised on technical aspects of their operation. He also advised and arranged the foreign studies of many young researchers and engineers at Nippon Steel and wrote recommendation letters to the appropriate universities. One of many specific technical contributions was his leadership, with Jin-ichi Takamura, of a project on oxide metallurgy that resulted in important advances in steelmaking technology. Under Professor Fuwa's guidance, many researchers and engineers were both educated in their professions and inspired to follow his example.

Professor Fuwa had many friends and acquaintances throughout the world, all of whom enjoyed his warm company and good humor, and respected his accomplishments and commitment to his profession.



ALAN N. GENT

1927–2012

Elected in 1991

"For significant engineering contributions in adhesive and mechanical properties of polymers."

BY STEPHEN Z.D. CHENG AND DONALD R. PAUL

ALAN N. GENT, the Dr. Harold A. Morton Professor Emeritus of Polymer Physics and Polymer Engineering at the University of Akron, Ohio, passed away on September 20, 2012, at the age of 84.

He was born in Leicester, England, on November 11, 1927, to Harry and Gladys Gent. He earned degrees in physics and mathematics at the University of London before receiving his PhD in 1955 on the mechanics of deformation and fracture of rubber and plastics. At the age of 17 he worked as a research assistant at the John Bull Rubber Co., then served the British Army in 1947–1949 before becoming a research physicist and later principal physicist at the British Rubber Producers' Research Association, where he initiated a program in polymer engineering research.

In 1961 Gent joined the faculty at the University of Akron as professor of polymer physics in the Institute of Rubber Research. Two years later he was named assistant director of the Institute of Polymer Science, a position he held until 1978, when he was named Dean of Graduate Studies and Research. Eight years later he returned full-time to research and teaching, as a professor of polymer physics and then as the Dr. Harold A. Morton Professor of Polymer Physics and Polymer Engineering until his "unofficial" retirement in 1994.

He also served as consultant and scientific advisor to the research division of the Goodyear Tire and Rubber Company from 1964 to 2002.

Internationally known, Gent was widely regarded as the foremost expert on the fracture mechanics of rubber and plastics. His research yielded significant contributions to the world's understanding of the physics of adhesion and the fracture of rubbery, crystalline, and glassy polymers. His work likely impacted nearly every rubber or plastic product developed today. He was also largely responsible for modern understanding of the strength of adhesive bonds; he identified and measured the separate contributions from chemical interaction (or reaction) between adherends, from rheological behavior of viscoelastic adhesives, and the fracture mechanics of simple adhesive joints.

During his distinguished career, he published more than 200 papers and book chapters on the mechanical properties of rubber and plastics, edited a book titled *Engineering with Rubber* (1992; now in its third edition), and was a coholder of two British patents and a US patent. He was frequently invited to address universities, corporations, and professional society meetings around the world and was a visiting professor at Queen Mary College at the University of London, McGill University, and the University of Minnesota. He also presided over three national scientific societies—the High-Polymer Physics Division of the American Physical Society, the Society of Rheology, and the Adhesion Society—and chaired four Gordon Research Conferences (on elastomers, cellular materials, adhesion, and composites). He served the National Academies as a member of the Panel on Technical Evaluation of NASA's Proposed Redesign of the Space Shuttle Solid Rocket Booster and the Committee on Reliability of Adhesive Bonds in Severe Environments.

Gent was elected to the National Academy of Engineering in 1991, and his extraordinary teaching and research were recognized with numerous other honors and awards: the Mobay Award, Society of the Plastics Industry's Cellular Plastics Division (1964); Bingham Medal of the Society of

Rheology (1975); Colwyn Medal of the Plastics and Rubber Institute (1978); Adhesives Award of the American Society for Testing and Materials International (1979); Society of Plastics Engineers International Research Award (1980); 3M Award for Excellence in Adhesion Science for the Adhesion Society (1987); George Stafford Whitby Distinguished Teaching Award (1987); Charles Goodyear Medal of the Rubber Division (1990); Medal of the Collège de France (1990); High Polymer Physics Prize of the American Physical Society (1996); NASA Distinguished Public Service Medal (1988); honorary degrees from the Université de Haute-Alsace, France (1997) and De Montfort University, UK (1998); the first Tan Sri Dr. B.C. Sekhar Gold Medal, instituted by Rubber Asia (2010); and the Inaugural Tire Technology International Lifetime Achievement Award (2012).

His colleagues recognized him as "brilliant and unassuming" and "both a remarkable scientist and a remarkable man." From the beginning of his ties to the University of Akron, it was clear he possessed an extraordinary knowledge of and passion for his field. His pioneering work was coveted by global research and development firms, his contemporaries and students, and the university gratefully acknowledges Dr. Gent's invaluable role in helping position it as a leading center for polymer science and polymer engineering research. Truly, Dr. Gent was a visionary scientist and educator.

Although Gent will probably be remembered primarily for his groundbreaking work as a scientist, his legacy is also that of an outstanding educator. He possessed a unique gift for bringing complex concepts into clear focus in both the laboratory and classroom, and during his lengthy career with the university he directed to completion more than 40 PhD dissertations and 35 MS theses. In honor of his international recognition and his service to the University of Akron, the board of trustees voted unanimously to change the name of the Ohio Research Scholar Professor at the University of Akron to the Alan N. Gent Ohio Research Scholar Professor of Polymers.

In addition to his passion for science, Dr. Gent's hobbies included scouting, sailing, and collecting books. He served for many years as scoutmaster for the Boy Scouts in both England and Silver Lake, and attained the rank of Queen's Scout in England. Throughout his life, he was known for his warmth, humor, and generosity. He was a devoted family man and friend to all who knew him.

Gent is survived by his wife Ginger Lee, former wife Jean Gent, sons Martin, Michael, and Andrew, 15 grandchildren, and several great-grandchildren.

DONALD W. GENTRY

1943–2012

Elected in 1996

"For contributions to understanding rock mass responses in long-wall coal mining, improvements in mining education, professional development, and public service."

BY THOMAS J. O'NEIL

DONALD W. GENTRY, a leading international figure in mining engineering education and minerals development, died on July 2, 2012, after a lingering illness. He was 69. Mining engineering is one of the smallest engineering fields and thus relies on a relatively small cadre of articulate, visionary leaders to make its case to the world. For decades, Don filled an important role in this capacity, and he will be sorely missed by his many mining friends everywhere.

Born in Alhambra, Illinois, some 40 miles northwest of St. Louis, Don was raised on a farm but decided to follow his grandfather's career in mining. He entered the University of Illinois in 1961 where he not only excelled academically but also was first chair trumpet in the Fighting Illini marching band. He was also an accomplished pianist and was pleased that his children developed a love of music as well. However, it was the excitement of minerals discovery and development that was his abiding interest, leading to a lifelong passion for his profession.

After his graduation in 1965, Don earned an MS from the Mackay School of Mines at the University of Nevada, where he broadened his education in mineral exploration strategies and mineral property evaluation. This was followed by a number of industrial assignments of increasing responsibility for the Anaconda Company.

He had always planned to return for a doctorate and a career in mining engineering education, and completed his PhD at the University of Arizona in 1972, focusing on rock mechanics. This work carried over to the Colorado School of Mines, where he began a 26-year career. His important research on rock mass response to longwall coal mining in steeply dipping strata helped to propel his career and he advanced rapidly to the rank of professor in 1979. From 1983 to 1990 he was dean of engineering and undergraduate studies at Mines, followed by five years as head of the Department of Mining Engineering.

In 1998, Don retired from the Colorado School of Mines as professor emeritus and became president, chairman, and CEO of PolyMet Mining Corporation, where he spent the next five years advancing a large nickel, copper, and platinum group minerals project in northern Minnesota. He also served on the boards of directors of several other mining companies, including Santa Fe Gold Corporation and Newmont Mining Corporation. At the time of his death, he remained active as a director of Gryphon Gold Corp.

In his later years at Mines and after his retirement from education, Don became increasingly interested in the financial aspects of mine project assessment, investment decision analysis, project financing, and corporate investment strategies. He earned a strong international reputation in these areas as he presented more than 60 short courses, authored more than 100 papers, and coauthored the textbook *Mine Investment Analysis* (1984), which became the standard in nearly all mining engineering programs. He was particularly active in helping to restructure mineral policies and related taxation issues, both for developing nations and for Native American tribes. He consulted extensively on this topic in Chile, Argentina, Peru, and Brazil.

Don was very active in his profession. He chaired the Accreditation Commission of the Accreditation Board of Engineering and Technology (ABET), and served in a great many capacities for the Society for Mining, Metallurgy, and Exploration (SME) and the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), including as president of SME in 1993 and of AIME in 1996. He initiated a strategic planning process at SME that has served the Society very well. He remained devoted to SME throughout his career, particularly with respect to its programs on leadership development for young engineers. He also dedicated a great deal of time to the National Academy of Engineering after his election in 1996, serving in all leadership positions of Section 11, Earth Resources Engineering.

A list of Don's awards and honors would be very long. Among them would be his selection as an ABET Fellow; 1987 Henry Krumb lecturer for AIME; recipient of the 1991 AIME Mineral Industry Education Award, 1998 SME Daniel C. Jackling Award, and 1998 AIME Mineral Economics Award; and election in 1992 as a Distinguished Member of SME. He was named an Outstanding Alumnus of the Mackay School of Mines in 1992 and was awarded an honorary doctor of engineering degree from the University of Arizona in 2002. In 1996 he was named an AusIMM/AIME Distinguished Lecturer, and he considered the associated speaking tour in Australia one of the highlights of his career.

Don Gentry was a natural leader and an exceptionally talented engineer and educator. He was direct and plain spoken, and his work ethic was remarkable. He always delivered and had little time for those who didn't. A colleague once commented, "Make sure you really want it done before asking Don to do it, because it *will* get done—and fast."

Aside from his commitment to his family and his profession, his other love was hunting and fishing, which he vigorously pursued around the world. He loved his Arkansas retirement home where he could walk out the back door to his boat house and go bass fishing.

Don is survived by his wife of 47 years (and high school sweetheart), Sheila, daughter Tara, son Chad, four granddaughters, and younger brother Darrell.

NORMAN A. GJOSTEIN

1931–2006

Elected in 1990

"For original contributions to the technology of surfaces and interfaces and for technological leadership in the application of advanced materials to ground vehicles."

BY W. DALE COMPTON

NORMAN A. GJOSTEIN, a leader in materials science research and applications of new materials in the automotive industry, died on April 5, 2006, at the age of 74.

Norm, as he was called, was born in Chicago on May 26, 1931. He was always fascinated by mathematics and was encouraged by his electrician father to apply it to engineering. He received his BS and MS from the Illinois Institute of Technology (IIT) in 1953 and 1954, respectively, and his PhD from Carnegie Mellon University in 1958, all in metallurgical engineering. He attended IIT as an Evans Scholar and was awarded the Standard Oil Fellowship while at IIT and the Alcoa Fellowship while at Carnegie Mellon.

After two years as a research engineer at Thompson Ramo-Wooldridge he joined Ford Motor Company as a research scientist. Over the next 14 years (1960–1974) he engaged in research on the physics and chemistry of surfaces and the development and application of new analytical tools for surface analysis, including LEED/Auger surface studies of reconstructed surfaces and mechanisms of particle growth in catalyst systems. He also led teams to develop lightweight composite automotive components, silicon micromachining facilities for smart sensors, fiber optic multiplex wiring systems, and sodium-sulphur batteries. Of the 60 or so publications that resulted from his research, five were cited between 100 and 200 times.

A need for strong technical leadership led Ford management to encourage Norm to turn from active research to the management of research programs. He was manager of the metallurgy research department in 1974–1976, and was then asked to establish a new liaison office to foster closer cooperation between the US research and the Ford of Europe organization. Over the next two years Ford research broadened its program to encompass the interests of Ford of Europe, much to the delight of the company's management. Upon his return from Europe, Norm became the program planning manager for Ford research. From 1979 until his retirement in 1996, he served as director of various research groups, the last being the Powertrain and Materials Research Laboratory. Upon retirement from Ford he accepted a position as clinical professor of engineering at the University of Michigan, Dearborn, in the Department of Electrical and Computer Engineering.

Norm was active in the National Research Council (NRC). He served on the committee that reviewed the Research Program of the Partnership for a New Generation of Vehicles and contributed importantly to the first published *Review of the Research Program of the FreedomCAR and Fuel Partnership.* He was also a member of the committees that produced *Industrial Technology Assessments: An Evaluation of the Research Program of the Office of Industrial Technologies* and *Engineering Education: Designing an Adaptive System.*

In addition to his election to the NAE in 1990, Norm was honored by many colleagues. He was a fellow of ASM International and a member of its board of trustees. He was a fellow of the Engineering Society of Detroit (ESD) and served on its board of directors. As a member of the ESD Strategic Planning Committee, he also chaired the Strategic Planning Implementation Task Force. He received ASM's John H. Shoemaker Award and ESD's Gold Award. He was active in the

American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), SAE, and IEEE. In 1995 he was elected to the board of directors of Ceradyne, a Salt Lake City ceramics company that had licensed some of Ford's ceramic technology. He served on advisory boards at Princeton University, Brown University, Carnegie Mellon University, University of Pennsylvania, and California Institute of Technology. He established the Michigan Industry Initiatives for Math and Science Education, a program to give high school science and math teachers an industrial experience.

Norman was a close friend, a valued associate, and a steadfast contributor to his profession, his company, and many community causes. He is survived by daughter Joan G. Daye of Wexford, PA; son Thomas A. Gjostein of Columbus, OH; and four grandchildren.

His son wrote:

> Of all of the privileges that could be granted to me in my life, participating in this memorial about my father, Norman A. Gjostein, may be one of the greatest. I wish to thank, foremost, Mr. Dale Compton for his synopsis of the career and life of my father, as well as for his friendship and guidance through much of my father's career in research and development at Ford Motor Company. My mind is flooded with many memories of a lifetime with the man that I knew as my dad, a scientist and a friend. Although brevity is important here, it is also difficult, given the sheer volume of memories that I could share about him.
>
> When I think of my father the scientist, my earliest memories involve riding with him over to the lab at Ford Motor Company in his red Mustang and how he would make science understandable to me along the way through visual examples either natural or man-made, such as bridges, buildings, and cars.
>
> At the lab itself, I remember his sitting in a white coat with his glasses in hand, showing me how a laser worked. This image of him resonates in my memory, glasses in hand while listening to another person, since he often was known for this posture as listener and thinker. His ability to think matters through in silence is, truly, the greatest skill that I was able to learn from him. Integral to that ability

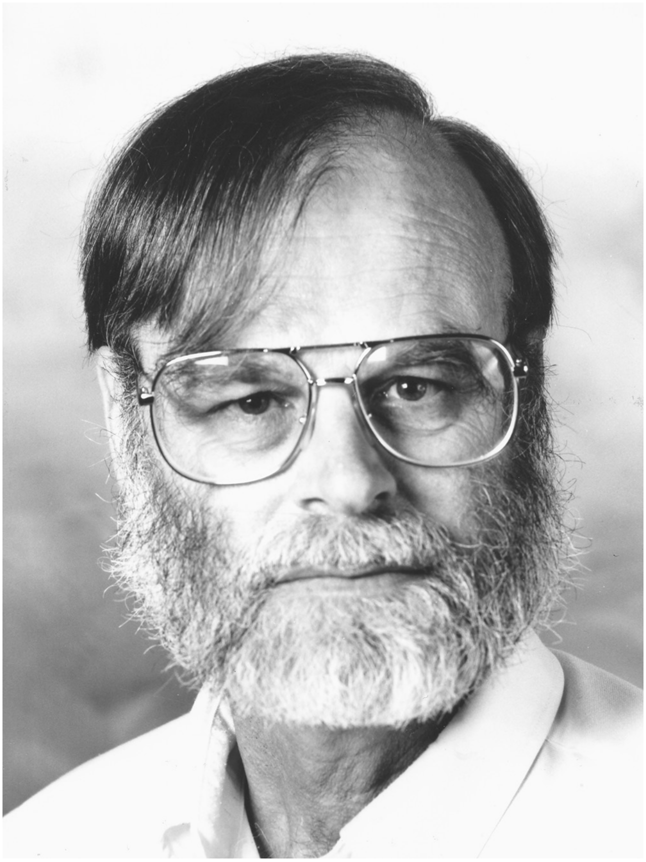
was his capacity to listen intently to the person with whom he was speaking, so that person always felt that they were the only one in the room.

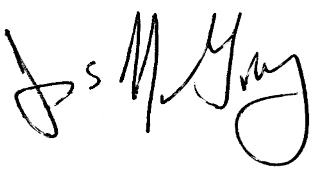
The first cause for my father to be drawn to math, science, and engineering must have come from his own father, Nils Gjostein, who immigrated with his new wife, Amalia, in 1926. My grandfather taught his son, a first-generation American, a great deal about electrical and carpentry work, which became the seed for his future interests, professionally and personally. There was nothing my dad could not fix or build.

Throughout his life, my father had a thirst to learn and a love for math and science, which influenced our whole family, especially my mother, as she listened to him talk about his projects at the lab every evening before dinner. Their marriage of 47 years is a testament to Catholic faith and the complementarity of husband and wife—a role model for me with my own wife, Rebecca. For my sister, Joanie Daye, his love of math and science fostered her interest in studying chemistry in college and drew her to the automotive field as well. For my brother-in-law Ken and nephew Jeff, his fascination for detail in automotive engineering led him to send a ten-page letter with diagrams on making the best pinewood derby car when Jeff was in scouting. Both Ken and Jeff always enjoyed sharing their interests with him.

For me, his love to learn has instilled a fascination for math and science as well as a love for automobile technology. Although my career has been different, his support of me was profound. When I was in college, I remember a dinner between just the two of us, where he sat across the table from me and beamed about how he enjoyed watching my mind blossom and develop. He discussed his interest in returning to the academic world and teaching after retirement from Ford—he wanted to watch the same growth in his students. During my career as a trial lawyer, he never lost interest in learning and always asked about my work or some high-profile case in the media. It is no coincidence that I can see many of his qualities in my children, Luke, Julia, and Joseph.

His greatest example to me is in his being a whole person. He was so successful in research and in management at Ford, but was always there for his family. Shortly after his death, an engineer friend of mine did a Google search of his name and told me that I needed to see it because of all the references to his work, associations, and publications. I was amazed at the amount of links associated with his name. That was just one facet of the greatest man I ever personally knew. All of his family and friends knew him as a humble yet great golfer who wanted to hear all about the person he was with that day.





JAMES N. GRAY

1944–2012
(Lost at sea in 2007)

Elected in 1995

"For contributions to the development and understanding of database systems, especially concurrent and distributed systems."

BY DAVID DEWITT, ED LAZOWSKA, AND MIKE STONEBRAKER

JAMES N. GRAY, a leader in the field of database management systems, was lost at sea off the coast of northern California while sailing on January 28, 2007, at the age of 63. After a legally mandated waiting period, he was officially declared dead on January 28, 2012.

Jim was born on January 12, 1944, in San Francisco, where he spent most of his childhood. He received his BS and PhD degrees from the University of California, Berkeley, in 1966 and 1969, and then worked at the IBM T.J. Watson Research Laboratory before joining IBM's San Jose Research Laboratory. There he helped lead the design and development of System R, one of the first database systems to use the relational data model. He left IBM in 1980, worked for Tandem until 1990 on the parallel relational database system Non-Stop SQL, and then at Digital Equipment Corporation until 1995, when he joined Microsoft. At the time of his disappearance in 2007, he held the title of Technical Fellow at Microsoft.

In 1988, System R (along with the INGRES project at Berkeley) was honored with the ACM Software Systems Award, for pioneering the development of relational database systems. It was while working on the System R project that Jim first developed the notion of what it meant for transactions to be serializable, the connection between serializability and database consistency, and how a protocol known as "two-phase locking" could be used to ensure that two or more transactions are serializable with respect to each other without having to understand the semantics of the transactions.

Jim's pioneering research on transactions at IBM in the 1970s provides the foundation for today's world of electronic commerce: every time someone uses an ATM, reserves a seat on an airplane, or purchases an item on the Web, they are relying on the mechanisms that Jim first developed. These techniques ensure that "the right thing" always happens, even in the presence of software and hardware failures. While they seem second nature today, when Jim conceived of them they required deep insight into the complexities of concurrently executing queries against a shared database system.

During his career Jim made a number of other significant technical contributions as well—database system architectures and algorithms, fault tolerance, input/output architectures, parallel database systems, database system performance evaluation and benchmarking, and multidimensional data analysis. Later in his career, he became interested in helping natural scientists with their work. As part of the Microsoft TerraServer and the Sloan Digital Sky Survey projects he put astronomy observation data into a database system, so scientists could query their data in SQL rather than writing custom programs in C++ or another general purpose language. The implementation of this idea for the Sloan Digital Sky Survey has resulted in more than 2,000 astronomy publications. The success of SQL also profoundly influenced how many scientists manage their data today.

Jim received numerous awards for his contributions to the database field, including the ACM A.M. Turing Award in 1998 for "seminal contributions to database and transaction processing research and technical leadership in system implementation." In addition to being a member of the National Academy of Engineering, Jim was elected in 2001 to both the National Academy of Sciences and the American Academy of Arts and Sciences, and in 2003 he was elected to the European Academy of Sciences. He was in the first class of ACM Fellows (1994), and served on President Clinton's Information Technology Advisory Committee (PITAC), whose 1999 report had a significant impact on the nation's investment in information technology research and development.

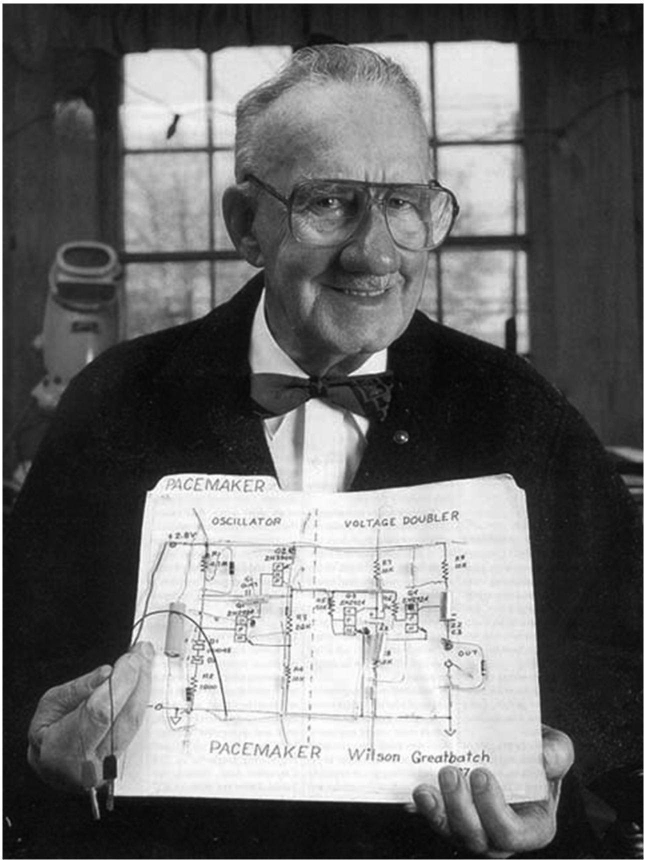
At a tribute event at UC Berkeley on May 31, 2008, 700 of Jim's friends, family, and colleagues met to talk about his professional contributions and his impact on their lives. Speaker after speaker described his professional accomplishments in transaction processing and science applications as well as the ways that Jim had been a friend, mentor, and research collaborator. He was a mentor to many of the younger people in our field and traveled widely to universities and research centers to interact with research personnel.

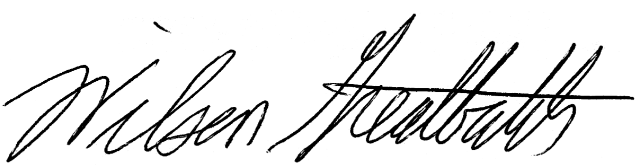
Stories about Jim's unique character are legendary. He was an unmanageable free spirit in the workplace, who could write prodigious amounts of code and even more prodigious research reports. He was almost never seen wearing a coat and tie and refused to conform to social norms. It was reported at the tribute that he had asked IBM to transfer him from Yorktown to San Jose so that he could work on System R. When his manager refused, Jim quit on the spot and drove across the country to be hired by the San Jose lab. Equally legendary are stories of his backpacking and hiking trips. He also loved to take people sailing on his boat, and it seems that half of the database community has had this pleasure.

Jim was a true scholar and friend of the entire database community. Those of us who knew him well will always strive to live up to the model that he set by his behavior.

He is survived by his wife Donna, daughter Heather, grandchildren Sam, Grant, and Nika, and sister Gail.

We miss him. He was one of a kind.


PACEMAKER
OSCILLATOR
VOLTAGE DOUBLER
OUT
PACEMAKER
Wilson Greatbatch


Wilson Greatbatch

WILSON GREATBATCH

1919–2011

Elected in 1988

"For the invention and relentless improvement of the life-saving implantable cardiac pacemaker and the long-life lithium-iodine battery."

BY CURT HOLMES
SUBMITTED BY THE NAE HOME SECRETARY

WILSON GREATBATCH, inventor of the first implantable cardiac pacemaker and holder of more than 325 patents, passed away on September 27, 2011, at the age of 92 in his home in Williamsville, New York. In addition to the pacemaker, his prolific career of invention included the creation of a long-life lithium battery used in medical implantation devices, contributions to AIDS research, alternative fuel experiments, and a solar-powered canoe.

For his inventive contributions he was honored with induction into the National Inventors Hall of Fame in 1986, election to the National Academy of Engineering in 1988, selection for the 1990 National Medal of Technology and Innovation, presented by President George H.W. Bush, and receipt of the 1996 Lemelson-MIT Lifetime Achievement Award. He was also awarded honorary doctoral degrees from Houghton College in 1970 and from the State University of New York (SUNY) at Buffalo in 1984. And he was a member of several professional societies, including the British Royal Society of Health, American College of Angiography, and American Association for the Advancement of Science, and a fellow of the Institute of Electronic Engineers.

He was an active mentor and often spoke to engineering students at various levels about invention. He advised one audience, "Nine things out of ten don't work. The tenth will pay for the other nine," stressing the importance of perseverance. He counseled an audience of Clarkson University students, "Don't fear failure. Don't crave success. The reward is not in the results, but rather in the doing."

Born on September 6, 1919, in Buffalo, Wilson Greatbatch was the only child of Warren, a construction contractor from England, and Charlotte Recktenwalt Greatbatch, a secretary who named their son after President Woodrow Wilson. As a boy he was interested in radio technology, and he later used his skills in shipboard communications and guidance systems in the Navy and then as a telephone repair technician before he pursued undergraduate studies.

He was honorably discharged from the US Navy after World War II and, with assistance from the GI Bill, enrolled in Cornell University, where he earned a BEE in 1950. He completed his education with a master's degree, also in electrical engineering, from SUNY Buffalo in 1957.

Greatbatch started his career as manager of the electronics division of the Taber Instrument Corporation in Buffalo, and began experimenting with pacemaker implant models. Because Taber did not support his research, he continued the work independently, setting up an electronics workshop in the barn behind the Clarence home he shared with his wife, Eleanor Wright Greatbatch—his childhood sweetheart and a home economics teacher whom he married in 1945—and their five children: Anne, John, Kenneth, Peter, and Warren.

In 1956 he was working as an assistant professor of electrical engineering at SUNY Buffalo when he had his first breakthrough in experimentation with the university's Chronic Disease Research Institute. While building a heart rhythm recording device, he reached into a box of parts for a resistor. Happenstance drew him to choose the wrong size, and when he installed it the resistor emitted intermittent electrical pulses that he recognized as remarkably similar to the human heartbeat. Drawing on his expertise in radio frequency, he surmised that heart block occurred because of the body's inability to deliver critical signals to the heart. It was, he said simply, a failure of communication. He then began experimenting with methods to shrink the materials and to protect the device from body fluids.

On May 7, 1958, doctors at the Veterans Administration Hospital in Buffalo tested a two-cubic-inch model of Greatbatch's design and successfully controlled canine heartbeat. Greatbatch returned his focus to a practical human implant and discovered that other American research groups were racing alongside him to produce the first pacemaker. He redoubled his efforts, drawing on $2,000 in savings and enlisting his wife Eleanor's assistance in the administration of shock tests for the device's transistors by taping them to a bedroom wall. He collaborated closely with Dr. William C. Chardack, surgical chief at the VA Hospital, where the device was initially tested, and Dr. Andrew Gage. In 1960 the team implanted Greatbatch's pacemaker in ten human patients, including two children. The following year, Greatbatch sold the licensing rights to Minneapolis-based Medtronic, which had developed an external pacemaker, and went on to serve the company as a consultant for many years.

In 1968, troubled by the short life of the zinc-mercury batteries used in the original pacemaker, Greatbatch acquired the rights (from a Baltimore-based research team at Catalyst Research Corporation) to a lithium-iodine-polyvinylpyridine design that extended the average battery life of a pacemaker from two to ten years. He licensed the technology, recruited a team of battery scientists, and in 1970 founded Wilson Greatbatch Ltd. (now known as Greatbatch). The company quickly became a power-component supplier for the medical device industry and expanded into related businesses based on Greatbatch's oft-stated belief, "History has repeatedly shown that when a new method or material becomes available, new uses for it arise."

By 1972 he had reengineered the pacemaker into a compact sealed package and his company had become an international enterprise that produced implantable batteries, commercial industrial lithium batteries, medical devices, and related components. He chronicled his career and research in his 2000 memoir, *The Making of the Pacemaker.*

In 1985 he left his company to dedicate more time to other research interests. In conjunction with research partner John Sanford at Cornell University, he made progress against the replication of the AIDS virus in cats.

In 1983 the National Society of Professional Engineers selected Greatbatch's pacemaker as one of the top two engineering contributions of the last half-century. Today, nearly one million pacemakers are installed annually worldwide, changing the life expectancy of recipients to nearly that of the average human extension.

WILLIAM A. GROSS

1924–2011

Elected in 1996

"For air bearings research leading to magnetic disk memories and low-cost video recording and for industrial and academic leadership."

BY ERNEST S. KUH, FRANK E. TALKE,
TAMARA WILLIAMS, AND SHARON P. GROSS

WILLIAM ALLEN GROSS, former dean of the University of New Mexico School of Engineering and professor of mechanical engineering, died on February 20, 2011, at the age of 86. He is recognized for pioneering breakthroughs in computer and video recording technologies, for visionary leadership in industry and education, and for innovative programs to support nontraditional engineering students and engineering entrepreneurship.

Bill was born on November 17, 1924, in Los Angeles, to William Allen and Margaret (Hill) Gross. On the heels of Pearl Harbor, he enrolled in the US Coast Guard Academy because of his love of the sea and his commitment to saving lives. Upon graduating in 1945, he served for three years as an officer in the Pacific and then, a newlywed, resigned a secure commission to pursue further education. He received his PhD in applied mechanics at the University of California, Berkeley in 1951. He taught there and at Iowa State University until 1955, when he left to get industrial experience. He returned to academia in 1974 as dean of engineering at the University of New Mexico.

Friend and colleague Ernest Kuh writes that he first worked with Bill when they were new members of the technical staff at Bell Telephone Labs in Murray Hill, New Jersey, as part of an amazing team charged with identifying and solving telecommunication problems. From that time forward, Ernie saw Bill "develop into a distinguished engineering scholar, a well-known researcher in his field of mechanics, an outstanding educator and university administrator, and a creative industrialist and leader."

In 1956 Bill joined IBM as a member of the research staff and later manager of the Applied Mechanics Department at IBM's newly opened research lab in San Jose, California. He worked with a small group of colleagues to develop the fundamentals that made computer disk memories possible, and published the first scientific papers on gas lubrication in magnetic recording disk drives. His book *Gas Film Lubrication* (1962) and papers were seminal for the development of a generation of engineers and for the development of the fields of computer-aided design and tribology.

Frank Talke recalls that, for his work on tape and disk technology, Bill was a source of excitement in those early years. And when Frank started at IBM in 1969, he read all of Bill's research reports and studied his book on gas lubrication from cover to cover. He still cherishes that book, which was signed by Bill and has a special place in Frank's office. Bill's pioneering research on gas lubrication built the scientific basis for understanding how and why magnetic recording sliders fly in hard disk drives. Frank describes Bill as a leader in his field, a true icon, and very well respected by scientists and engineers who had the privilege of knowing him.

In 1961 Bill accepted the challenge to become director of research, and later vice president and general manager, of the Advanced Technology Division at Ampex Corporation. At that time Ampex was the world leader in audio recording, and Bill managed a team of engineers that made videotape recording feasible and affordable. His collaborative management style fostered innovation, and under his leadership Ampex produced the first terabit memory and a new line of microwave ferrites. His son Mark Gross recalls helping an Ampex engineer field test one of the first portable video recorders, a 90-pound monster backpack carried while filming. They did the test at a

Stanford university football game, and "instant replay" from the field was born.

At the University of New Mexico Bill served as dean from 1974 to 1980 and as professor and dean emeritus from 1982 to 1999. Among his many achievements as dean were doubling enrollment, adding the Department of Computer Science, and doubling research funding. He initiated and developed the political support to obtain a five-year, multimillion-dollar legislative commitment for science and engineering equipment. He also had the vision to develop innovative programs to increase the numbers of Native Americans, Hispanics, and women in the School of Engineering. He created and secured funding for NAPCOE (Native American Program in the College of Engineering), HEP (Hispanic Engineering Program), and the Engineering Program for Women, all of which evolved into national programs. A former student and Albuquerque entrepreneur notes that HEP, and the national program into which it evolved, "has been a critical aid to many hundreds of engineering students, providing scholarships, mentoring, tutoring, fellowship, and high school visits."

As a professor, Bill was instrumental in creating curricula beyond the traditional engineering disciplines, including an entrepreneurial engineering class for engineering students, working engineers, and scientists. Many of these students credit him with giving them the tools and confidence to start companies or to use what they learned in their workplace. According to Bill Miera, founder and CEO of Fiore Industries—now a $7.5 million engineering and technology company—Dr. Gross' entrepreneurial engineering class at UNM not only opened his eyes to the possibilities of helping society through technology but also inspired him to start his own business. "I am thankful for knowing him and will remember him always," he says.

Lem Hunter, another former student and serial entrepreneur, says that "Dr. Gross's personal breadth and diversity were evident in his contributions to UNM and to the community." He adds, "Not only was he an inspirational engineering professor, but he could tackle the intangibles of entrepreneurialism and business. I learned how integrity and technological advances can work together to make a profit and improve the condition of mankind."

Bill also developed interdisciplinary courses with other UNM faculty, including classes on Technology and Culture and on Technology and Social Change. From 1982 to 1986 he was codirector of the New Mexico Technology Innovation Program at UNM, a program of both the College of Engineering and UNM School of Management. Professor of American Studies Vera Norwood found Bill the "most interdisciplinary colleague I ever met." And Mr. Miera observes that "Dr. Gross had the wisdom to recognize the value of diversity to an organization. This includes the diversity of interdisciplinary collaborations. We worked collectively on the Da Vinci corner, which brought together colleges to highlight projects demonstrating the marriage of engineering and art."

Bill was recognized with many awards and honors for his leadership as an innovator and educator. These include election to the National Academy of Engineering (1996) and his selection as a Distinguished Alumnus, College of Engineering, University of California, Berkeley, and US Coast Guard Academy (1995 and 1997, respectively); Engineer of the Year, New Mexico Society of Professional Engineers (1991); Chief Manuelito Award of the Navajo Tribe (1982); Fellow, ASME, IEEE, and AAAS; Honorary Mention for the Paul Bartlett Ré Peace Prize (2007); and New Mexico Solar Energy Association Lifetime Achievement Award (1998).

From the late 1960s on, Bill was deeply concerned about energy sustainability and strongly committed to leaving the world a better place. He was active in efforts to support sustainability, renewable energy, and social change. As part of a leave of absence from UNM in 1980–1982, he developed international programs for supporting renewable energy in developing countries. He revitalized the New Mexico Solar Energy Association in the 1980s, served on the Albuquerque Energy Conservation Council, and worked with renewable energy programs in Kenya and Sudan. He created a joint UNM-University of Khartoum graduate program with coursework in both the United States and Sudan and thesis topics of immediate energy value for Sudan.

He also volunteered his time and gifts in many ways, such as by serving on the Albuquerque Energy Conservation Council, Albuquerque Urban Enhancement Trust Fund Committee, Lovelace Inhalation Toxicology Research Institute Board, New Mexico Solar Energy Association Board, and Sigma Xi Board. He was a significant presence in the Albuquerque Friends Meeting and other Quaker entities. In addition to his family, he loved downhill skiing, hiking, and exploring nature and culture around the world. He trekked four times in the Himalayas, several times ascending to more than 18,000 feet and thrilling to glorious mountain views.

He is survived by his wife Sharon P. Gross, children Connie Jackson, Ellen Philo, Mark Gross, and David Gross, and thirteen grandchildren and great-grandchildren.

ANDREW R. HILEMAN

1926–2012

Elected in 1999

"For contributions to the understanding of lightning and its effects on electric power system performance."

BY LIONEL O. BARTHOLD

ANDREW R. (BOB) HILEMAN died in Monroeville, Pennsylvania, on February 3, 2012 at the age of 85. He was born on August 28, 1926, in New Bethlehem, Pennsylvania, son of Andrew Z. and Margaret N. Hileman.

During his extraordinary half-century career, Bob Hileman made significant contributions to world understanding of lightning's impact on power lines and to the protection of power systems against electrical surges in general. His efforts helped shape transmission line design practices that to this day reduce vulnerability to lightning flashovers. Equally significant was his work on the application of surge arresters for protection of electrical equipment—work that encouraged both improvements in protective devices and economies in major electrical substation equipment.

As a leading contributor to both US and international professional societies and standards organizations, Bob was among the first to recognize the need for, and to apply, probabilistic methods in the coordination of insulation with protective devices. His long list of technical papers on these subjects culminated in publication of *Insulation Coordination for Power Systems* in 1999—the most comprehensive book ever written on the subject. It is still widely used and referred to throughout the industry.

Hileman, a veteran of World War II, earned his BSEE from Lehigh University in 1951 and MSEE from the University of Pittsburgh in 1955, then studied at the University of Berlin in 1966–1967 under a Benjamin G. Lamme Fellowship. He later lectured in Penn State University's Advanced Power Engineering Program. After a distinguished career with Westinghouse Electric Corporation, he retired in 1989 to pursue a career in consulting.

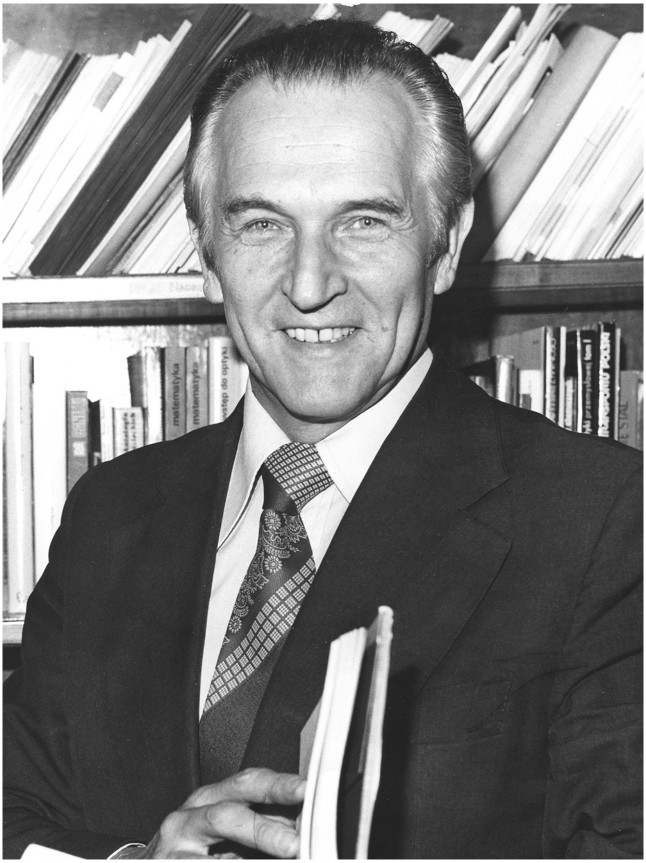
Bob was elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), chaired the Power Engineering Society's Protective Devices Committee, and was an active member of virtually all of IEEE's committees dealing with lightning and insulation coordination. He also chaired the American National Standards Institute (ANSI) Committee C92 on Insulation Coordination and was a principal author of its standards. His expertise was recognized internationally as well; he served on the International Electrotechnical Commission (IEC), was US representative on CIGRÉ's[1] Study Committee 33 on Insulation Coordination, and lectured in both Europe and South Africa.

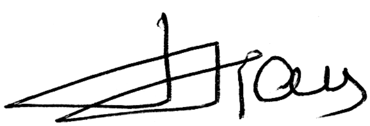
Recognition of Hileman's extensive impacts on power engineering are evidenced by the awards granted him by his peers. In addition to his election to the National Academy of Engineering in 1999, he received IEEE's Herman Halperin Award and Standards Medallion and was elected to the IEEE Surge Protection Hall of Fame. CIGRÉ honored him with its Attwood Associate Award and, from the CIGRÉ US national committee, the Philip Sporn Award "For cumulative career contributions to the advancement of the concept of system integration in the theory, design, and/or operation of large, high-voltage electric systems in the United States."

Bob Hileman was a skilled lecturer, a gentleman, and a mentor to countless young engineers. Those who knew and worked with him were enriched by his keen insight, his courtesy, his spontaneous sense of humor, and his thoughtfulness.

[1]Conseil International des Grands Réseaux Électriques

He is survived by his wife, Thelma "Becky" B. Hileman; daughters Judith (Charles) Spiegal, Linda (Alan) Ackley, and Nancy Hileman (Dan Simmers); grandchildren Evan Andrew Ackley and Aaron Ross Ackley; and sisters Patricia Yanello and Virginia Sprenkle.





JAN KACZMAREK

1920–2011

Elected in 1977

"For pioneering work in the theory and technology of machining and metal cutting."

ADAPTED FROM A MEMORIAL
WRITTEN BY KAZIMIERZ E. OCZOŚ
SUBMITTED BY THE NAE HOME SECRETARY

JAN KACZMAREK, founder and first editor in chief of the *Advances of Manufacturing Science and Technology Journal* and well known in the Polish and international engineering communities, died October 18, 2011, in Paris. As his former student and then friend, I present his numerous achievements to highlight the scale of loss that Polish science and the associated community have suffered.

Jan Marian Kaczmarek was born on February 2, 1920, in Pabianice, Poland. He obtained a pilot license before starting his studies in Warsaw in 1938. One year later, he took part in his homeland defense as a pilot of the Polish Air Force. He was wounded, but after his release from a military hospital in Vilnius he joined the Lithuanian Resistance Movement (1940–1942) and in 1942–1945 served in Poland's underground resistance Home Army.

In 1945 he came to Krakow to continue his studies at the Academy of Mining (which in 1949 became the AGH University of Science and Technology). In 1947, while still a student, he started working as a teaching assistant in the Department of Product Engineering, directed by Professor Witold Biernawski. He obtained an MSc degree in mechanical engineering in 1948, his PhD in 1958, and his DSc in 1960. He became an associate professor in 1962 and a full professor in

1969. During his academic career he promoted 29 PhDs in engineering, six of whom became professors.

He worked at the Institute of Advanced Manufacturing Technology in Krakow (1949–1968), becoming its vice director (1953–1957) and then managing director. In 1958 he was named director of the Department of Manufacturing Technologies at Krakow University of Technology, and then assistant vice rector and vice rector of the university (1965–1968).

In 1968 Jan Kaczmarek moved to Warsaw. In 1965 he was elected a corresponding member of the Polish Academy of Sciences, and in 1971 he became a full member and scientific secretary (1971–1980). He also served as chair of the National Committee for Technical Progress (1968–1972), and next as Minister of Science, Higher Education, and Technology (1972–1974). During his tenure in these two positions he stimulated and modernized scientific and technological education and research in Poland. He fostered policies aimed at broadening research outcomes and promoting inventions for use in industrial and social practice; several complex research programs were initiated and international cooperation was partly reestablished. Poland began to be perceived as a country with valuable potential in science and higher education, thus becoming an important country for Europe's future.

Professor Kaczmarek's scientific activity was particularly fruitful in the 1950s and 1960s. Among his numerous publications, *Principles of Machining by Cutting, Abrasion, and Erosion* (1969 in Polish; 1976 in English) played a crucial role in the education of many generations of students and was widely read by workers in many branches of production engineering. The English edition quickly won recognition in many countries.

Jan was the first Polish citizen to become a member of the International Academy for Production Engineering (Collège International pour la Recherche en Productique; CIRP) in 1961. In 1973–1974 he was elected president of this elite international organization and in 1990 became an honorary fellow.

In 1978 he started working at the Polish Academy of Sciences' Institute of Fundamental Technological Research, directing the Institute of Mechanical Systems, and returned to research on surface layer engineering. He was interested in the technological engineering of surface layers and particularly the microstructure of surfaces. His research involved the new stereometric estimation of accounting for the smoothness and load-bearing capacity of the surface and the construction of an ion implanter. His contributions—in books, papers, and applications—to the development of this area are exceptional.

Kaczmarek's research activities were always closely connected with measurement science and technology. The development of a system for measuring machine tool vibrations was his first metrological project (inspired by Professor Stanislaw Ziemba), which he completed just after graduation. He continued to work on measurement-related issues at Krakow University of Technology, at the Institute of Metal Cutting, and later at the Institute of Fundamental Technological Research.

He became a member of the Polish Society of Mechanical Engineers and Technicians in 1949, an honorary member in 1972, chair from 1980 to 1987, and in 1998 he was awarded the title of honorary chairman. He chaired the Supervisory Council of the Polish Federation of Engineering Associations (Naczelna Organizacja Techniczna; NOT) from 1972 to 1976, chaired NOT from 1984 to 1990, and in 2010 was named honorary chairman. In addition, he was a member of the Warsaw Scientific Society, Technical Culture Society, and Polish Association of Universalism. He was one of the founders of the Academy of Engineering in Poland (1992), served as its vice president (1994–1999), and in 1998 was named an honorary member. He was also active in the development of the Polish Academy of Arts and Sciences.

Professor Kaczmarek received honorary doctorates from Chemnitz University of Technology (1973), Bauman Moscow State Technical University (1974), Poznan University of Technology (2001), and Koszalin University of Technology (2003). He was elected a foreign associate of the US National Academy of Engineering (1977) and a member of the Bulgarian Academy of Sciences (1977), the Royal Academy of Sciences, Literature, and Arts of Belgium (1978), and the Central European Academy of Sciences and Arts (1998). He was named a Commander in the Ordre des Palmes Académiques (1974) and Grand Officier de la Légion d'Honneur. In Poland he was awarded the Polonia Restituta Commander's Cross, Officer's Cross, and Knight's Cross, and the Copernicus Medal.

Jan remained faithful to his motto:

> Everybody who cares about the development of civilization should—to the largest extent and according to his abilities and possibilities—act creatively and should not skip any opportunities that come [across] one's path. [In this way] one will have a positive influence on the activation of entrepreneurship and will improve conditions favorable to using effectively the results of creativity.

Goodbye, my dear friend.
Kazimierz E. Oczoś

CHARLES H. KAMAN

1919–2011

Elected in 1967

"For aeronautical research and development."

BY KEN ROSEN

CHARLES H. KAMAN, one of the original pioneers of the American helicopter industry and a world-famous inventor and entrepreneur, died on January 31, 2011, at age 91.

Charlie was born on June 15, 1919, in Washington, DC, the only child of Charles William and Mabel Davis Kaman. His interest and aptitude in aviation revealed themselves early as he built model airplanes from balsa wood and flew them in indoor competitions. In high school he set national duration records for hand-launched model gliders.

He received a bachelor's degree (magna cum laude) in aeronautical engineering from the Catholic University of America in 1940, and eventually went on to receive honorary doctorates from the University of Connecticut, the University of Colorado, and the University of Hartford, of which he was one of a group of founders.

After graduation, he went to work for the Hamilton Standard Propeller Corp., which was then a unit of United Aircraft Corp. (now United Technologies Corporation). In Connecticut he soon met Igor Sikorsky, the famous helicopter pioneer and head of Sikorsky Aircraft, who became an inspiration to Charlie.

In 1945 Charlie founded the Kaman Aircraft Corp. on a shoestring ($2,000 invested by friends) and led the company as CEO for 55 years. He started the company to demonstrate a new rotor concept intended to make helicopters more stable and easier to fly. He succeeded, and his first machine, the K-125, achieved first flight on January 15, 1947, when Charlie was 27 years old.

The fledgling business of vertical flight was very risky and helicopters were somewhat unstable and very difficult to fly. Charlie developed a novel system of rotor control based on "servo flaps," small ailerons added to the trailing edges of the rotor blade to improve helicopter stability. He also refined the idea of intermeshing counterrotating rotors, which increased lift and eliminated the need for a tail rotor. These innovations became standard in all subsequent Kaman designs.

The company grew to provide products and services for the industrial, commercial, and defense markets, including advanced multimission helicopters, UAVs, software systems, scientific studies, missile devices, next-generation electromagnetic motors, and commercial aircraft structures. And when Charlie developed an interest in making composite-material guitars, his business incorporated worldwide musical instrument manufacturing and distribution—and Kaman Music Corp. became the largest independent distributor of musical instruments and accessories in the United States.

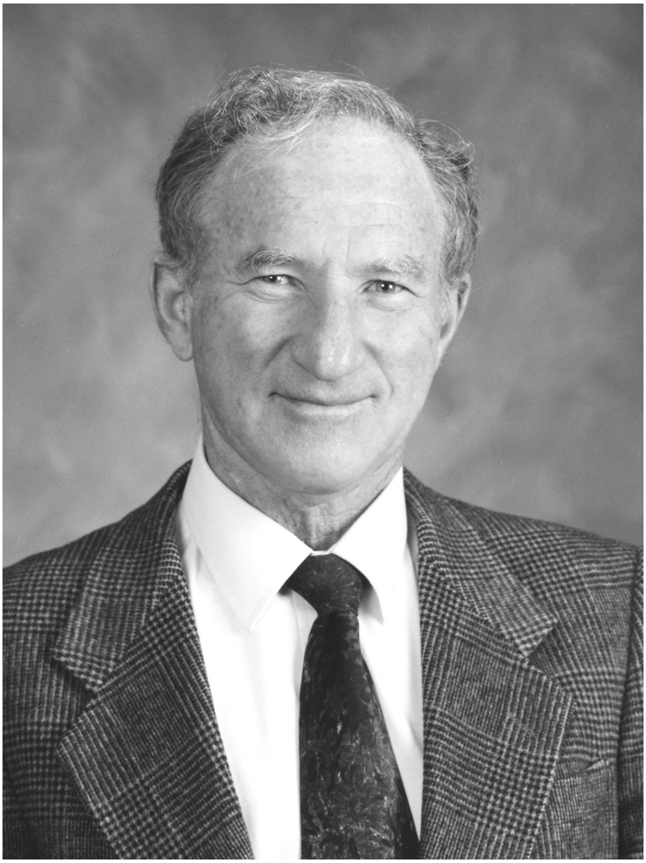
The Kaman Corp. now employs more than 5,000 people at more than 250 locations in the United States, Canada, Mexico, and Europe. Specific product achievements include the Kaman K-125 helicopter, which first flew in 1947, utilizing intermeshing rotors and Kaman's patented servo-flap stability control. In 1951, he developed the Kaman K-225, the world's first helicopter to be powered by a gas turbine engine. Later, Charlie was the lead designer of the Kaman HOK-1, the HH-43 Husky, the SH-2G Super Seasprite maritime helicopter, and the K-MAX® "aerial truck." He was most proud of the more than 15,000 lives that Kaman helicopters were estimated to have saved in rescue missions over the second half of the 20th century.

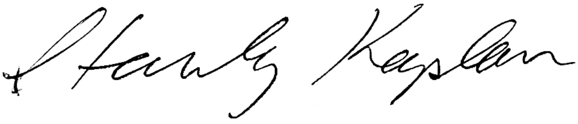
Throughout his career, Charlie led the way in developing a wide range of vertical takeoff and landing (VTOL) technologies such as compound helicopters, convertiplanes, jet-driven rotors, rotor chutes, and drones. His achievements are highlighted by an outstanding list of "firsts"—the first servo-controlled rotor, first gas turbine–powered helicopter, first production all-composite rotor blade, first remotely controlled helicopter, and first helicopter (H-43B) to complete its service life with no accidents or loss of life.

Charlie Kaman earned a very large number of awards, citations, and honors throughout his long career. Notably, in 1996 he received the National Medal of Technology from President Clinton, and in 1967 he was elected to the National Academy of Engineering. He was also a fellow of the American Institute of Aeronautics and Astronautics (AIAA), an Honorary Fellow of the Royal Aeronautical Society, an International Honorary Fellow of the American Helicopter Society (AHS), and he earned the prestigious Dr. Alexander A. Klemin Award, given by AHS "for notable achievement in the advancement of rotary wing aeronautics." In 1997 he received both the nation's premier aviation award—the National Aeronautic Association's Wright Brothers Memorial Trophy—and the Navy League's highest award, the Fleet Admiral Chester W. Nimitz Award, which recognized his leadership, statesmanship, and contributions to our nation's security. Charlie was also a charter member of the Aviation Hall of Fame and in 1996 was inducted into the US Naval Aviation Hall of Honor at the National Naval Aviation Museum. Additionally, he received the Connecticut Medal of Technology, the US DOD Distinguished Public Service Medal, and the Aviation Week and Space Technology Laurel.

Aside from his professional accomplishments, Charlie was much admired for his humanitarian interests. In 1981 he founded, together with his wife Roberta, Fidelco Guide Dog Foundation, New England's only guide dog school. Fidelco's pioneering "in-community" training program makes it possible for a blind person to remain at home, and at work, while being trained with a Fidelco guide dog. Fidelco has placed 1,300 guide dogs in 35 states and four Canadian provinces. And in 1987 he received the National Human Relations Award from the National Conference of Christians and Jews.

Charles H. Kaman was an aviation innovator and giant. He was the last of the helicopter "pioneers" who created the American vertical flight business and made it the envy of the world. He should be remembered as a courageous and committed entrepreneur, inventor, and humanitarian. He will be greatly missed.





STANLEY KAPLAN

1931–2011

Elected in 1999

"For providing the framework of a general theory of quantitative risk assessment and development of synthesis methods in reactor physics."

BY B. JOHN GARRICK

STANLEY KAPLAN, a leading contributor to the risk sciences and nuclear reactor physics, died on June 6, 2011, at the age of 79. His work and impact crossed many boundaries—private and public sector, science and engineering, theory and practice, and academia and industry—and improved risk assessment practices in nuclear power; space; the transport and handling of hazardous materials; plant operations; transportation systems; pipeline construction; fuels processing, fabrication, storage, and handling; and aircraft impact.

Born and raised in Brooklyn, New York, Stan showed strong intellectual leanings toward the sciences and technology at a very early age, and pursued these in his engineering and mathematical studies at the City College of New York. He graduated in 1951 with a degree in civil engineering and his outstanding performance won him a fellowship/scholarship to the prestigious graduate program in nuclear science and engineering at the Oak Ridge School of Reactor Technology (ORSORT) at the Oak Ridge National Laboratory. ORSORT was established by the US government after World War II to train especially talented scientists and engineers to practice nuclear science and engineering for peaceful applications of atomic energy. Because most of the education material was still classified "secret" such training was not practical at universities until later; ORSORT was a means for gifted US scientists and engineers to get the jump on this emerging technology.

Stan then accepted a position with the Westinghouse Bettis Atomic Power Laboratory and simultaneously was given a grant to continue his graduate studies at the University of Pittsburgh, where he received an MS and PhD in mechanical engineering and applied mathematics. At Bettis he contributed significantly to the US Naval Nuclear Propulsion Program by analyzing the xenon spatial instability problem, using methods he developed based on reactor space-time kinetics, and by developing the Kaplan synthesis methods in reactor physics.

He went on to occupy key positions in other company settings, among them PLG, Inc., a consulting engineering and science firm in the Los Angeles area, where he was vice president and technical director. He was also founder and board chair of Bayesian Systems Inc., a Washington, DC–based company that develops and markets software for decision making in the face of risk and uncertainty.

Stan's interests and skills found their way into many different applications, such as the health and risk sciences. He developed computational methods for determining the size and location of tumors, analytical methods for quantifying the risk of complex systems, and cost and risk models of very large and complex engineering projects. These achievements established him as a thought leader in several fields, and his ideas and methods are now widely used in the international risk and reliability community and in regulatory agencies worldwide.

An example of Stan's ability to cross important boundaries was his role in bringing the quantitative risk assessment thought process to the US Department of Agriculture for use in regulatory decision making about food safety and agricultural imports. He was one of the first American scientists to take an interest in and actively contribute to TRIZ, the Russian Theory of Inventive Problem Solving, and especially its subset, Anticipatory Failure Determination, and transform the methods for use in the risk sciences. Among his specific analytical contributions to risk assessment were the discrete probability distribution method for probabilistic calculations, the two-stage Bayesian technique for data analysis, the matrix theory for event tree computations, and a component of the software package RISKMAN® widely used for interactive risk analysis.

Stan had a passion for clarity of thought. Under one of his specialties, "the science of uncertainty," he included risk, reliability, decision analysis, probability, and logical inference. He emphasized the quantitative, "evidence-based" approach to these subjects with Bayes' theorem as his point of departure to develop the language of probability curves and "let the evidence speak." He used this approach to bring about clarity, communication, decision, and action where there was confusion, conflict, waste, delay, and litigation.

In addition to his election to the National Academy of Engineering in 1999, Dr. Kaplan was a fellow of the Society for Risk Analysis and recipient of its highest honor, the Distinguished Achievement Award.

The Stan Kaplan legacy is forever imprinted on the process of probabilistic evidential and inferential thinking, the cornerstone of quantitative risk assessment, and he is sorely missed.

He is survived by his wife Joanne Damours, daughters Deborah, Jinnae, and Susan, and sons Steven and Alan.

James R. Katzer

JAMES R. KATZER

1941–2012

Elected in 1998

"For research on catalysis and reaction engineering, and leadership in commercializing catalytic processes."

BY JAMES WEI

JAMES R. KATZER was the retired manager of strategic planning for ExxonMobil and affiliate professor of chemical engineering at Iowa State University. He passed away in his sleep on November 2, 2012, at his mother's house in Marshalltown, Iowa, after a family gathering with his siblings.

He was born on September 30, 1941, to Robert Katzer and Velma McWilliams in Grundy County, Iowa. He came from a farming family and spent a great deal of time during his childhood working on a farm. He lost a leg because of a farm accident, but this did not stop him from engaging in many physically demanding activities later, such as gardening, sailing, and ocean scuba diving.

He obtained his bachelor's degree in chemical engineering at nearby Iowa State University and in 1969 completed his doctorate in chemical engineering at MIT. He became a professor at the University of Delaware and began his teaching and research in the field of catalysis and reaction engineering.

Unlike many of his contemporaries, Jim was not confined to the theoretical and scientific side of catalysis but championed the study of industrial practice and benefit to society as well. He and Bruce Gates cofounded the university's Center for Catalytic Science and Technology, which attracted a great deal of attention and cooperation from industry. Gates said that

"Katzer established himself as a strong teacher and scholar [at the University of Delaware], and realized the vision of the Center, which was one of the first of its kind."

Katzer and Gates also collaborated, together with George Schuit, to produce the landmark textbook *Chemistry of Catalytic Processes* (McGraw-Hill, 1979), whose five chapters are devoted to the most important industrial processes. Several generations of chemical engineering and chemistry students were taught from this book on both the scientific and applied aspects of catalytic science and engineering.

Jim was recruited by Mobil Oil Research in 1981 to become a member of the Central Research Laboratory in Princeton, New Jersey. Pretty soon he was drawn into rescuing an important but failing project in the Paulsboro Laboratory devoted to process development and engineering. He became a relentless driving force to do things right, and worked very hard and long to save the project.

He subsequently showed another side of his talents and achievements in administration and planning, and rose to become vice president for technology, working with Mike Ramage, Mobil's chief technology officer. Jim's main responsibility was downstream research and development, involving the conversion of crude oil and gas into useful products of fuel and chemicals. He was also concerned about the environment and global warming, and assembled a technical advisory group that was instrumental in changing the views of corporate management and produced a public pamphlet to explain the need for responsibility in carbon dioxide emissions. Ramage said, "Jim had immense credibility in the upper echelon of Mobil, and they often asked about [his] views before coming to conclusions." When Exxon merged with Mobil in 1999, he became manager of strategic planning for the new company.

He chose to retire in 2003, and became an affiliate professor at Iowa State University, where he received the Marston Medal, the university's highest alumni award. He remained very active at the university, and chaired its external advisory committee.

He was elected to the National Academy of Engineering in 1998 and became active in several of its committees. He also served on National Research Council committees that produced the reports *Transitions to Alternative Transportation Technologies* (2010) and *Liquid Transportation Fuels from Coal and Biomass* (2009). Robert Williams of Princeton worked with him on these studies and said, "It might come as a surprise to many of his oil industry colleagues, he came to be also passionately interested in the future of coal." Indeed, Jim served as editor and executive director of the MIT committee that produced the 2007 report on *The Future of Coal.*

He was active in international professional societies and meetings as well, including the advisory committee of the National Institute of Clean and Low Carbon Energy (NICE) sponsored by the Shenhua Group, the world's largest coal company. And he helped to organize the 6th Sino-US Chemical Engineering Conference.

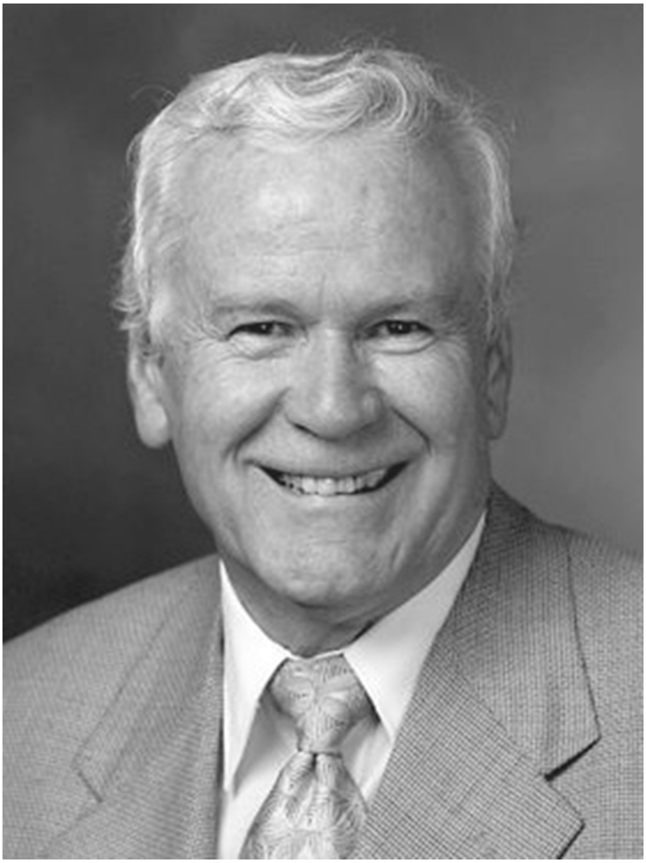
People remember Jim as a perfect gentleman, always smiling, never complaining, and always ready to help others. Every time he came to the Iowa State campus, he brought chocolates or orchids and flowers for the staff members. He seldom talked about himself and never self-promoted, so it is quite possible that some of his achievements remain unpublicized. He had an exemplary work ethic and was always working on numerous projects at the same time.

He made his home in Washington, DC, in the winter, and in Blue Hill, Maine, in the summer. His house on the shore in Maine occupies three acres, one of which is devoted to flowers, ferns, and stone walls. He enjoyed gardening despite the difficulties of gardening on a rocky slope by the sea. He was a member of the Blue Hill Garden Club. He also took pleasure in symphonic music—his favorite composers were Bach, Beethoven, and Mozart—and the choral music of requiems and oratorios by Handel and Haydn.

Jim loved sailing and had a 22-foot sailboat, which he sailed from Delaware to Cape May, New Jersey. Delaware Bay is full of shoals, has a strong tidal current, and is completely exposed to the winds and waves. He would not hesitate to tack upwind into fog and poor visibility with his son Robert, without GPS or other modern navigation equipment, depending only on a compass and dead reckoning. As his friend and sailing companion Fred Krambeck said, "This is really the essence of sailing, and it's kind of a metaphor for life in general. No matter what challenges you face in meeting your goals, you need to remember exactly what the goals are. And always follow your compass."

He was married in 1980 to Isabelle McGregor, after they met on a redeye flight from San Francisco to Boston. Their son Robert is a medical doctor married to Jenni with a daughter, Autumn; and their daughter Anne is a graphic artist.

Jim will be greatly missed by everyone who knew him.



HELMUT KRAWINKLER

1940–2012

Elected in 2012

"For development of performance-based earthquake engineering procedures for evaluating and rehabilitating buildings."

BY GREGORY G. DEIERLEIN

HELMUT KRAWINKLER, a pioneer in performance-based earthquake engineering and the John A. Blume Professor Emeritus of Engineering at Stanford University, died on April 16, 2012, at the age of 72.

Helmut was born in Innsbruck, Austria, on April 6, 1940, and graduated from Vienna University of Technology in 1964. He was awarded a Fulbright Fellowship to study in the United States, and earned a master's degree from San Jose State University in 1967 and a doctoral degree from the University of California, Berkeley, in 1971. He joined the faculty at Stanford University in 1973, where he conducted research and taught for more than 39 years, codirected the John A. Blume Earthquake Engineering Center (1985–1995), and directed the Stanford/USGS Institute for Research in Earthquake Engineering Seismology (1988–1998). He "retired" to emeritus status in 2007 and remained active in research, education, and professional activities until his death.

Early in his career, Helmut focused on experimental research, combining his knowledge of structural behavior, earthquake engineering, and design to make fundamental advances in engineering research and practice. His groundbreaking research on the seismic design and nonlinear behavior of steel-framed structures established principles that underlie modern building code provisions. The "Krawinkler model," which he developed early to simulate the nonlinear behavior of connections in steel frames, continues to be widely used and cited.

He was among the younger participants in the early US-Japan cooperative research programs on seismic design for steel and reinforced concrete structures, through which he made many lasting friendships with Japanese collaborators. His expertise grew as he made fundamental contributions to experimental methods and the development of major earthquake engineering testing facilities throughout the world.

He embraced and promoted new ideas that were often well ahead of their time. In the early 1990s he pioneered the practical application of nonlinear structural analysis for the seismic assessment and rehabilitation of existing buildings. In true professorial fashion, he wrote a classic paper on nonlinear static analysis, "Pushover Analysis: Why, How, When, and When Not to Use It." Although he was an early promoter of simplified static analysis as a way to introduce nonlinear analysis into earthquake engineering practice, as the profession became too enamored with the procedure he was soon cautioning against its inappropriate use, advocating instead for more advanced nonlinear dynamic analysis.

After the 1994 Northridge earthquake, Helmut led the building system performance team of a major project, supported by the Federal Emergency Management Agency (FEMA), to investigate the seismic collapse safety of buildings where unexpected fractures occurred to welded connections. During this project, he began a close collaboration with C. Allin Cornell, a well-established expert in seismic risk analysis.

Starting in 1997, Helmut played a key role in establishing the Pacific Earthquake Engineering Research (PEER) Center, supported through the National Science Foundation's Engineering Research Center program. For the next ten years, he championed the PEER Center's initiative to develop a new methodology for performance-based earthquake engineering. His keen understanding of structural behavior, design, and earthquake engineering was the perfect complement to Allin's deep knowledge of probability and seismic risk analysis. With great respect for one another, their intellectual synergy led to the formalization of PEER's seismic performance assessment framework, which has been embraced by groups around the world and adopted as the basis for national guidelines on performance-based seismic design.

Throughout the 1990s and early 2000s, Helmut published many groundbreaking and influential papers, including reports of three workshops on performance-based earthquake engineering that he coorganized with his longtime friend Peter Fajfar of the University of Ljubljana. The workshops, held at Lake Bled in Slovenia in 1992, 1997, and 2004 as part of the so-called Bled Workshops, engaged researchers from around the world in discussions that helped formulate the research agenda and the basis for performance-based earthquake engineering. At the last Bled workshop, in 2011, Helmut and Peter were honored by the assembled delegates for their visionary contributions. Helmut's keynote address at that workshop, which would turn out to be his last major professional talk, provided a forward-looking view on challenges to improve earthquake resilience through performance-based earthquake engineering.

In 1994, he cofounded a consulting firm with his former student Gregory Luth, and together they pioneered creative new design concepts. Luth described Helmut as the firm's "secret weapon—bringing the state of the art to our office." Among their innovative designs is a rocking shear wall system with replaceable fuses for the School of Cinematic Arts Complex at the University of Southern California. Helmut also served as an advisor on seismic performance assessment for Risk Management Solutions, Inc. and the Applied Technology Council (ATC).

He maintained a close connection to engineering practice through professional committees, consulting, peer reviews, and other activities. Early on he had chaired technical committees of the American Society of Civil Engineers (ASCE) and Structural Engineers Association of California (SEAOC), which provided a vehicle for transferring research into practice.

Helmut's contributions were recognized through many awards, including the ASCE's State-of-the-Art Award, the American Institute of Steel Construction's Special Achievement Award, and the ATC Award of Excellence. He was president of the Consortium of Universities for Research in Earthquake Engineering (1997–1998), and was elected an honorary member (2004) of the Structural Engineers Association of Northern California and the SEAONC College of Fellows (2003). Shortly before his death, he was recognized by three of the highest honors in his profession: the 2012 Earthquake Engineering Research Institute's George Housner Medal, the 2012 ASCE Earnest E. Howard Award, and election to the National Academy of Engineering.

While Helmut made tremendous research and professional contributions, his most enduring legacy may be in educating and inspiring a generation of young structural and earthquake engineers. During his 39-year career at Stanford University, he taught hundreds of undergraduate and graduate students and directed the research of 31 doctoral students, many of whom have gone on to prominent careers in engineering practice and academia. His design courses were legendary, engaging students in broad discussions that straddled the traditional bounds of analysis, design, and behavior. His classes combined the fundamentals of equilibrium free-body diagrams and deflected shapes with state-of-the-art concepts in nonlinear analysis and seismic risk assessment. Even after "retirement," he developed a new course in performance-based earthquake engineering, which he taught to graduate students at Stanford and adapted to a professional course for practicing engineers.

At a memorial service on May 30, 2012, held at Stanford University's Memorial Church, more than 300 family members, colleagues, former students, and friends gathered to remember and celebrate Helmut's life, reminiscing about his zest for life and his infectious enthusiasm. One former student and now consulting faculty at Stanford, Piotr Moncarz, remarked, "Helmut exercised tough and demanding professional standards, and yet he was warm and fun to be with. His students over the years formed a Helmut alumni society. He had a profound impact on our professional and personal lives. He became a close and admired friend to many of us." The memorial reunion was a heartwarming reminder of the many lives that Helmut touched.

Helmut is survived by his wife Michele, of Los Altos, California; son Marcus and daughter-in-law Julie; grandchildren Alexander and Emily; sister Gretel and brother-in-law Otto; niece Angie; and many cousins in Austria.

BENSON J. LAMP

1925–2012

Elected in 1998

"For research and development of harvesting machinery and commercialization of agricultural equipment worldwide."

BY CARL W. HALL

BENSON J. LAMP, founder, president, and general manager of BJM, Inc., and an internationally recognized leader in education, research, design, and development in agricultural mechanization, died on September 14, 2012, at the age of 86. He possessed an innovative spirit—one of getting things done.

Benson was born on October 7, 1925, in Cardington, Ohio, and raised on a farm in Franklin, an experience that undoubtedly influenced his education and professional work. He entered the Army Air Corps in World War II at the age of 18 and was honorably discharged on V-J Day as a second lieutenant (navigator). He married Martha Jane Metz on August 21, 1948, and they raised four children.

He studied agricultural engineering at the Ohio State University (OSU) College of Engineering, where he received a BS cum laude in 1949 and MS in 1953. He began his academic career there in 1949 as an instructor in agricultural engineering and rose quickly to associate professor. He went on to earn a PhD at Michigan State University in agricultural engineering with minors in mechanical engineering and mechanics. After receiving his PhD he spent 26 years in industry, advancing from an agricultural research engineer to vice president of Ford Motor Company. He also became a PE early in his career.

Benson joined Massey-Ferguson, Ltd. in 1961 as a research engineer in Detroit. When he left the company in 1966 he was a marketing and product manager for tractors in Des Moines. At that point he joined the Ford Motor Company, where he advanced through the following positions: worldwide equipment product planning manager (in Troy, Michigan), manager of marketing plans for North American Ford tractor operations, marketing manager for Europe (stationed in Brussels, Belgium), worldwide marketing manager of Ford tractor operations, vice president of marketing and business development, and vice president of Ford Aerospace and Communications Corporation (in Dearborn).

His focus at Ford was on developing a strategy to expand internationally in light industrial and construction markets. To that end he introduced a common marketing concept for all companies with local dealers in 14 European countries in the early 1970s; coordinated marketing efforts in new markets in the mid-1970s; and developed a universal marketing plan in the late 1970s for a new family of tractors that was used in 30 different countries and was so successful that it was expanded into operators' and service publications, saving the company thousands of dollars. As vice president of Ford Aerospace and Communications, he implemented a marketing plan that brought four separate operating systems into a single business. And he was instrumental in establishing business for Ford with the emerging market in China.

In 1986 Benson retired from industry and accepted a position as adjunct professor at OSU in the Department of Agricultural Engineering, where he taught both an introductory course and a professional development course for senior engineering students. He worked for several small companies on a consulting basis and formed a company, ACA, Inc., to make and distribute a portable PTO (power takeoff) dynamometer for tractors. Then in 1990 he founded BJM, which grew into a real estate and farming business.

He was also active in many professional societies. He chaired a number of committees of the American Society of Agricultural Engineers (ASAE; now the American Society of Agricultural and Biological Engineers, ASABE) before becoming ASAE president. He was a member of the American Management Association, American Society of Engineering Education, Equipment Manufacturers Institute, and Institute of Industrial Research, among others. He helped these organizations implement strategic plans, encouraged cooperation of members with different views, and inspired others to do the same in their deliberations.

Benson also received many honors and awards, the most prominent being membership in both Tau Beta Pi and Sigma Xi as well as his election to the National Academy of Engineering. In 1956 he was named Professor of the Year at Ohio State University. He was presented with a Distinguished Alumnus Award by both Ohio State University and Michigan State University. In 1993 he was awarded the ASAE McCormick Case Gold Medal.

He published 47 articles, bulletins, and reports for public use and wrote many others that were private and confidential for company use only. With W.H. Johnson he coauthored the book *Principles, Equipment and Systems for Corn Harvesting* (Agricultural Consulting Associates, Ohio, 1966).

In addition to his dedicated involvement in engineering and education, he had a broad and diverse range of interests and was active in his church.

Benson was a devoted family man. He is survived by his loving wife of 64 years, Martha Jane; children Elaine (Jim) Yarbrough of Peachtree City, GA; Marlene (Steve) Soule of Ventura, CA; Linda (Bill) Connor of East Lansing, MI; and Dave (Denise) Lamp of Southlake, TX; grandchildren Robb (Melissa) Yarbrough, Jamie (Matthew) Fearrington, Katie (Derek) Walton, Matthew Connor, Julie (Mike) Warren, Erik Soule, Ellen Connor, David Lamp, Olivia Soule, and Lauren Connor; great-grandson Connor Warren; brothers Wilbur and Russell; sisters-in-law Joan Motz and Joanne Lamp; and many friends.

JAMES F. LARDNER

1924–2012

Elected in 1985

"For a major influence on the advancement of manufacturing technology through both engineering concepts and engineering applications."

BY RON LEONARD

The news of JIM LARDNER's death on December 17, 2012, marked the passing of a talented engineer who left a broad trail of accomplishments during his 88 years of life. From his birth in 1924 until his passing, his life was filled with achievement. His inquisitive mind and cherubic manner magnified his influence in every activity, as he could glibly verbalize his thoughts in crisp, salty language—a skill likely developed during his service in the Navy.

As a bright young student from Moline, Illinois, Jim's thirst for knowledge propelled him to accept different responsibilities and undertake new, challenging assignments throughout his life. He graduated from Cornell in 1945 as a mechanical engineer via the US Navy V-12 program. Following his military service as an ensign and later lieutenant, he served on ships in both World War II and Korea. At Deere & Co. he distinguished himself by championing and implementing new manufacturing technology during his 44-year career.

He was elected to the NAE in 1985, with a citation for advancing manufacturing technology in concept and application. Outside of Deere & Co., he continued to develop his interest in the industrial application of new manufacturing technology across the spectrum of education, industry, and governmental agencies. In 1993 he was elected a fellow of the Society of Manufacturing Engineers.

Jim's diverse business experience began at an early stage of his career with Deere & Co. After his return from Navy duty in Korea in 1953 he resumed his work at Deere, concentrating on manufacturing. Deere soon began an expansion of its successful North American agricultural business into countries with a significant need for modern agricultural tractors. Jim's initial major international assignment was to oversee the construction and startup of the company's first Latin American factory, in Monterrey, Mexico, in 1956. Then he was assigned to explore the possibility of starting a tractor factory in Brazil, but because of instability in the Brazilian economy Deere decided against that. Next Jim was asked to move his family to Spain, where Deere had purchased a tractor factory in Getafe, near Madrid. This was his first management assignment that included the responsibility of converting a factory to production of John Deere designed tractors and marketing them in Spain, which was then a restricted market with high import taxes. Within six years tractor production at this factory production tripled the Deere market share in Spain.

Jim returned stateside in 1968 to the Deere & Co. World Headquarters in Moline, Illinois, as director of manufacturing and plant engineering for all of the company's factories and facilities. This position provided a challenge and opportunity to implement modern manufacturing technology in Deere factories that then included agricultural and industrial machines. The work included the largest manufacturing facility expansion undertaken in the history of the company and was completed in 1981 at the Waterloo Works tractor factory. Jim championed the installation of computer-aided design and manufacture at all Deere factories, and in 1980 was elected vice president for manufacturing systems.

From 1982 to 1988 the US agricultural and industrial business was in a severe recession. Deere & Company survived a period of dramatic lower sales and financial losses while some of its North American counterparts went bankrupt or consolidated with others. When Deere needed someone to take on a difficult new assignment, senior management often turned to Jim. He was appointed vice president of government products and component sales enabling Deere to reach a larger market by selling its manufactured products and components to others, thus helping to stabilize the company during the recession.

In 1986, with the transition to new leadership in the company, Jim was appointed vice president of Deere's North American tractor and component operations. His job was to rationalize the high degree of vertical integration at the company's tractor manufacturing operations worldwide and restructure manufacturing operations for significantly lower production schedules. This responsibility also included the design of worldwide agricultural tractors, which would affect all Deere tractor factories—in the United States, Germany, France, Mexico, Argentina, and Spain. He also reestablished the connection with the company in Brazil that he had visited in his early career and that now manufactures the modern design of John Deere tractors.

The international consolidation for tractors was the greatest challenge of Jim's career with Deere. Since 1961 the company had twice attempted—and failed—to accomplish a worldwide tractor design, which caused significant duplication of parts and higher fixed costs by producing similar designs in different economic regions of the world. Under Jim's direction a new tractor design and restructured manufacturing facilities provided tractors for each power range that were manufactured at one location but supplied to all open markets around the world. The successful rationalization of the diverse manufacturing and engineering design of agricultural tractors was well under way when Jim retired in 1990.

His oversight of design and manufacture of tractors and their components established the foundation for successful growth in sales and profits for Deere from a business that was faltering in 1982–1986. The new designs and rationalized production locations enabled successful growth and profitable sales in major agricultural markets of the world.

Jim's talent's were not limited to Deere & Co. He served as a director of Trane Company, American Standard Company, and Potash Company of Saskatchewan. He was also a member of the advisory committee for the Air Force integrated computer-aided manufacturing (ICAM) program, chair of the industry review board to oversee the product definition data interface of the ICAM program, and, from 1983 to 1985, director of Computer-Aided Manufacturing International, Inc. in Arlington, Texas.

Over his long and distinguished career Jim's sharp, penetrating mind and broad experience in the implementation of new design and manufacturing technology were unmatched. After his retirement from Deere he served on numerous community boards and organizations. During 20 years on the Saint Luke's Hospital Board of Trustees in Davenport, Iowa, he was board chair for four years. He was a trustee of the Putnam Museum of Regional History and Natural Science for 16 years and president of its board from 1989 to 1991. Other community activities included membership in the Rock Island Arsenal Golf Club and the Outing Club. During the challenging years in the startup of manufacture of John Deere tractors in Madrid, Jim was a founding member of the American School of Madrid and served on its board for four years.

Jim was a generous mentor to talented people throughout his lifetime—at Deere, in the many organizations he served, in the community, in his neighborhood, among his friends and within his extended family. He took a sincere interest in helping others navigate professional development choices, and was highly supportive of his mentees' success.

His daughters remember their father as committed to Deere, passionate about manufacturing, and engaged in his community. But he also relished his life. He and his beloved Barbara enjoyed their expatriate assignments, entertaining, traveling, and collecting together. They loved the house they built overlooking the Mississippi River upon their return to the Midwest. Friends still mention their Christmas parties. He always had projects in process at home and counted bird shooting, wood carving, photography, and wildflower gardening among his hobbies. As a father, Jim shared his love of words with his daughters. They recall many poems memorized and books read aloud together. Jim loved his brothers and their families and spending time with them at home and in the field. His letters to the editor were published even in his last years as he kept up with current events. He enjoyed spending time with his grandchildren as they grew up. Jim loved his wife, his family, his Gordon Setters, his company, his community and his profession. Reflecting back toward the end of his life, he considered himself a happy man.

Jim married Barbara Keepers in Rock Island, Illinois, in 1949. He is survived by daughters Lucy (Jay) Romans, Katy (Kerry) Kearney, and Amy Lardner; grandchildren Annie and Jim Kearney.

Vaya con Dios, Señor Jim.

YAO TZU LI

1914–2011

Elected in 1987

"For contributions to innovation in instrumentation, control, and to engineering education."

BY JENNIFER CHU
COURTESY OF MIT NEWS
SUBMITTED BY THE NAE HOME SECRETARY

YAO TZU LI, professor emeritus in the Department of Aeronautics and Astronautics and cofounder of the Man Vehicle Laboratory at the Massachusetts Institute of Technology, passed away on August 14, 2011, of an aortic aneurysm. He was 97.

A member of the National Academy of Engineering since 1987, YT Li (as all his friends and students knew him) and his brother Prof. SY Lee, also of MIT, were honored in China for their NAE membership with a special commemorative porcelain plate designed and presented by the Chinese space pioneer Prof. H.C. Tsien. Li's remarkable career and life story are spelled out in his autobiography *Freedom and Enlightenment: My Life as an Educator/Inventor in China and the United States.*

YT Li was born in Peking on February 1, 1914. After earning a bachelor's degree from Peking University and a master's degree from Central University in China, he continued his studies in aeronautical engineering at MIT, where he received a master's degree in 1938 and an ScD in 1939. Shortly thereafter he returned to China, where he joined the Chinese Air Force as a chief engineer. In this capacity, he oversaw the construction and operation of an underground airplane engine manufacturing plant in Guizhou Province. In 1945–1946 he worked with the Chinese government to advance aircraft technology, heading up development of the country's first "homegrown" aircraft engine.

In 1947 he made his way back to MIT, where he became a research associate in the Department of Aeronautics and Astronautics. From 1953 to 1957, he directed the MIT Cruise Control Project in the Aerophysics Laboratory, where he worked with Charles Stark Draper to develop an automatic optimization system for the B-52 bomber.

He became a full professor at MIT in 1961, and around that time Draper paired him with a newly appointed assistant professor, Larry Young, to launch the Man Vehicle Laboratory. Together, the two investigated the effects of air and space travel on human passengers, winning a grant from NASA to study the phenomenon of space sickness—particularly for astronauts in the early Apollo program.

An energetic innovator and educator, Li encouraged students to explore their entrepreneurial spirit. In 1973, he established the MIT Innovation Center, a program designed to shepherd students through the process of innovation, from developing an idea to engineering a prototype to marketing a product. "It is a common belief that inventors and [entrepreneurs] are self-made men, born with that talent. Edison, the Wright brothers—none attended college," Li told the Associated Press in 1973, shortly after launching the program. "But with limits on natural resources, environmental concern, and the shrinking US share of the world market, we simply cannot rely upon the self-breeding process of a few innovators to keep the rest of the educated engineers employed. What we need is an organized training ground for innovators and entrepreneurs."

Young, now the Apollo Program Professor of Aeronautics and Astronautics, remembers Li as a generous mentor and friend—and a born inventor. He recalls a weekend in the 1960s when the two took a break from work to go skiing; Li had asked Young, an avid skier, for a lesson.

"We went up to Mount Sunapee…on a Friday," Young says. By Monday, "he had gotten a pair of skis and had modified them by attaching an I-bolt to the back of the ski and a little steel cable that went from the back of the ski up to a kind of harness around his lower leg, so when he would lean forward, the ski would bend."

The invention made turning easier: A skier would otherwise have to hop to switch directions, to prevent the back of the skis from catching in the snow. With Li's contraption, a skier would simply have to lean into the turn.

"Only in the '90s did the ski racers and ski manufacturers discover the ease and grace, as well as the speed, of the turn-by-leaning technique," Young says. Li's design "[foretold] the evolution of skis by a decade or more."

Throughout his career, Li was a prolific inventor, with more than 60 patents to his name. In addition to aircraft optimization systems and pressure indicators for rocket engines, he patented designs for an archery bow and a tennis racket with flexibly anchored strings.

In 1972, shortly before launching the MIT Innovation Center, Li made national headlines with a particularly entrepreneurial idea: a scheme, as a Boston Globe article put it, to "tackle the tilt" of the Leaning Tower of Pisa. The idea started as a joke—Li made light of the tower's tilt with his children, after hearing about the problem in the news. The joke turned into a project during a European tour, when Li dined with a professor then in charge of saving the tower.

Li came up with a blueprint to keep the tower from toppling, involving a ring of concrete pads surrounding the base of the tower to redistribute pressure and support the tower's weight. The plan never gained traction, but Li, ever the entrepreneur, was unfazed. He simply moved on to his next project.

"He had an incredible way of looking at complex mechanical problems and getting to the heart of them," Young recalls. "He was not inhibited by the conventional way of doing things."

Li was predeceased in 2004 by his wife of 56 years, Nancy Tung Tuan Lin. He is survived by four children—Winifred and her husband William Oliver of Weston, Massachusetts; Karl and his wife Wei Xu of Millwood, New York; Kenneth and his wife Valerie Ng of Piedmont, California; and Wendy and her husband Jonathan Spector of Weston, Massachusetts—and grandchildren Jeffries, Parker, and Alisan Oliver-Li; Lindsay, Nicholas, Jason, and Jasmine Li; and Daniel, Michael, William, and Benjamin Spector. He is also survived by his brother SY and sister-in-law Lena Lee, as well as numerous cousins, in-laws, nieces, and nephews.

His daughter Wendy wrote:

> Fully committed to his work and ideas, he was also readily available to family and community. As one of nine children, YT became the oldest brother when his older brother died as a young man. He quickly assumed responsibility for helping his remaining siblings achieve their academic dreams of studying in the US. With his wife, herself from a family of eleven, the two aided siblings, cousins, nieces, and nephews with financial support, temporary lodging, and hospitality. His younger brother, SY Lee, also a member of the National Academy of Engineering, was his lifelong business partner and neighbor.

This generosity of spirit was never discussed explicitly, but his youngest daughter Wendy absorbed this lesson. "For what is the value of our work and lives if it doesn't help others, help our communities, or help the world? My father was respected for his intellect, but he was also admired for his generosity and good will."

As the grandfather of eleven and uncle to countless nieces and nephews, YT was a consistent advocate and inspiration, attending numerous athletic, musical, and theatrical performances as well as milestones such as birthdays, graduations, family reunions, and weddings.

YT was also a leader in the Chinese-American community. He was president of the National Association of Chinese-Americans in the early 1980s, and served as a behind-the-scenes diplomat in an attempt to foster relationships between Taiwan and the People's Republic of China as well as the United States and China, meeting numerous times with national leaders.

As an immigrant YT appreciated the country and culture of his childhood, but he embraced America and epitomized its pioneering, creative, and generous spirit. He loved people and parties. He and his wife invited MIT graduate students to their house for barbecues and tennis, hosted birthday parties for friends and the weddings of relatives, and traveled extensively for business as well as for pleasure with friends and family. After his wife's death, he continued his social life as a "ROMEO"—a retired old man eating out. In his later years, he studied history, with a special interest in the Needham Puzzle, and published an autobiography. Although he was no longer able to play tennis or ski, he was an active singer, joining community choruses as a bass. He was singing when he died.

HANS W. LIEPMANN

1914–2009

Elected in 1965

"Fundamental contributor to the field of fluid mechanics."

BY HANS HORNUNG AND ANATOL ROSHKO

HANS WOLFGANG LIEPMANN, Theodore von Kármán Professor of Aeronautics emeritus at the California Institute of Technology and a pioneering researcher and passionate educator in fluid mechanics, passed away at the age of 94 on June 24, 2009, at his home in La Cañada Flintridge, California.

Widely honored for his contributions to aeronautics, Liepmann came to Caltech in 1939 and from 1972 to 1985 was the third director of its Graduate Aeronautical Laboratories (GALCIT). Through his students and colleagues, he was highly influential in spreading GALCIT's fundamental research approach and rigorous curriculum. Known for his sharp wit and distinctive accent, he was a noted teacher who mentored more than 60 PhD students and hundreds of undergraduates, many of whom became leaders in the aerospace industry and at universities around the world.

Liepmann was born in Berlin on July 3, 1914, and grew up surrounded by the political turmoil and liberal Berlin society of the 1920s. His father, a well-known physician and hospital director, had a passion for the humanities and an abhorrence of mathematics. Insisting that Hans have a classical education despite the boy's interest in physics, he nearly ended his son's scientific career before it began. Looking back, Liepmann observed that, "Of my 10 years in school, I can remember no more than maybe three teachers who were more than drillmasters." Those experiences likely contributed to his passion for teaching.

His time in Berlin came to an end shortly after his graduation from high school and a stint in the Siemens factory as an apprentice. His father decided to emigrate after the rise of the Nazi government and the infamous Reichstag fire in 1933. Liepmann joined his family in Turkey in 1934 where his father was invited to head the gynecology department at the University of Istanbul. The young man enrolled at the university to study physics, mathematics, astrophysics, and mechanics. The classes were taught in a mix of German, French, and Turkish, by the numerous German expatriates who found Turkey more welcoming than Germany under Hitler.

After a year in Istanbul and an unproductive term in Prague, Liepmann traveled to Switzerland and found academic success in the physics department at the University of Zürich. His talent as an experimenter was immediately recognized, leading to an invitation to pursue his doctoral studies on low-temperature physics under Richard Bär. Liepmann's scientific temperament was strongly influenced by the exciting physics scene of 1930s Zürich and the teaching style of Gregor Wentzel, a student of Arnold Sommerfeld, whom many consider the father of modern physics. Throughout his life, Liepmann maintained the perspective of a physicist and emphasized to his students the importance of a scientific approach.

He came to the United States in 1939 after impulsively expressing an interest in hydrodynamics during a drinking party at the successful conclusion of his PhD defense. An offer from Theodore von Kármán led to a research position in experimental fluid mechanics at GALCIT, where von Kármán was the first director. Liepmann's early experiments, on boundary layer instability and transition to turbulence, were followed by investigations of various turbulent flows that are relevant to engineering application—a recurring theme throughout his career.

With the entry of the United States into World War II, he began research on problems associated with high-speed flight, including transonic flight phenomena and interaction of shock waves with boundary layers on aerodynamic surfaces. This marked the beginning of a longtime interaction with the Southern California aircraft industry.

In addition to his research, Liepmann worked with Allen Puckett to organize short wartime courses on high-speed aerodynamics for working engineers, resulting in their pioneering textbook *The Aerodynamics of Compressible Flow* (1947, John Wiley). It was followed in 1956 by *Elements of Gasdynamics* (1957, John Wiley, republished by Dover in 2001), coauthored with Anatol Roshko; this text influenced a broader, mainly graduate student following and was translated into Russian, Spanish, and Japanese.

In the rapid expansion of scientific and applied research that followed World War II, Liepmann emerged as a respected and influential contributor to aeronautics and to the physics of fluid flow. By 1949 he had advanced to professor of aeronautics at Caltech and had developed a vigorous program of research around his group of PhD students and visiting postdoctoral fellows as well as senior scientists, many of them seeking a change from their work in postwar Europe.

Believing strongly that experimental research must relate to theoretical foundations and questions, Liepmann sought association for his group with applied mathematicians among visitors and Caltech faculty. An outgrowth of this was the establishment, in 1967, of the applied mathematics option at Caltech. As if tying up loose ends, he was also instrumental, along with Caltech colleagues Amnon Yariv and Roy W. Gould, in the establishment of the applied physics option in 1974.

The work of Liepmann's group was distinguished by its innovation in experimental apparatus and instrumentation, often designed for the specific needs of particular problems. Pioneering contributions were made to a wide range of topics that frequently anticipated future technology. These include flow instability and transition, turbulent shear flow, transonic flow, shock wave–boundary layer interaction, turbulent skin friction at supersonic speeds, aircraft buffeting, rarefied gas flow, magnetohydrodynamics, plasma physics, fluid mechanics of liquid helium, chemistry of turbulent mixing, and flow control.

Another of Liepmann's strongly held principles was that teaching is vital, even at a research-oriented institution such as Caltech. Throughout his career, up to retirement, he was devoted to teaching both graduate and undergraduate courses. The enthusiasm, clarity, and teaching effectiveness of his lectures are legendary.

In recognition of his accomplishments, Liepmann was elected to both the National Academy of Engineering (1965) and the National Academy of Sciences (1971). In 1968 he was selected to receive the Ludwig Prandtl Ring, the highest honor conferred by the German Society for Aeronautics and Astronautics. In 1986 President Ronald Reagan awarded him the National Medal of Science, and he received the National Medal of Technology in 1993.

Liepmann leaves behind sons Dorian, Till, Christopher, and Paul and two grandchildren. His wife, Dietlind, passed away in 1990.

John Lowe, III

JOHN LOWE III

1916–2012

Elected in 1974

"For leadership in the development and application of the principles of soil mechanics."

BY INGO FOX
SUBMITTED BY THE NAE HOME SECRETARY

JOHN LOWE III, renowned both in the United States and internationally as a preeminent civil engineer in the field of geotechnical engineering, died on January 2, 2012, at the age of 95. He had been a senior partner at the New York consulting engineering firm TAMS (formerly Tippetts-Abbett-McCarthy-Stratton) until his retirement in 1983, after which he continued his career as a much-respected US and international private consultant and chaired the US Society on Dams (USSD; formerly USCOLD).

John was born on March 14, 1916, on New York City's Upper East Side and grew up in Throggs Neck in the Bronx. He attended Townsend Harris High School (in Flushing, Queens), a school for students gifted in mathematics and science, from which he graduated in 1932 at the age of 16. Later he made his home with his family on Grandview Boulevard in Yonkers, where he lived until 2011. He spent the last year of his life in Seattle with his wife Jeanne and their two daughters.

John received his bachelor of science degree in engineering from City College of New York (CCNY) in 1936. The next year he received his master of science degree in engineering from MIT, where he studied under Professors Karl Terzaghi and Arthur Casagrande, whom many consider the founding fathers of modern soil mechanics. Needing employment before continuing his work toward a doctorate, John took a teaching position at the University of Maryland, where he stayed until 1940 when an instructor position opened at MIT. He continued to work toward his doctorate under associate professor Donald W. Taylor of MIT, with some side work on defense projects. In 1945 he transferred to the Navy's D.W. Taylor Model Basin in Bethesda, Maryland, to work on ship hulls as a physicist.

On a personal recommendation from Karl Terzaghi, John joined the Knappen Engineering Firm in Manhattan in October 1945. The firm was looking for someone highly motivated and qualified to start up a soils department in support of various contracts recently awarded by the US Army Corps of Engineers. John was only the 11th employee when he joined. In the postwar years the firm grew exponentially across the United States and overseas and as a consequence expanded its partnership. In 1951 it became known as Tippetts-Abbett-McCarthy-Stratton. The firm established its headquarters in midtown Manhattan and soon earned a world-class reputation.

As chief soils, foundation, and dam engineer and head of the firm's geotechnical group, John's responsibilities and staff grew in concert with the expanding firm. He was made an associate partner in 1956 and full partner in 1962. He retired in 1983 as a senior partner, leaving behind an invaluable legacy in his body of work on the design of civil and dam engineering projects.

At the same time he maintained his close links with the academic world and demonstrated his passion to give and serve by teaching night classes as an adjunct professor at New York University from 1949 to 1951 and as a lecturer in soil mechanics at CCNY from 1953 to 1960.

As head of the TAMS geotechnical group John used a comprehensive soil mechanics testing laboratory in the basement of the firm's building, developing, among other things, the gradient-controlled consolidation test, a novel approach to estimating time-dependent settlement in cohesive soils. He was also responsible for the development of a new and improved method for taking undisturbed subsurface soil samples, as well as a breakthrough in the limit-equilibrium stability method of analysis for the design of embankment dam slopes. The Lowe-Karafiath method, as it is now known, has since been incorporated in state-of-the-art computer software packages that are accepted as standard tools for the design of slopes and earth embankments.

John worked on a diverse range of civil engineering projects—ports and harbors, airports, bridge pier foundations, tunnels, and highways—but the main body of his design work was on dams and their ancillary structures. He was involved in the planning, design, and supervision of construction and rehabilitation of more than 45 dams in the United States, South America, Africa, the Middle East, and Asia. Of special note among these was his work in Morocco, where TAMS designed and supervised the construction of three dams. For his work and leadership on the Hassan Addakhil Dam on the Ziz River, King Hassan II of Morocco decorated John as Commander of the Order of Alaouites.

With his relentless quest to find new applications, John developed a novel approach for the use of existing construction materials in dam projects through the use of roller-compacted concrete (RCC), now considered a very cost-effective lean mix of cement and semi-dry petrous aggregates compacted in layers and used in many applications around the world. RCC was first applied in 1960 for the upstream cofferdam at Shihmen Dam in Taiwan, a TAMS project. Nowadays it is widely used for the construction of gravity dams at a fraction of typical construction costs for conventional concrete gravity dams and, in some cases, earth dams.

The most exceptional challenge in John's engineering career and one that occupied almost two decades of his professional life was his design work and participation in the construction supervision of the Tarbela Dam in Pakistan. This was an additional example of the highly successful use of RCC.

Located on the Indus River at the foothills of the Himalayas, some 75 km northwest of Islamabad in the district of Abbottabad, the Tarbela Dam is a megasized multipurpose hydro project and is the capstone of the Indus Basin Plan and 1960 Water Treaty that was effected between India and

Pakistan after partition. John was a lead engineer in the early investigations for this very large ($1.8 billion, 1968 USD) and politically important project. He participated during the entire period of design, construction, and remedial works. Today we are used to multibillion-dollar projects, but in 1968 Tarbela was the largest civil engineering contract ever awarded, and could not have been carried forward without the assistance of the World Bank and grants and loans from a number of donor countries. The responsible agency in charge of the project was the Water and Power Development Authority of Pakistan.

This project presented enormous new design and construction challenges for TAMS. Of particular significance were the occurrences that beset the project during the first filling of the dam reservoir in 1974, as well as several critical follow-up events resulting from a series of complex factors. Thanks to John's sheer energy and unyielding determination to put things right, the necessary remedial works to address these challenges were completed successfully without major delays from the projected start date for supplying irrigation water to the lower Indus Valley in 1975. This was followed in mid-1977 by urgently needed generation of hydroelectric power.

John travelled to Pakistan more than 45 times during that period. He also was the driving force behind reservoir sedimentation studies in the early 1980s; reanalysis of the seismic resistance of all project structures based on updated seismicity studies; seismic risk studies; and more comprehensive and thorough knowledge of the tectonic environment affecting the project site. This information was not available at the time of the project inception, design, and construction.

This project was a prototype and was instrumental in further progress in civil engineering understanding and hydraulic modeling for similar structures. The advances and lessons learned were communicated through international presentations and technical papers in engineering and specialty conferences and journals. The resulting insights were fundamental in the advancement and understanding of civil engineering in complex geologic settings and hydrology, and in the disciplines of geology, geotechnical engineering, hydraulics, seismicity, sedimentation, instrumentation, and the "observational method" (first proposed by the Casagrande brothers). Through John's initiative the project attracted the attention and participation of a number of leading US and international consultants in many of the key disciplines.

John also found the time to contribute engineering chapters to four technical books, publish more than 35 technical papers in professional journals, and present at national and international conferences both in the United States and overseas. He gave six honorary lectures: the Eighth Terzaghi Lecture in 1971, the Fourth Nabor Carrillo lecture in 1978, the second annual lecture of the US Commission on Large Dams (USCOLD) in 1982, the Marty Kapp lecture in 1986, the keynote address of the Roller-Compacted Concrete II Conference in 1988, and the Mueser Rutledge Lecture in 1997.

In addition, he served as chair or moderator at engineering symposia and conferences and held significant positions in professional societies. He chaired the Geotechnical Engineering Division of the American Society of Civil Engineers (ASCE) and USCOLD. He was also an ASCE fellow and a member of the International Committee on Large Dams (ICOLD), International Society of Rock Mechanics, the Moles (an association of contractors in heavy construction), and the four-member board of consultants to USCORPS Chief Engineers in Washington, DC (1960–1982). He was a life member of the University Club of New York City.

John was honored by election in 1974 to the National Academy of Engineering, and in 1982 he received the CCNY Townsend Harris Medal for extraordinary lifetime achievements in his field.

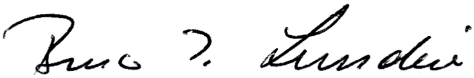
John enjoyed a variety of interests. At a young age, he gathered rocks and minerals. When he traveled internationally as an adult, he collected small artifacts and ancient coins. He was a keen photographer everywhere he went, keeping up with each new generation of still cameras and some movie cameras, each of which became part of his large and ever expanding collection. He loved watches and Swiss Army knives. He read widely and kept up to date on current issues and events. He was committed to keeping up a diary in Lefax notebooks where he recorded all manner of professional and personal details, especially aspects of his personal health fitness regime, including biometric cycle graphs.

In addition to a basic exercise routine that included jogging, push-ups, sit-ups, and stretching, John enjoyed a number of sports, including downhill skiing into his 80s and tennis, which he played throughout his life until he was 90. And harking back to his days as a young gymnast, John would sometimes insist with a twinkle in his eye on demonstrating that he could "stand on his ear," occasionally in his office in his business suit. He enjoyed ping pong and camping with his family, and he was a dedicated gardener/farmer well into his 80s, spending many happy hours working in the side lot at his house in Yonkers. He was also an active member of the Asbury Methodist Church in Crestwood, New York.

Beyond his highly technical and professional personality, his diverse interests, and his athleticism, John had uncommonly strong interpersonal skills and charisma that commanded respect and loyalty and ingratiated him with a wide professional, social, and family circle of friends. He was deeply devoted to his wife Jeanne; they were both gregarious, and she was an exceptional cook and hostess—they loved to entertain guests at home and away.

John Lowe III was an inspiration and mentor to many. His clear thinking, instincts, enthusiasm, and energy were his hallmark, particularly during the sometimes difficult periods throughout his long career. He was always firm yet a very generous and gentle person, a good listener, someone who led from the front and yet always managed to find the time to help others. He helped establish soils laboratories, mentored geotechnical engineers both in the States and abroad, and became one of the profession's most respected authorities. He was always ready to serve and will be greatly missed.

John is survived by Jeanne Wright Lowe, his wife of 68 years, son Jonathan in Tampa, daughters Barbara and Heather in Seattle, grandchildren Alicia and Alan, and great-granddaughters Sarah and Amanda.



BRUCE T. LUNDIN

1919–2006

Elected in 1976

"For leadership in aeronautical propulsion research and launch vehicle development."

BY ROBERT S. ARRIGHI
SUBMITTED BY THE NAE HOME SECRETARY

BRUCE T. LUNDIN played a crucial role in establishing the framework for the National Aeronautics and Space Administration (NASA) in 1958 and was an integral figure for nearly 35 years at the Cleveland laboratory that is now the NASA Glenn Research Center. He was an exceptional researcher and manager who pioneered significant areas in modern aeronautical propulsion, complex space programs, and new methods of energy conversion and conservation. He died on January 24, 2006, at the age of 86.

Bruce's efforts in developing thrust augmentation techniques such as the afterburner and in testing full-scale engines in altitude-simulating facilities led to industrywide advances. In the late 1950s he developed a document that spurred the National Advisory Committee on Aeronautics (NACA) to assume a primary role in the new field of space flight. Throughout the 1960s he spearheaded the center's development work, which included launch vehicles such as Centaur and Agena. After a brief transfer to NASA headquarters, he was named director of the NASA Lewis Research Center in 1969 (it later became the NASA Glenn Research Center). He guided Lewis through the most difficult period in its history by delving into energy-efficient engines, the development of alternative energy resources, and environmental monitoring before retiring in 1977. His integrity, doggedness, and well-reasoned managerial style resulted in a number of major aerospace and energy accomplishments.

Bruce was born on December 28, 1919, and raised in Alameda, California. He earned his bachelor's degree in mechanical engineering in 1942 at the University of California, Berkeley, specializing in heat transfer. He then took a position in San Francisco with Standard Oil of California, where he participated in the design of power plants, water treatment plants, and pumping stations for oil refineries. At the time, the NACA was building a staff for its new Aircraft Engine Research Laboratory (AERL) in Cleveland. When a former professor recommended Bruce, the AERL offered him a mechanical engineering position. Engineering jobs in California were scarce at the time, and he accepted what he believed would be a temporary job and moved to the Midwest.

Bruce's initial AERL work involved the cooling and heat transfer of an Allison V-1710 piston engine for the P-39 fighter. He was responsible for determining the cooling characteristics of the multicylinder, liquid-cooled engine on a dynamometer test stand. But he was soon thrown into the secret new field of jet propulsion, and received a deferment from the World War II draft because of his ongoing research in this field. By the time the AERL restructured itself in October 1945 to concentrate on the turbojet and supersonic flight, 24-year-old Bruce had accumulated enough experience to be named head of the Engine Research Division's new Jet Propulsion Research Section.

Bruce and his roughly 15 research engineers tested a series of full-scale turbojet and ramjet engines. A major problem with early turbojets was the need to increase speed during takeoffs. The group's work between 1943 and 1946 yielded new thrust augmentation concepts such as the afterburner and variable-area nozzle, which remain basic elements of many modern jet aircraft. The afterburner had been proposed elsewhere, but Bruce's team was the first to create an operational version, with a variable-area nozzle whose size would increase or decrease at various stages during flight.

Bruce believed strongly that researchers learn by operating engines in large flight-simulating facilities, not by sitting at a desk. To facilitate these efforts he advocated the construction of the Four Burner Area (1947) and Propulsion Systems Laboratory (1952); the latter was the nation's most powerful facility with this capability. The altitude chambers at these facilities, whose design was more efficient than wind tunnels, could test actual engines in simulated flight conditions and became a standard tool for engine research.

Bruce received a brief promotion in August 1949 to become chief of the thermodynamics branch, with responsibility for about 30 engineers who analyzed engine cycles, propulsion systems, and basic thermodynamics in turbojets and ramjets. Just months later, he was named assistant chief of the Engine Research Division, and in 1952, at age 33, he was promoted to chief. In these positions he continued to oversee full-scale engine testing in simulated flight conditions. The research analyzed automatic control systems, exhaust systems, and complete propulsion systems. Exhaust nozzles, ejectors, directional controls, radiant heat transfer, and ramjets were all studied during these years. These investigations contributed significantly to the performance and reliability of modern commercial and military aircraft. One key development by the group in the 1950s was the reverse thruster, directing the jet engine's exhaust forward to quickly slow the aircraft when landing.

During this period Bruce was also responsible for establishing requirements for future aircraft and ramjet engines. He advocated the expansion of the AERL's research to spacecraft propulsion, seeing it as an extension of the NACA's aeronautical propulsion efforts. The Cleveland lab had done small-scale fuels studies for rocket engines since 1945, flight-tested ramjets for missile applications in the late 1940s and 1950s, and added a test stand for firing large rocket engines in 1955. Although others at the lab were also interested in space, Bruce was among the most outspoken.

In 1957, Bruce participated in the Research Planning Council with other NACA veterans to develop and coordinate the lab's research goals and test facilities. The group members felt that the need for aircraft propulsion work was diminishing and should be replaced with additional space programs. Bruce famously recalled "that about half the staff was afraid of getting sucked into space and no longer protected to do their research in a quiet manner, and the other half of us, we were afraid of being left out of this new frontier." He felt passionately that the NACA should not only participate but coordinate all space-related research.

The launch of Sputnik in October 1957 resulted in widespread calls for the establishment of a national space program. One Sunday afternoon in December 1957, Bruce drafted "Some Remarks on a Future Policy and Course of Action for the NACA," outlining the formation of a new space agency based on the NACA structure. This seminal document advocated a broad range of space research to be coordinated by the NACA, warned against concentrating on any single project, and called for the establishment of a new laboratory dedicated to space. Updated by Associate Director Abe Silverstein and renamed "Lewis Laboratory Opinion of a Future Policy and Course of Action for the NACA," the report was presented to headquarters and served as the basic template for NASA.

With the establishment of NASA and the transfer of Abe Silverstein to headquarters in 1958, Bruce was named associate director, responsible for directing and planning research for the entire lab, which had been renamed the NASA Lewis Research Center. The Center expanded its space propulsion and power research during Bruce's tenure, with the development of electric, solar, and nuclear power–generating systems for spacecraft and high-energy chemical, electric, and nuclear propulsion systems.

Shortly after President Kennedy's April 1961 pledge to send Americans to the Moon within the decade, studies were undertaken to analyze various orbital rendezvous and direct ascent approaches to reach the Moon. Bruce led a team that was given one week to assess different Saturn boosters and consider the Earth orbit, lunar orbit, and combination of Earth and lunar orbit methods of rendezvous. The group, known as the Lundin Committee, pressed NASA to continue to consider all options and emphasized the need to concentrate on launch vehicles and rendezvous options during Apollo's early stages. The committee felt that the rendezvous option would accelerate the Apollo program, permit the use of different size boosters, and save the money earmarked for the massive Saturn V boosters. The committee unsuccessfully lobbied for the use of a low-altitude Earth-orbit rendezvous using two or three smaller Saturn vehicles. A later, more detailed study supported the Lundin Committee findings, but the direct ascent method was eventually selected because it was deemed less complicated.

During this period Bruce was also asked to lead a group to investigate sites for the Manned Space Flight Center. NASA Administrator T. Keith Glennan originally restricted the search to sites near existing NASA centers, then narrowed it further to the NASA Langley or NASA Ames Research Centers. After discussing the matter with 20 aerospace officials in Washington, the group recommended a site near Ames. NASA initially agreed with Bruce's suggestion, but pressure from Congressional leaders resulted in the consideration of numerous other sites. Continued efforts by Vice President Lyndon Johnson, including a large donation of land, resulted in the selection of Houston.

Abe Silverstein returned to Cleveland as the director of NASA Lewis in November 1961. At the time there was some internal controversy at Lewis about the Center's overinvolvement in developmental work. Bruce, a strong advocate for its involvement in program management, suggested segregation of the research and development work. Lewis was restructured, with Bruce serving as associate director of development. The development staff, which increased from 200 to 800 in just three years, moved into the new Development Engineering Building located outside the main campus.

Bruce was responsible for hiring, negotiating contracts with industry, and managing multimillion-dollar budgets while continuing his oversight of electric propulsion, chemical propulsion, nuclear power generation, and nuclear rocket systems. By 1962, he had established a centralized office to support four major chemical rocket programs: the M-1 engine for the Nova rocket, the J-2 and F-1 engines for Saturn, and the RL-10 engine for Centaur. The development group's work expanded with the addition of the Centaur program in 1962, the Agena rocket program in 1963, and the 260-inch-diameter solid rocket and supersonic transport programs in 1964.

The uniquely designed Centaur second-stage rocket, the first spacecraft to run on liquid hydrogen, was Lewis's most important contribution to the national space program. It was designed to transport Surveyor spacecraft to the Moon in order to explore possible landing sites for the Apollo missions. The NASA Marshall Space Flight Center was originally responsible for the Centaur program. After the explosion of the first launch attempt in May 1962, Marshall sought to cancel the program. Instead, NASA headquarters asked Abe Silverstein and Bruce Lundin to assume management and transferred the program to Lewis, where Bruce and Abe oversaw an extensive multiyear test and evaluation effort for the rocket. Centaur not only successfully completed the Surveyor missions but has carried over 100 satellites and interplanetary probes to date. Lewis's 35-year management of the Centaur program is one of its greatest achievements.

In May 1968 Bruce was transferred to NASA headquarters to serve as deputy associate administrator and then acting associate administrator for the Office of Advanced Research and Technology. After only eight months, he returned to Cleveland as the director of NASA Lewis after the retirement of Abe Silverstein. Nearing the end of a long career, Bruce did not discover a comfortable summit as director but rather a long season of turmoil.

Lewis had refocused its efforts in aeronautics in the late 1960s. Significant gains had been made in areas such as noise reduction, supersonic nozzles and compressors, and more efficient engines. The Apollo Program was winding down, however, and Lewis had virtually no direct participation in the development of the space shuttle. Budgets for nonshuttle programs were slashed. The Lewis staff was reduced by 700 by

1971, and the nation's nuclear rocket program was cancelled in late 1972, resulting in the closure of Lewis's subsidiary, Plum Brook Station. On January 6, 1973, Bruce personally informed the staff that the station was to be closed almost immediately. That year, another 800-plus employees left through dismissal or retirement. Bruce implemented a job placement program and prided himself on the fact that every separated employee found other employment.

Further tears were beginning to show in the fabric that held Lewis together. The Center's core management team, who had worked, raised families, and socialized together for more than 30 years, began retiring in the 1970s. In addition, Bruce was mandated by headquarters to begin using contractor labor for many of Lewis's technical and support positions. This led to increased internal tensions and shattered Lewis's cohesiveness at a time of already low spirits. In an effort to boost morale and generate staff support for Lewis's goals, Bruce instituted the Lewis Awareness Program in 1974, featuring talks by him, ceremonies, film specials, and newspaper articles to recognize Lewis's accomplishments, programs, and staff.

Bruce sought new areas of research for Lewis and increased research on energy-efficient engines and noise reduction for the airline industry. He was convinced that the staff's long history of energy conversion work for space applications could be applied to new methods of clean and renewable energy. In the midst of the oil embargo, Lewis undertook a wide range of alternative energy programs. One of the most successful was a wind energy program in partnership with what is today the Department of Energy; it set a precedent for what has become an entire wind turbine industry. Lewis also developed solar-powered electric systems for remote areas and towns, batteries for electric automobiles, and the efficient Stirling automotive engine. In these ways Bruce successfully molded Lewis into a leading energy-conversion laboratory.

Lewis also began a number of environmental monitoring programs. Bruce reached agreements with the city of Cleveland to assist with pollution testing; aircraft were used to collect air samples and to map shipping channels on the frozen Great

Lakes; and the Brayton engine was developed to reduce automobile emissions.

Lewis's greatest achievements during Bruce's tenure were in the Launch Vehicles Division. The group was responsible for not only maintaining and updating the Centaur rocket but also integrating the payload with the Atlas and Titan boosters. More than 30 high-profile missions were launched during Bruce's term, including Pioneer 10, the first spacecraft to explore the outer solar system; Mariners 6 and 7, which mapped Mars; Mariner 10, which orbited Venus and Mercury; and the Viking spacecraft, which placed two rovers on the Mars surface.

Overall, however, the Lewis Center continued to struggle under a somewhat strained relationship with NASA headquarters, difficulty convincing the energy industry to use renewable resources, and requirements to continually reduce its workforce and operating budget. There were even rumors that Lewis would be transferred from NASA to the Department of Energy. Despite the difficult circumstances, Bruce was able to maintain Lewis's preeminence in aircraft engine research, launch vehicles, and power generation.

Bruce retired in 1977 after 35 years of federal service. His achievements were recognized throughout his career, beginning in 1953 when he received the Cleveland Technical Society Council's Technical Award. He went on to receive NASA's Medal for Outstanding Leadership in 1965, Public Service Award in March 1971, and in October of that year NASA's highest award, the Distinguished Service Medal. In 1966 he was selected to deliver the Jennings Scholar Lecture, in 1975 he was awarded an honorary doctor of engineering degree by the University of Toledo, and in 1976 he was elected to the National Academy of Engineering and also presented with the National Space Club's Astronautics Engineer Award.

Bruce chaired the NASA Investigation Board for the Skylab mission in 1973 and the NASA Seasat Failure Review Board in 1978. He also served as staff director and consultant to the chairman of the President's Commission on the Accident at Three Mile Island in 1979 and participated in the Wakefield

Overview Commission. He was a member of the US Air Force Scientific Advisory Board and of the NASA Aerospace Safety Advisory Panel. In 1980 he cochaired the Atlas-Centaur Review Board, which strongly recommended continued use of Centaur despite the availability of the new space shuttle vehicles.

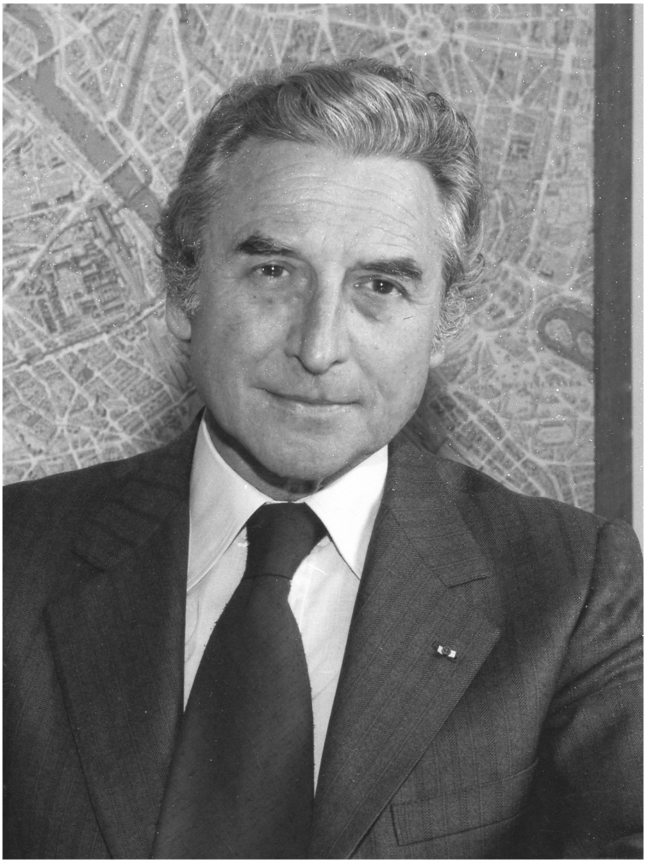
He was a fellow of the American Institute of Aeronautics and Astronautics, American Astronautical Society, and Royal Aeronautical Society, and a member of Tau Beta Pi, Sigma Xi, and the American Society for Public Administration. He wrote over 40 technical papers, including the chapter on ramjet engines in the Princeton series on High-Speed Aerodynamics and Jet Propulsion and an influential postwar report that summarizes the NACA's afterburner development.

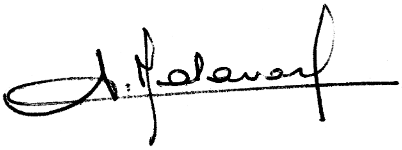
In addition to this service, Bruce was a frequent spokesman for NASA in the community and was also active in various civic, religious, and educational organizations, such as the Federal Executive Board, the Combined Federal Campaign, the Southwest Community Hospital of Berea, Ohio, and the Boy Scouts of America, from which he received the Order of Merit. He sponsored Explorer Scout Posts in electronics and aerospace for top science students and opened the NASA Explorer Posts to a wider community. He also served as the district chairman of the southwest suburbs and led its sustaining membership enrollment drive for several years. He was named chairman of the Cleveland Executive Board.

Bruce had a long, distinguished career as an engineer, manager, and director of major programs. His efforts provided a firm foundation for subsequent achievements in aeronautics, space, and energy. He continually demonstrated outstanding leadership in planning research, organizing resources for effective and timely execution, and inspiring extraordinary efforts from his staff to solve complex problems.

He was a personable and very human man who enjoyed nature and woodworking when not engaged in his aerospace work. He built much of his family's furniture, toys, and accessories. In his house overlooking a wooded ravine just outside Lewis's rear entrance he maintained an extensive library on a variety of topics.

Bruce is survived by his widow Jean, daughters Dianne and Nancy, son Robert, three grandchildren, and two great-grandchildren.





LUCIEN C. MALAVARD

1910–1990

Elected in 1980

"For contributions to the field of aerodynamics and, in particular, original work in flow visualization and in French research and development."

BY PIERRE C. PERRIER

LUCIEN MALAVARD, an international aeronautical engineer known simply as Malavard, died in Paris on March 2, 1990, at the age of 80.

Malavard was born in Marseille, France, on October 7, 1910. He received a master in sciences degree from the University of Marseille in 1930 and then started a PhD under the supervision of Joseph Pérès, a renowned professor of theoretical mechanical engineering sciences at the University of Marseille. Malavard became his assistant when Pérès received funding to open a laboratory for research in aerodynamics at the request of the French Defense Ministry. The ministry wanted to increase research in aeronautics by creating a network of institutes for fluid mechanics, the first in Paris and the second in Marseille. In addition to experimental work on propeller blades in the new low-turbulence wind tunnel facility, Pérès hoped to extend to three dimensions the analog voltage and current equivalent measurements that are analogous to speed voltages in incompressible fluids surrounding subsonic aircraft in motion.

Pérès set out to build lift load distribution tables (cord and wing-tip) to provide data for structural calculations for new aircraft and thereby optimize their performance. This was achieved in the late 1930s, not in Marseille but in Paris: when Pérès was appointed director of the Institute of Fluid

Mechanics at the Sorbonne, Malavard accompanied him as his assistant.

While working with Dr. Pérès, Malavard continued his studies and in 1934 was awarded a diploma in aeronautical engineering. He then "upgraded" his doctorate to a state doctorate, qualifying him to teach at the university. During this time he also contributed to the final work on the main wind tunnel in southeastern France (near Modane), initiated in Austria at the end of World War II. He was appointed to chair the Aviation Science Faculty of Science, Paris, and also accepted a position as scientific director at the Aeronautical Institute in Saint-Cyr (near Versailles). In 1960 he assumed the directorship of his own laboratory and became professor at both the Von Kármán Institute and the Free University of Brussels, Belgium. The following years were intensively devoted to research for the validation and use of his centers for analog computation in both research and industry. He acquired an international reputation.

This was a time of renaissance in French aeronautics as well as the beginning of various international actions. Malavard became a major actor in the European success of a proposal by Theodore von Kármán that was well received in the United States: to achieve military coordination of the Western world, in the framework of the NATO treaty, through multinational cooperation in aeronautical research and development (R&D). von Kármán, a refugee in the United States, needed collaborators in France (Malavard) and Great Britain (Alec Young) with whom he could cooperate directly to give weight and substance to the project. Naturally, it was important to succeed with the working party on fluid mechanics, von Kármán's primary field. Malavard and Young brilliantly explored several paths opened by the famous Hungarian professor. Such coordination of R&D was the first of its kind, and was duplicated in other aeronautical disciplines through the famous Advisory Group for Aerospace Research and Development (AGARD), where Malavard from the outset was an active collaborator with von Kármán in the Fluid Dynamics Working Group.

When von Kármán died in 1963, Malavard was invited to work with his successor, Courtland D. Perkins, who at the time chaired the Aeronautics Department at Princeton University (he was later elected president of the National Academy of Engineering); their collaboration led to numerous useful exchanges for both European and US R&D policies.

In addition to his tenure as professor of aerodynamics and aviation at Sorbonne University, Malavard worked in the field of analog simulation of fluids for aeronautics with extensions from incompressible flows to sonic and supersonic linearized equations. He also turned to other applications as soon as it appeared that numerical computers would play a major role in future computations of compressible flows around aircraft and other vehicles.

Thanks to his time spent sailing boats on his holidays in the Mediterranean Sea, Malavard soon directed his research toward reducing losses of energy, particularly in the field of transportation, in the newly created laboratory for the sciences and engineering at Orsay University, which he headed continuously from its creation in 1971. He proposed mixed propulsion systems with motors coupled to standard propellers and sails; the latter were rigid to avoid the need for sailors to handle the sails and complete a maneuver under sail. This led to the application of new digital codes of airflows to the TGV (France's high-speed train) and the reuse of wind energy for propulsion of boats.

Malavard nourished a great love for the sea, with sailing forays out of Marseille. He followed with interest the ecological work of Jacques Cousteau, world-famous for his research on submarine fauna in particular in the southern seas. Malavard invented a silent sailing ship with a patented "turbo-sail": a rigid cylinder replaces both mast and sail, with a slot to catch the winds and supply drive that is far easier to control than a suite of sails, since there is only one that can be reset by simple rotation and a control for the air slot. A boat built according to this design crossed the Atlantic, with Cousteau at the wheel, in a remarkably short time. But Malavard's work on auxiliary propulsion systems for boats to reduce energy consumption did not come to fruition (other than for sea-based research programs) because of the very low cost of oil at that time.

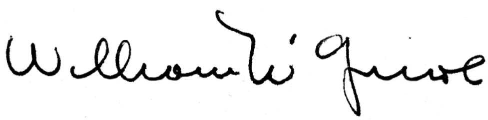
In contrast, he and his laboratory colleagues, back at the University of Orsay, were reorienting their research to a new form of computation, digital algorithms. He was the first scientist in the world to define the regular links needed for the so-called difference method (or singularity method for sources and drains), calling on the definition of surfaces developed by Pierre Bézier for automobile manufacturing and assembly. This led to software for computer-aided design (CAD) and an early version compatible with digital computation, used to compute designs for the first TGVs (particularly in the case of tunnel penetration at speed). This CAD was also used for ship building. Even as Malavard reduced his time in the laboratory to sporadic brief (but always very congenial) visits, his lab became a pioneer in artificial intelligence.

Former NAE president Perkins said at the time of Malavard's death:

> During my tenure as chairman of AGARD, I had the good fortune to become a friend and close associate of Malavard. We achieved this in spite of the fact that he spoke very poor English and I spoke very poor French. I soon recognized Lucien as a man of many talents, an able scientist and innovator, a strong leader of men, a fine manager of major enterprises, and a man of wit and great charm. He has held many important positions in academia and in government, and his work is well recognized outside of France. This was demonstrated when he was elected a foreign associate of the National Academy of Engineering of the United States, one of the first scientists and engineers so honored. Lucien Malavard, then, was a great teacher-scholar, a powerful contributor to the NATO alliance, and an innovative and creative person who brought great credit to France in many ways…. France and the international scene of aeronautics have lost a strong leader and I feel that I have lost an able and close friend.

Lucien Malavard was a pacifist at heart and also displayed great courtesy *à la française* without ever conceding or compromising his positions. When discussions were on scientific grounds, he would aptly and quietly recall the sound bases for the reasoning, never needing to raise his voice to be heard. This ability alleviated numerous difficulties in the missions he led and when his role was to defend forward-looking projects. His attendance was therefore most sought in project phases where protagonists were debating the “foundation steps” or deep disagreement had to be overcome. If as a PhD student he famously contributed to the success of the building of the big transonic wind tunnel, as a professor at the Sorbonne he played an even greater role in the establishment of an integrated administration for research and test centers (DRME) in France’s Ministry of Defense, where there was a manifest lack of connections between the academic and institutional world. He also participated in several working groups linked to government departments.

Lucien Malavard was greatly appreciated as a true coordinator among people and organizations in science and engineering, both in France and elsewhere in the world.



WILLIAM McGUIRE

1920–2013

Elected in 1994

"For contributions to the understanding of the behavior of steel structures and the development of computer graphics capabilities for design of those structures."

BY STEVEN J. FENVES*

WILLIAM McGUIRE, a prominent contributor to knowledge of the behavior and design of steel structures, died on January 31, 2013, at the age of 92.

Bill, as he was universally known, was born on December 17, 1920, on Staten Island, New York, the only child of Edward J. McGuire, a transit police officer, and Phoebe McGuire, née Sellman. After high school he enrolled at Bucknell University and received a bachelor of science degree in civil engineering in 1942.

While a senior at Bucknell, Bill was commissioned as an ensign in the US Navy, and served from 1942 until his separation from active service on January 7, 1946. After training as an aircraft maintenance officer for dive bombers, he served from January 1944 to May 1945 in the Pacific Theater aboard the aircraft carrier *USS Franklin,* which participated in the Third Fleet operations in the Marianas, Western Carolines, and Leyte Gulf. The *Franklin* was attacked twice. The first, a kamikaze attack off Leyte Island on October 30, 1944, damaged the flight deck and aft elevator. After repairs, the *Franklin* joined the Fifth Fleet operations off the coast of Japan, where a bomber strike

*With assistance from John F. Abel, Gregory G. Deierlein, and Ronald D. Ziemian.

on March 19, 1945, caused 800 fatalities and 500 wounded on the carrier. The Navy citation of Lieutenant McGuire states, in part: “In the face of continuing explosions and raging fires, he led a valiant group fighting the fires until forced by flames and smoke to go overboard.” In his characteristically modest way, Bill refers to the citation in his *Memories of Service* as “perhaps exaggerated slightly in that [it] did not mention that we weren’t successful.”

Bill’s experiences in the wartime Navy remained a formative influence throughout his life and an inexhaustible source of anecdotes. Because he could detect engine faults from their sound, during launching operations he stood on the flight deck directly behind the launch officer; when he heard a faulty engine, he tapped the officer’s shoulder and the flight was aborted.

After his discharge from the Navy Bill enrolled at Cornell University and earned a master of civil engineering (MCE) degree in structural engineering in 1947. He was also an instructor, responsible for undergraduate courses. In 1947 he joined Jackson & Moreland Engineers, a structural engineering office in Boston, as a designer and worked on the design of then-novel nuclear power plants and atomic energy facilities.

In 1949 he joined the faculty of Cornell’s School of Civil Engineering as an assistant professor. He went on to become an associate professor (1952), professor (1960), director of the school (1966–1968), and, in 1989, professor emeritus after 40 years of service. During that time he also spent periods away from Cornell as a visiting professor at the Asian Institute of Technology (Bangkok, Thailand), the University of Canterbury (Christchurch, New Zealand), the University of Western Australia (Perth), the University of Tokyo (Japan), the University of Liège (Belgium), and Strathclyde University (Glasgow, United Kingdom).

Bill’s work dealt primarily with the behavior of steel structures and their design and analysis. He was the author or coauthor of numerous papers and reports and of two widely used textbooks: *Steel Structures* (1968) and *Matrix Structural Analysis* (first edition, 1979, with R.H. Gallagher; second edition, 2000, with Gallagher and R.D. Ziemian).

Starting in the early 1970s, Bill was an innovator in the adaptation of interactive computer graphics techniques to the computer-aided nonlinear analysis and design of three-dimensional framed structures. He advocated that better designs would always come from a better understanding of structural behavior. To this end, it was his ambition, and that of his coworkers and PhD students, to model the behavior of such structures under load as realistically and comprehensively as possible with computational models. He led a 20-year effort that eventually resulted in a revised appendix to the Specification of the American Institute of Steel Construction (AISC) that provides an opportunity for engineers to use this approach.

On the education front, Bill led efforts to make advanced nonlinear analysis accessible to students and professional engineers through interactive computer programs, including the MASTAN2 software widely used in structural engineering courses on analysis and design.

His teaching, mentoring, research, writing, and consulting earned him wide respect from students, colleagues, and the structural engineering profession as a whole. In 1994, the year he was elected to the National Academy of Engineering, he was also named a Distinguished Member of the American Society of Civil Engineers (ASCE). He was twice a winner of the ASCE Norman Medal, with G.P. Fisher (1962) and with R.D. Ziemian and G.G. Deierlein (1994). Other honors included the ASCE Shortridge Hardesty Award (1992); the AISC T.R. Higgins Lectureship (1992) and Geerhard Haaijer Award (2000); and the Structural Stability Research Council Lynn S. Beedle Award (2005).

Bill consulted widely on a number of special structural problems and structural failure investigations, including the Hyatt Regency Hotel walkway collapse (1980) and the L'Ambiance Plaza collapse (1988). For more than 40 years he was almost continuously engaged with aspects of the planning, design, and periodic upgrading of the structure of the Arecibo Observatory, the world's largest single-dish radio telescope (a 305 m–diameter fixed dish with a movable feed suspended on three cables) in Puerto Rico, conceived and operated by

Cornell University faculty and administration members as the National Astronomy and Ionosphere Center (NAIC). He also designed, in partnership with Solomon Cady Hollister, retired dean of the College of Engineering, the Fall Creek Suspension Bridge on the Cornell campus (1959).

Bill's colleagues and friends remember him as a true gentleman, an avid reader, especially of nonfiction, and a wonderful conversationalist who invoked history, travel, politics, and current affairs in addition to what he termed his "sea stories," many of which had nothing to do with the Navy.

Bill and Barbara Weld, daughter of Dr. Stanley B. and S. Frances Weld, were engaged in November 1943 and married in Hartford on February 5, 1944, while Bill was on leave from the Navy. For the next four years, theirs was the typical Navy life of short periods of togetherness in many different places. Until her death in 2009, Barbara and Bill offered their hospitality to colleagues, friends, visitors, and students in their home in Ithaca. They traveled extensively throughout the world.

Bill is survived by two sons, Robert of Ithaca, New York, and Thomas of Tucson, Arizona; two granddaughters, Christina McGuire Adelman of West Baldwin, Maine, and Marketa Elsner of Lakewood, Colorado; and two great-grandsons, Cash Thomas Adelman and Elias Weld Elsner.

Harold L. Michael

HAROLD L. MICHAEL

1920–1999

Elected in 1975

"For leadership in education, research, and practice in the fields of highway traffic engineering, planning, and safety."

BY KUMARES C. SINHA

HAROLD L. MICHAEL, professor emeritus, School of Civil Engineering, Purdue University, and a pioneer in the field of traffic engineering, died August 2, 1999. Born in Columbus, Indiana, on July 24, 1920, he grew up on a family farm during the Great Depression. The family's original German name was changed to Michael to avoid the prejudice against Germans during World War I. After finishing high school, Harold did not attend college but worked at the farm for several years before going off to World War II. He took part in five separate campaigns in Europe and was awarded the US Army Bronze Star. He continued his military service for many years as a reservist and ultimately rose to the rank of lieutenant colonel.

After the war he enrolled, with support from the GI Bill, as a student of civil engineering at Purdue University, where he received his BS in 1950 with distinction and his MS in transportation engineering in 1951. He moved up through the ranks at Purdue, from assistant professor to full professor, between 1954 and 1961.

The world was exploding with postwar opportunities. In the emerging field of transportation engineering, Harold unequivocally established himself as a national expert. One of the highlights of his career was his involvement in the planning and development of the US interstate highway system in the

1950s. He was associate director of the Joint Highway Research Project (JHRP) of Purdue University and the Indiana State Highway Commission for many years before becoming its director and head of the School of Civil Engineering in 1978. The JHRP continues to this day, as the Joint Transportation Research Program, and is a model of a university-government-private sector consortium in the nation.

Harold had a distinction that is unheard of in academia today: he accomplished all this without a PhD. Purdue rewarded his contributions with an honorary doctorate of engineering in 1992 after his retirement.

Harold's specialty of traffic engineering and planning was a very new field in the 1950s, and he contributed significantly to shaping it into a discipline. He was an early proponent of the use of statistical methods to relate peak hour flows to average daily traffic flow, to express pavement surface qualities as rider responses, to quantify a hazard index for highway-railroad crossings, and to estimate the performance of unsignalized intersections. In the 1960s he was also a pioneer in using computers for processing traffic data.

An educator with practical applications in mind, Harold's interest was in devising tools and techniques to regulate traffic flow. One of his major contributions was his work on the "bible" for modern-day traffic engineers, the Federal Highway Administration's *Manual on Uniform Traffic Control Devices.*

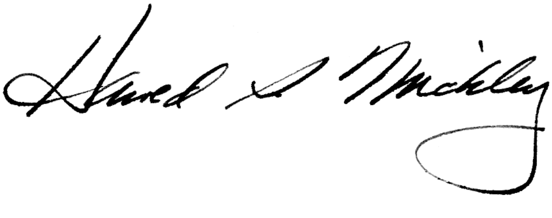
Harold believed in giving back to his community, locally and nationally. He was an outstanding volunteer for various professional organizations, including the National Research Council's Transportation Research Board (TRB), the Institute of Transportation Engineers (ITE), the American Road and Transportation Builders Association, and the American Public Works Association among others. He held leadership roles in many of these organizations.

Over the years he received many honors from professional societies in recognition of his dedicated and continuing service. These included the James Laurie Prize and the Wilbur S. Smith Award of the American Society of Civil Engineers (ASCE), TRB's Roy W. Crum Distinguished Service Award, the George

S. Bartlett Award of the American Association of Highway and Transportation Officials, and the ITE Burton W. Marsh Award and Theodore M. Matson Award. In addition, ASCE and ITE named him an honorary member. In 1975, at the age of 55, Professor Michael was inducted into the National Academy of Engineering, a testament to his stature as an authority in transportation engineering.

Locally in Indiana, he was instrumental in the establishment of both a traffic commission for the city of West Lafayette and a highway planning committee for Tippecanoe County; he served these groups until his death. He was also a dedicated member and leader of the Rotary Club. He valued community service in other ways too, and it was not uncommon to see him ringing a bell in front of local stores at Christmas time for the Salvation Army.

At his funeral his son very eloquently summarized Harold's life by saying that his motto was "I serve"—and serve well he did, and at the highest level with humility. Former Purdue President Steven Beering said of Harold, "He was a giant in the discipline of civil engineering. He brought national and international acclaim to Purdue through his prolific and astute research and because of his vast knowledge of transportation infrastructures."



HAROLD SOMERS MICKLEY

1918–2011

Elected in 1978

"For original research on transpired turbulent boundary layers and for creativity and leadership in the industrial development of oxychlorination processes."

BY KENNETH A. SMITH

HAROLD SOMERS MICKLEY had a major impact on both chemical engineering education and the industrial practice of chemical engineering. He died in Sarasota, Florida, on December 3, 2011.

Harold was born on October 14, 1918, in Seneca Falls, New York, the only child of Marguerite and Harold F. Mickley. His father, a US army physician, died before his son's birth, a victim of the 1918 influenza pandemic. Harold's mother subsequently moved to Long Beach, California, where she remarried. Harold grew up there and enrolled at Caltech, where he studied chemistry and was exposed to a mode of thought that emphasized physics, chemistry, and mathematics. His advisor, Linus Pauling, was a significant factor in developing in Harold a pattern of thinking that was rigorous and demanding. During this period, Harold supported himself in part by contributing science fiction pieces to *Amazing Stories* magazine.

Upon graduation in 1941, he wed Margaret Phillips, whom he had met during his Long Beach school days. Sons Steven and Richard followed in 1945 and 1948. Sadly, Margaret predeceased Harold. He later married Edith James and is survived by her, Steven (Diane), Richard (Cynthia), and seven grandchildren.

Despite his love of science, Harold desired a career that could more directly enhance the lives of others, so he chose to enroll in chemical engineering at MIT for his graduate education. The country was by then fully involved in World War II and Harold undertook classified research on torpedo propulsion. This led to the award of his ScD in 1946 and an appointment to the MIT faculty.

Harold rapidly became known as an expert in fluid mechanics, heat and mass transfer, heterogeneous catalysis, and industrial chemistry. He was among the first to realize that research was badly needed to improve understanding of the transpired turbulent boundary, which is central both to the cooling of turbine blades and reentry vehicles and to problems in which the mass transfer rate is high. He was the lead author (with T.K. Sherwood and C.E. Reed) of *Applied Mathematics in Chemical Engineering* (1957), for decades a standard in graduate chemical engineering curricula. *Recent Advances in Heat and Mass Transfer* (with J.P. Hartnett, E.R.G. Eckert, and R.L. Pigford) followed soon thereafter (1961). He also initiated (with T.B. Drew) the writing of an advanced undergraduate text, *Understanding and Predicting the Interactions of Matter, Energy, and Forces.* Twenty chapters were drafted and, for a decade, the blue ditto copies were an important element in the education of MIT undergraduates in chemical engineering.

These activities placed Harold in the forefront of those who, in the early 1960s, were changing engineering education to increase emphasis on mathematics and science. In recognition of this, he was named in 1961 the prestigious Ford Professor of Engineering at MIT, and in 1962 he was promoted to chairman of the MIT faculty. In that capacity, he attracted the attention of Alfred P. Sloan, who asked him to be the founding director of MIT's Center for Advanced Engineering Study. This novel educational experiment was devoted to the continuing advancement of engineers employed in industry. Under Harold's leadership, the Center became a pioneer in what is now known as "distance education."

He was also highly valued as a consultant to many international chemical and petroleum firms, and in 1967 he accepted a position as technical director at Stauffer Chemical Company, where he rose to the position of executive vice president in 1971, responsible for research and engineering leadership and for interactions with economic and societal considerations. (Much of this was proprietary and is therefore not available for review.) But his thirst to participate in technological activities was irrepressible, and many of his 50 patents are based on work undertaken at Stauffer Chemical Company; his contributions to Stauffer's oxychlorination process are especially apparent.

Harold's greatest impact may have been as a mentor, the common denominator of his careers in academia and in industry. He believed deeply in honesty, fairness, commitment to the truth, hard work, and generosity. He demanded these of himself and provided the example for us. It was not always easy to comport with the associated expectations, but we are far better for trying. His example and his generosity demonstrated his humanity, and we miss him.

YASUO MORI

1923–2012

Elected in 1986

"For contributions to heat transfer and energy conversion research, and for contributions to international scholarly exchanges."

BY ARTHUR E. BERGLES

YASUO MORI, professor emeritus of mechanical engineering at Tokyo Institute of Technology, died on March 20, 2012, at the age of 89. He was a superb engineering educator and an outstanding leader in the international heat transfer community.

Yasuo was born in Tokyo on February 24, 1923, raised by his parents in the company of two brothers and a sister, and stayed in Tokyo most of his life. In 1942 he graduated from Dai-Ichi High School, a gateway to Tokyo Imperial University (University of Tokyo), which he attended in the deteriorating environment of the war years. He studied aeronautical engineering and earned a bachelor's degree in October 1945, shortly after the conclusion of the Pacific War. He belonged to the generation that experienced social disruption and economic hardship brought about by the war, as well as the introduction of American culture after the war. His experiences in those difficult years contributed to his commitment to hard work, dignity, justice, and international collaboration.

He was on the way to becoming a junior faculty member in aeronautical engineering at the University of Tokyo when the department was shut down in 1946 at the behest of the US government, which was busy eliminating the remnants of military technologies in postwar Japan. Having seen his career path at the university closed, he landed a research job in a government laboratory, the Institute of Physical and Chemical Research (RIKEN), in 1947. In 1953 he moved to the Tokyo Institute of Technology (TIT) as a research associate, and in a few months was appointed to associate professor. His research at RIKEN and TIT was fruitful and, after submitting a doctoral thesis to the University of Tokyo, he was granted a doctor of engineering degree in 1956. (At the time, graduate schools were not established; a doctoral degree was granted on the basis of a submitted thesis and the applicant's performance at its defense.) In 1961 he was promoted to professor, and remained with TIT until his mandatory retirement in 1983.

From 1983 to 1988 he continued teaching and research at the University of Electro-Communications in suburban Tokyo. After his final retirement from teaching, he consulted for an instrument manufacturing company, Tokyo Keiso, for several years. In 1990 he was recruited by the Ministry of Foreign Affairs to become an advisor and senior scientist for a US-Japan joint research project at the Pacific International Center for High Technology in Honolulu. He served there for two years, then retired to a quiet life in his hometown in a western suburb of Tokyo.

As a young man Yasuo Mori earned recognition from the heat transfer research circle in the United States for his paper "Buoyancy Effects in Forced Laminar Convection Flow Over a Horizontal Flat Plate," published in 1961 in the *ASME Journal of Heat Transfer.* The paper was the result of his work at Cornell University, where he was a Fulbright visiting scholar in 1959–1960. In this work, he used a perturbation expansion technique to solve a nonlinear problem where vertically applied buoyancy was superposed on a horizontally developing boundary layer flow. Later at TIT, he conceived a more powerful method to solve complex three-dimensional convection heat transfer problems. This technique was applied to the analysis of flow and heat transfer in tubes under the influence of various body forces. The results were distilled to a set of concise formulas for use by the designers of spiral tube heat exchangers, coolant paths of electric generators, and other equipment.

During his academic career, Yasuo expanded his research to a wide range of subjects related to the development of energy sources and the efficient use of energy. One of the projects to which he was committed for many years concerned the development of magnetohydrodynamic (MHD) power generation. Important research topics for this project were heat transfer from plasma to the electrode, shockwave formation, and combustion in MHD channels. He also extended his research to other high-temperature heat transfer topics associated with another national project on multipurpose gas-cooled reactors as well as nitrous oxide and carbon dioxide issues. In addition, he played a leading role in projects on the use of geothermal and ocean thermal energy. While such large-scale projects were largely run by practicing engineers, he consistently emphasized the role of academics in providing industrial designers with a solid and accurate scientific knowledge base.

He demanded convergence of theory and experiment in arriving at a conclusion. His philosophy of research benefited the graduates of his laboratory, who numbered more than 300 (including undergraduates who performed BS thesis work) and most of whom went to work in industry, remembering his teaching during their careers. Many were proud coauthors of papers published in journals and conference proceedings. Yasuo himself was an author or coauthor on more than 300 papers and 15 books (one authored, 11 coauthored, and 3 coedited).

Yasuo's legacy is in the Japanese heat transfer community. He was a founding member of the Heat Transfer Society of Japan and served as its president in 1978; he took the initiative to develop the Society's organization, enhance its financial foundation, and create a scholarly award for young researchers. He also contributed to the development of the Japanese mechanical engineering community through his official services to the Japan Society of Mechanical Engineers (JSME); he served on the JSME board of directors four times in the 1960s and 1970s, and was vice president in 1978.

His legacy includes efforts to establish channels of international collaboration in heat transfer research for his peers and younger generations of researchers. He chaired the JSME Board of International Affairs during his tenure on the Society's board of directors, and initiated an International Cooperation Program, through which JSME supports bi- and multinational conferences. He played a pivotal role in organizing the International Heat Transfer Conference in Tokyo in 1974 and the first US-Japan Heat Transfer Seminar in Tokyo in 1980. He was the principal coorganizer of the first US-Japan Thermal Engineering Joint Conference (Honolulu, 1983) and the US-Japan Heat Transfer Seminar in San Diego (1985). He was actively engaged with the International Center for Heat and Mass Transfer (ICHMT) since its foundation in the early 1970s, and was its president from 1990 to 1994.

He served as an editor or advisory board member for major international journals: the *International Journal of Heat and Mass Transfer* (1973–1986), *International Communications in Heat and Mass Transfer* (1976–1986), *Energy Developments in Japan* (1980–1987), and *Heat Transfer Japanese Research* (1975–1986). He was invited to present keynote lectures at major international conferences and universities, and was Springer Distinguished Professor at the University of California, Berkeley, in 1984.

The list of awards bestowed on Yasuo Mori by Japanese societies and government includes the JSME best paper award four times (1963, 1973, 1980, 1984), the Award for Distinguished Services to the Promotion of Science and Technology (Tokyo Municipal Office, 1982), the Award for Significant Contributions to the Development of Large-Scale Technology (the Ministry of International Trade and Industry, 1986), JSME Thermal Engineering Division Award (1989), and the Order of the Rising Sun, Gold Rays with Neck Ribbon (1999). He also received the ASME Heat Transfer Memorial Award (1982), the AIChE/ASME Max Jakob Memorial Award (1988), and the ICHMT A.V. Luikov Medal in 1988. He was especially proud of his election in 1986 to the US National Academy of Engineering as a foreign associate.

In the international heat transfer community, Yasuo is remembered both for his quick thinking and sharp manner of discussion at conference sessions, and as a congenial and likable gentleman on private occasions. He was also known as an avid sportsman since his youth. He played baseball and skied with his students, and in later years excelled in golf. Many of his former students challenged him on the golf course, but bit their lips as they realized that he was above them even in casual play.

Yasuo is survived by his wife Reiko to whom he was married for 59 years. The couple had no children, but one of their nieces was very close to them—almost like an adopted daughter. Reiko describes him as a warmhearted and gentle husband, and cannot imagine that he demanded rigor and discipline from his students in their research work. Those students who experienced his stern guidance, however, sensed that he had a genuine warm heart and that he never lost confidence in them.

Hearing of his death, the alumni of his TIT laboratory staged a memorial. Many stories about Yasuo were told at the event. One, in particular, stands out: The Mori laboratory was in a barracks from which the main faculty building was visible. It was a daily experience for the students to see Prof. Mori emerge from the faculty building and dash to the laboratory with his white laboratory coat flapping. This was the indication that he had suddenly gotten an idea on research and wanted to promptly convey it to a student. The students were alerted and enjoyed the game of guessing who would be approached during the impending visit.

Yasuo's achievements stand out not only in his research but also in his inspiration of so many generations of students who remember him with great respect, pride, and warmth. Foremost among the presenters was his doctoral student Wataru Nakayama, who kindly provided material for this tribute.

Richard B. Neal

RICHARD B. NEAL

1917–2012

Elected in 1979

"For leadership in the design and construction of multi-GeV linear electron accelerators."

BY GREGORY LOEW
SUBMITTED BY THE NAE HOME SECRETARY

RICHARD BARR NEAL, a key figure in the design, construction, and operation of the Stanford Linear Accelerator Center, died on November 22, 2012, in Solana Beach, California, at age 95.

Richard Neal was born on September 5, 1917, in Lawrenceburg, Tennessee, a small town 80 miles south of Nashville. After education in local schools, he attended the US Naval Academy in Annapolis, Maryland, where he excelled in track events and played football before graduating in 1939. He then served two years aboard the battleship *USS Pennsylvania* until his discharge in 1941 because of a defect in his eyesight.

He accepted a position as a field service engineering supervisor for New York–based Sperry Gyroscope Co., which at the time was involved in high-power microwave research, including the development of the first klystron designed at Stanford University. Klystrons later became the microwave power sources to accelerate electrons in linear accelerators.

In 1944, Neal and Gail Annette Nesbitt were married at Forest Hills Gardens, Long Island, New York, where they resided for the next three years.

After working on rocketry systems for Sperry at the close of the war, he left to attend Stanford as a graduate student in 1947. In this capacity he worked on the development of many systems and components needed for linear electron accelerators at Stanford, and in 1953 he published his doctoral thesis, a voluminous technical report about Stanford's 220-foot-long Mark III accelerator project, a precursor to the 2-mile-long accelerator. He became a physics research associate at Stanford in 1951.

As a result of the success of the Mark III machine as a physics research tool, Neal became part of a small group of visionaries who started meeting in 1956 in the home of Wolfgang "Pief" Panofsky, who would later become SLAC's first director, to discuss preliminary plans for building a much larger electron linear accelerator, then dubbed "Project M" (the "M" affectionately stood for "monster" because of its scale). The group submitted a proposal in 1957 to several US government agencies to build such a machine on Stanford-owned land. After several years of negotiations, the project was finally approved for construction by the US Atomic Energy Commission in 1961. The Stanford University Board of Trustees named it the Stanford Linear Accelerator Center (SLAC).

At this point, Neal was appointed associate director of SLAC and became the leader of its technical division, which grew to a staff of nearly 600 physicists, engineers, technicians, and support staff. Under Panofsky's and Neal's leadership, construction of the center was completed successfully in 1966 within schedule and budget ($114 million). Neal was also selected as a member of the SLAC faculty, a group of professors responsible for steering and discussing the ongoing and future intellectual and scientific programs of the laboratory.

Neal was a superb technical writer, always attentive to detail and style. He chronicled the entire design, construction, and early operation of the project as the lead author of a 1,169-page work, *The Stanford Two-Mile Accelerator* (also known as "The Blue Book"). It is a lasting tribute and valuable reference for the innovations and expertise in technology and engineering brought to bear in constructing the linear accelerator, which continues to power cutting-edge research.

Neal remained head of the SLAC technical division until 1982. During his tenure, SLAC saw many new developments, a gradual increase in the electron and positron beam energies through the construction of more powerful klystrons; the invention of a microwave energy storage cavity system called SLED (SLAC Energy Development); the construction of two successive electron-positron colliding beam rings, SPEAR and PEP; and the award of Nobel prizes to SLAC physicists Burton Richter and Martin Perl. Richard Taylor later received a Nobel for research conducted during Neal's time at the lab. During all these years, Neal was recognized as an excellent leader and manager. An extremely hard worker, he truly led by example and was highly respected by Panofsky and other colleagues and staff.

Neal was also renowned in the physics and accelerator community at large. During his career he authored more than 100 reports and technical papers, contributed to several books, and participated in numerous national and international committees and conferences related to accelerators. He was a fellow of the American Physical Society, a member of the scientific research society, Sigma Xi, and in 1979 was elected to the National Academy of Engineering.

Before retiring from SLAC in 1985, Neal had taken up flying as a hobby, obtained a pilot's license, and would on occasion fly over the lab. His hobbies also included ballroom dancing, ice skating, cycling, hiking, music, reading, and spectator sports.

After his retirement, Neal, his wife, and daughter Martha moved to a residential community in Solana Beach in Southern California. He became a member of the board of directors of the homeowners association, and as secretary and treasurer he put great emphasis on achieving a firm financial foundation for the association, very much in tune with the way he had managed financial affairs at SLAC.

When Neal turned 80, he returned to SLAC for a 1997 symposium honoring him on this milestone birthday. The symposium was a wonderful occasion to celebrate his many SLAC accomplishments and for colleagues and physicists from all over the country to see him once more and to look into the future of the scientific field he served so well.

Richard Neal is survived by his wife of 68 years, Gail, daughter Martha (Marti) Neal of Solana Beach, and son Richard Forrest Neal of Bonny Doon, California. If you ever visit SLAC and stand in front of Building 41 where he had his office, you will see the silk tree (*Albizia julibrissin*) he planted to commemorate his retirement in 1982.

David Okrent

DAVID OKRENT

1922–2012

Elected in 1974

"For contributions in fast reactor design, including critical experiments, safety tests and analyses, and neutron cross-section evaluation."

BY WILLIAM E. KASTENBERG, GEORGE E. APOSTOLAKIS, AND DONALD G. BROWNE

DAVE OKRENT was a giant in his field. As an engineer and physicist, teacher and scholar, mentor and friend, he was steadfast in his desire for all of us—family, friends, and colleagues—to achieve our highest good, while at the same time he fought, unflinchingly, for the values he believed in.

Whether designing the earliest nuclear reactors for research, commercial, or military use, or developing and participating in the United States regulatory structure, and indeed worldwide, Dave's guiding principle was the protection of the health and safety of the public and the environment. And as a scholar and teacher, he stood for regulation based on sound science, making the fields of safety and risk academic subjects. He always spoke in straightforward and simple, yet profound terms—grasping the broader implications of our questions, and indeed our work, far beyond what we were asking. Dave's compelling statements at our first meetings with him—40 or more years ago—would change the course of our careers, as was true for so many others. His wisdom, piercing questions, and subtle wit will be missed!

David was born on April 19, 1922, in Passaic, New Jersey, the son of Abram and Gussie (née Pearlman) Okrent. After his graduation from the Stevens Institute of Technology in 1943, he was employed during the latter days of World War II at the National Advisory Committee on Aeronautics (NACA), where he concentrated his efforts on improving engine performance for allied aircraft. In 1946 he got a teaching fellowship at Harvard, where he received his doctorate in physics in 1951.

He began work as an associate physicist at Argonne National Laboratory in Illinois, working initially on the core of the first nuclear submarine, the USS Nautilus (SSN-571), and then on the core of the USS Seawolf (SSN-575), which was designed with a sodium-cooled fast reactor, saving 40 percent of the machinery space in the reactor compartment of the boat. He then turned his attention to the more fundamental issue of fast reactor physics, design, and safety, coauthoring three primary works on fast reactor physics between 1960 and 1970: *Fast Reactor Cross Sections: A Study Leading to a 16 Group Set* (with Shimon Yiftah and Peter A. Moldauer; 1960), *Computing Methods in Reactor Physics* (with Charles Kelber; 1968), and *Reactivity Coefficients in Large Fast Power Reactors* (with Harry H. Hummel; 1970). He was the chief physicist on the Experimental Breeder Reactor (EBR) II and the Transient Reactor Test Facility (TREAT) reactor, both located at the National Reactor Testing Station in Idaho. When there was a serious accident at EBR I in 1957, he turned his attention to issues of nuclear safety, becoming the leading expert in issues of safety in liquid-metal-cooled fast reactors. He attended the first Atoms for Peace Conference in Geneva in 1955, and served as the scientific secretary of the American delegation at the second conference in 1958.

In 1963 David was appointed to the Advisory Committee on Reactor Safeguards (ACRS), a statutory body advising the US Atomic Energy Commission (AEC; now the US Nuclear Regulatory Commission) on issues of nuclear reactor safety and licensing. The accident at the Three Mile Island (TMI) nuclear power plant occurred in 1979, during his service on the advisory committee. Called immediately to Washington, David chose to work primarily on lessons learned, already grasping the implications of TMI for the nation's nuclear power industry and working through the ACRS to ensure that many of his recommendations were adopted and implemented. He served on the committee until 1987, and reported many of the lessons he learned during his years with the ACRS in his 1981 book *Nuclear Reactor Safety: On the History of the Regulatory Process.*

One area of concern that David questioned was the safety of pressure vessel integrity in nuclear power plants. Together with ACRS members Theos J. (Tommy) Thompson and N.J. Palladino, this area of investigation led to the ACRS *Report on the Integrity of Reactor Vessels for Light-Water Power Reactors* (1974), formation of the AEC Heavy Section Steel Technology Program, and development of the field of fracture mechanics as a technical tool to analyze the safety of not only the pressure vessel but also piping and structural supports throughout the plant. These improvements were formalized in the publication of Section III of the Pressure Vessel Code of the American Society of Mechanical Engineers.

David was an early proponent of the importance of understanding the potential of seismic risk for nuclear power plants. As of late 1963 relatively little attention was given to such risk, even in seismically active areas such as California. This changed after the great Alaska earthquake of 1964, and David urged the development of a more formal process for evaluating seismic risk—not only in seismically active areas along the west coast of the United States but also east of the Rocky Mountains.

In addition, together with ACRS member Jesse Ebersole, David recognized the importance of systems interactions in nuclear power plants. The result was the development of important benchmark studies in nuclear power plants throughout the country.

It was also during this period that David began to ask, and seek answers to, the question "How safe is safe enough, and why?" US safety policy was based on "defense in-depth," which relied on engineering concepts such as redundancy and diversity in plant structures, systems, and components, and safety margins in determining limits on key physical parameters. David noted in his critical paper "An Approach to Quantitative Safety Goals for Nuclear Power Plants" (1980) that this approach would lead to the judgment that there was reasonable assurance that a nuclear power plant could be operated without "undue risk to the public" without saying what that risk actually was. The accident at Three Mile Island changed all that, and David took it upon himself to answer the above question by proposing numerical criteria for measuring safety, called quantitative safety goals.

David's work led to a paradigm shift in regulatory decision making, enabling a plant owner, a regulator, or the public to determine whether or not a nuclear plant is safe enough. Moreover, it led to the concept of risk-informed regulation, enabling stakeholders to determine whether changes to a plant were worthwhile or not.

David considered his seminal work on safety goals to be one of his most important contributions to reactor safety. And John Ahearne, former chair of the Nuclear Regulatory Commission, noted that "Dave Okrent many times thought beyond the current problem. In the concept of safety goals, he was at least a decade, and probably more, ahead of the regulatory system."

In 1971 Chauncey Starr, then Dean of Engineering, recruited David to UCLA to develop a nuclear engineering program. Starr himself, an early pioneer in the field of risk analysis, recognized that the young nuclear engineering faculty at UCLA needed senior leadership and direction. Feeling right at home in an academic environment, David was responsible for making nuclear reactor safety and the emerging field of risk analysis (assessment and management) academic subjects by establishing funded research projects and developing courses at the graduate level.

Among his early projects at UCLA was an NSF-funded study that developed the first probabilistic methodologies for assessing risks associated with severe natural phenomena (e.g., hurricanes, tornadoes, earthquakes, meteors and meteorites), dam failures, accidental chlorine releases, as well as the risk to the public on the ground in the vicinity of airports due to aircraft crashes. Equally novel was David's inclusion of social scientists, such as Paul Slovic, Sara Lichtenstein, and Baruch

Fischhoff, expanding on Starr's early work on risk perception and pioneering new approaches for both assessing and interpreting public attitudes toward risk.

David went on to develop research programs and courses on liquid-metal-cooled fast spectrum reactors and then, after the TMI accident in 1979, on light water reactors. He also directed a three-year EPRI-funded project on fusion reactor safety, the first comprehensive study of its kind.

He served as advisor to over 50 graduate students and more than a dozen postdoctoral fellows at UCLA. He was never at a loss with regard to exploring new avenues of research, new concepts for improving reactor safety, unique approaches for regulation, or new approaches to consider intergenerational equity in societal decision making.

Between 1979 and 1992 he also served on the National Research Council's Committee on Maritime Hazardous Materials, National Materials and Manufacturing Board, Electrical/Nuclear Power Engineering Peer Committee, Committee on Future US Nuclear Power Development, and the Risk and Impact Panel of the Committee on Nuclear and Alternative Energy Sources (CONAES).

David received many honors and awards throughout his life, but felt that his greatest honor was election to the National Academy of Engineering in 1974 for his efforts in fast reactor safety. He was the recipient of two Guggenheim Fellowships, the first Argonne Universities Association Distinguished Appointment Award in 1970, and the US Nuclear Regulatory Commission's Distinguished Service Award in 1985. The American Nuclear Society honored him on three occasions: with the Tommy Thompson Award for nuclear safety in 1980, the Glenn Seaborg Medal for scientific and engineering research contributions to the development of peaceful uses of nuclear energy in 1987, and the George C. Laurence Pioneering Award for lifetime achievements in the development of reactor safety philosophy in 2007.

His daughters wrote that David was also companion to his beloved wife, Rita, in her bead hunting and travels. From the time Rita started her bead business in the 1970s, David assisted her. Many years later, he organized her inventory, got it appraised, and built and ran her website. He became a bead expert himself in the process and designed necklaces with Rita once she became ill. Even at age 90, David remembered details of customer purchases and assisted his daughter, Jocelyne, with his knowledge of the inventory, customer purchases, and with running the business.

David retired from active teaching in 1991 but continued an active research program until the early 2000s. His wife of 57 years, Rita (née Holtzman), predeceased him in 2005. He died at his home on December 14, 2012. He leaves his son Neil, daughters Nina and Jocelyne, and four grandchildren.

Equidem beatos puto, quibus deorum munere datum est aut facere scribenda aut scribere legenda, beatissimos vero quibus utrumque.

Charles Richard O'Melia

CHARLES R. O'MELIA

1934–2010

Elected in 1989

"For significant contributions to the theories of coagulation, flocculation, and filtration leading to improved water-treatment practices throughout the world."

BY MENACHEM ELIMELECH

CHARLES R. O'MELIA, Abel Wolman Professor Emeritus of Geography and Environmental Engineering at Johns Hopkins University and one of the world's leading authorities in water treatment, died on December 16, 2010, at the age of 76.

O'Melia, known to family, friends and colleagues as Charlie, was born in Manhattan, New York, on November 1, 1934. Charlie was the first child of Anne Dobbin O'Melia, an elementary school teacher, and Charles James O'Melia, an accountant. After his mother's untimely death during the birth of his sister, Charlie moved to Brooklyn to live with his grandmother and three aunts. For much of Charlie's life, his father worked overseas as an accountant for international construction companies.

Charlie's fascination with New York City's bridges and skyscrapers initially led him to study civil engineering at Manhattan College, but later he decided to focus his studies on the emerging field of environmental engineering. "It just seemed more intellectually challenging at the time," he said in an interview with the Johns Hopkins University *Gazette* in 2000.

O'Melia earned his master's degree in environmental engineering in 1956 from the University of Michigan. That same year he also married Mary Curley and began a family that would grow to six children. He then returned to New York City for an engineering consulting job with Hazen and Sawyer Engineers. The consulting job, however, was short-lived as O'Melia decided to return to the University of Michigan to pursue his PhD in environmental engineering, which he completed in 1963.

Following his initial academic position as assistant professor at the Georgia Institute of Technology, Charlie carried out research as a postdoctoral fellow and lecturer at Harvard University, working with Professor Werner Stumm from 1964 to 1966 on the chemistry of coagulation and filtration in water treatment. His seminal work with Stumm at Harvard resulted in award-winning publications that provided new chemical insights into the mechanisms of particle removal by coagulation and filtration.

After Harvard, Charlie joined the Department of Environmental Science and Engineering at the University of North Carolina (UNC) and was promoted to full professor in 1970. At UNC, he excelled in teaching and research; in his first three years there, he won the department's highest teaching award twice. "He held up the highest teaching standards for himself and he was his toughest critic," said his UNC colleague and friend Don Lauria. "He would come to the classroom early to collect himself and write on the blackboard."

In 1971 Charlie and his first doctoral student at UNC developed the first theoretical microscopic model for particle filtration and demonstrated its application. This pioneering work has since become standard textbook material and is widely used by water quality engineers to predict filter performance.

In 1980 Charlie accepted a position at Johns Hopkins University in the rejuvenated Department of Geography and Environmental Engineering. He spent nearly three decades with the department, including two terms as department chair. Under his leadership, the department significantly expanded and rose in stature. As Charlie told *Johns Hopkins Engineering Magazine* in 2007, when he announced his retirement: "It's been remarkable to see the growth of environmental engineering in the department, from almost non-existent in 1980 to a program that's consistently ranked among the best in the country."

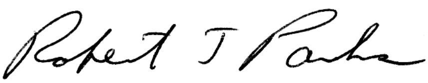
Charlie was an inspiring and dedicated educator, both as a classroom lecturer and as a mentor to his graduate students. During his illustrious academic career, he mentored numerous doctoral and master's students. His former graduate students now hold professorships at renowned institutions and senior positions in consulting firms and government. "Charlie mentored by his actions as a superb scholar, teacher, and engineer, interacting with great humility as he stressed the importance of fundamental concepts in solving environmental challenges," said John Tobiason, professor of environmental engineering at the University of Massachusetts and a former doctoral student of O'Melia.

In recognition of his outstanding research accomplishments, Charlie received numerous awards and honors. He was elected to the National Academy of Engineering in 1989 for his seminal contributions to the theory and practice of particle removal in water treatment. In 2000 he was awarded the prestigious Athalie Richardson Irvine Clarke Prize for excellence in water science and technology. Widely respected for the caliber of his publications, Charlie received publication awards from numerous organizations, including the American Water Works Association (AWWA) and the Association of Environmental Engineering and Science Professors (AEESP). Other major awards included the American Society of Civil Engineers (ASCE) Simon W. Freese Environmental Engineering Award in 1985, the A.P. Black Research Award from AWWA in 1990, and the AEESP Founders' Award in 1995.

Charlie's leadership roles and service to the profession were exemplary. He served on numerous committees of the National Academies and many other organizations. In 2000 he served as chair of a National Research Council committee that examined the watershed management of New York City. His book summarizing this work, *Watershed Management for Potable Water Supply: Assessing the New York City Strategy*, is a masterpiece that combines knowledge from such diverse disciplines as environmental engineering, hydrology, watershed management, ecology, microbiology, public health and epidemiology, urban planning, economics, and environmental law.

Charlie was a devoted family man. He took special pride in the accomplishments of his children and grandchildren. His love for his wife of 54 years, Mary, was inspiring. He was also humble, kind, caring, and giving. His devotion to his students and their loyalty and admiration to him in return is legendary. He will be greatly missed.

Charlie is survived by his wife, Mary, and their six children, Kathleen, Mary Margaret, Anne Marie, Charles, John, and Michael, 11 grandchildren, and a sister, Anne Frances.



ROBERT J. PARKS

1922–2011

Elected in 1973

"For contributions in radio-inertial guidance, communications methods, systems engineering, and project management of spacecraft and missiles."

BY JOHN L. MASON

ROBERT J. PARKS, known as Bob, was born in Los Angeles in 1922. He attended California Institute of Technology (Caltech), where he played in the backfield on the freshman football team (including one game in the Rose Bowl, Caltech's home field) and was elected to Tau Beta Pi, the honorary engineering fraternity. He graduated with honors in 1944, with a BS degree in electrical engineering.

From February 1944 to June 1946 he served with the US Army Signal Corps, including a tour in occupied Europe. During his service, he received considerable additional schooling in electronics and radar at Harvard, the Massachusetts Institute of Technology, and the Army's Fort Monmouth. He was discharged from the Army as a first lieutenant.

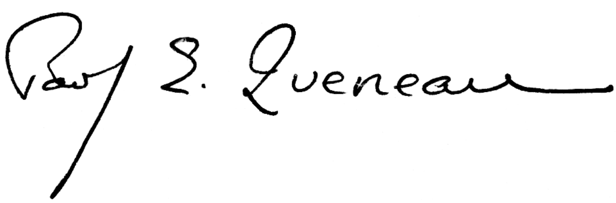
He was associated briefly with Hughes Aircraft Company in Culver City before joining the Jet Propulsion Laboratory (JPL) in 1947. His earliest work at JPL was on the guidance systems for the Army's Corporal and Sergeant missiles. He was also responsible for projects such as Mariner 2, which made a successful Venus flyby in December 1963; Rangers 7, 8, and 9, which produced the first close-up photos of the moon, before the Apollo lunar landing; Mariner 4, which photographed Mars in July 1965; the Surveyor lunar soft lander series, from 1966 to 1968 (including as Surveyor program manager); Mariner 5, to Venus in 1967; Mariners 6 and 7, to Mars in 1959; Mariner 9, to Mars in 1971; and Mariner 10, the first spacecraft to travel to Mercury, in 1973. In addition, he directed JPL's efforts in support of the Viking orbiter-lander project on Mars, and the Voyager missions to Jupiter and Saturn. Recently, Voyager left our solar system and continues on….

Bob became associate director for space science and exploration, assistant laboratory director for flight projects, planetary program director, chief of the guidance division, and, in January 1984, deputy director. In this position he was responsible for the day-to-day management of JPL and for the direction of its technical, administrative, and service activities until his retirement in 1987. He was also program director for the development of the US Army's Sergeant, a solid-propellant surface-to-surface ballistic missile.

In 1963 he received the Louis W. Hill Space Transportation Award (with Jack N. James) and the NASA Public Service Award. The Franklin Institute awarded him the Stuart Ballantine Medal in 1967, the same year that the California Air Force named him Man of the Year. NASA awarded him the Exceptional Service Medal in 1967 and the Distinguished Service Medal in 1980. He was elected a member of the National Academy of Engineering in 1973. In May of 1980, the American Institute of Aeronautics and Astronautics presented him with the Goddard Astronautics Award for "outstanding achievements and inspired leadership in his direction at JPL of flight projects from Mariner 2 to Voyager." In 1992 he was recognized as a Distinguished Alumnus of Caltech.

Bob and Hanne Parks were members of Caltech's Associates, a support group for Caltech. From 1998 to 2004, Bob served on the board of trustees of the Planetary Science Institute, a Tucson-based nonprofit research organization.

Bob died on June 3, 2011, of complications following injuries suffered from a fall in his home. He is survived by his wife Hanne, three sons, and three grandsons. Bob and Hanne made their home on Balboa Island, California.



PAUL E. QUENEAU

1911–2012

Elected in 1981

"For innovative leadership in the invention and commercial development of efficient technology for extraction of nickel, copper, and cobalt."

BY ELSA GARMIRE

PAUL ETIENNE QUENEAU, a pioneer in pyrometallurgy (smelting with oxygen to reduce environmental pollution) and coinventor of the Queneau-Schuhmann-Lurgi (QSL) process for efficiently extracting lead, died on March 31, 2012, at the age of 101.

Paul was born in Philadelphia, on March 20, 1911, to Augustin Leon Jean and Abbie Jean (Blaisdell) Queneau. His mother was a descendant of Ralfe Bleasdale, who landed at Pemaquid Point in Maine in 1635. As a young man, Paul and his family followed his father's engineering career across the globe. He said it was challenging adapting to new schools in new countries every few years.

After gaining admission to Columbia University at age 16, he persevered in his schooling through the Great Depression, working as a waiter to make ends meet. He earned his BA (1931), BSc (1932), and Engineer of Mines (1933), and in 1965 received Columbia's engineering alumnus Egleston Medal, "For fundamental discoveries in the field of process metallurgy."

After Columbia he began employment with International Nickel (INCO), where he worked for 35 years. He began as a "hot metal man," working more or less as a laborer in a nickel alloy plant—as he said, "smelling my sweat on a variety of furnaces." In 1937 he was transferred to the Copper Cliff research laboratory to work on improving efficiency, where he was inspired to pursue oxygen-based pyrometallurgy. In 1941 he was promoted to superintendent of research.

Queneau volunteered for service in the US Army immediately after Pearl Harbor and was sent to the Army Engineer School. He was deployed to Europe as part of the Corps of Engineers, and spent the next several years battling from the Normandy beachhead to the Rhine River. He was awarded the Bronze Star, the Army Commendation Medal, and the European Theatre of Operation Ribbon with five battle stars.

In 1945 he returned to the Army Reserve as a lieutenant colonel and to INCO, newly dedicated to environmental conservation. His experience in the Army exposed him to the mass destruction of war and he came back determined to improve the environmental record of smelters with oxygen.

In 1952 INCO's pioneering commercial oxygen reactor flashed into life. Paul and his team's research and development led to oxygen flash-smelting of copper concentrates, fluid bed roasting, copper-nickel in matte separation, and iron ore from pyrrhotite. These activities are documented in his 1967 book *The Winning of Nickel* (coauthored with Joseph R. Boldt), which is still considered one of the bibles on nickel recovery and processing. He retired in 1969 as INCO's vice president, chief technical officer, and assistant to the chairman.

After retiring, Queneau earned his doctorate at age 60 from the Delft University of Technology in the Netherlands. He then joined the faculty of Thayer School of Engineering at Dartmouth in 1971, where he taught for the next quarter century and continued R&D on environmentally sound smelting. In 1974 he and Reinhardt Schuhmann Jr. proposed the Q-S oxygen process, which carried out smelting in a single process within a continuous oxygen converter. They believed it would "prove to be a contribution to maximum economic utilization of the nation's mineral heritage, with due regard to conservation of natural resources—including the environment."

Working with the German company Lurgi, they demonstrated the feasibility of what came to be known as the QSL process on an industrial scale. Berzelius Metall ordered its primary smelter in Stolberg, Germany, converted to the QSL process; the plant was commissioned in 1990 and is still operating. The company's website attests that this plant, "one of the largest and most modern lead smelters in the world, complies with the demands of modern, energy-saving, ecologically compatible lead production technology upholding stringent environmental standards on a continuing basis." The QSL process is also employed in two lead smelters in Korea. Queneau's dream of commercial QSL oxygen converters that continuously produce metal directly from mineral feed with minimal environmental consequences has become a reality.

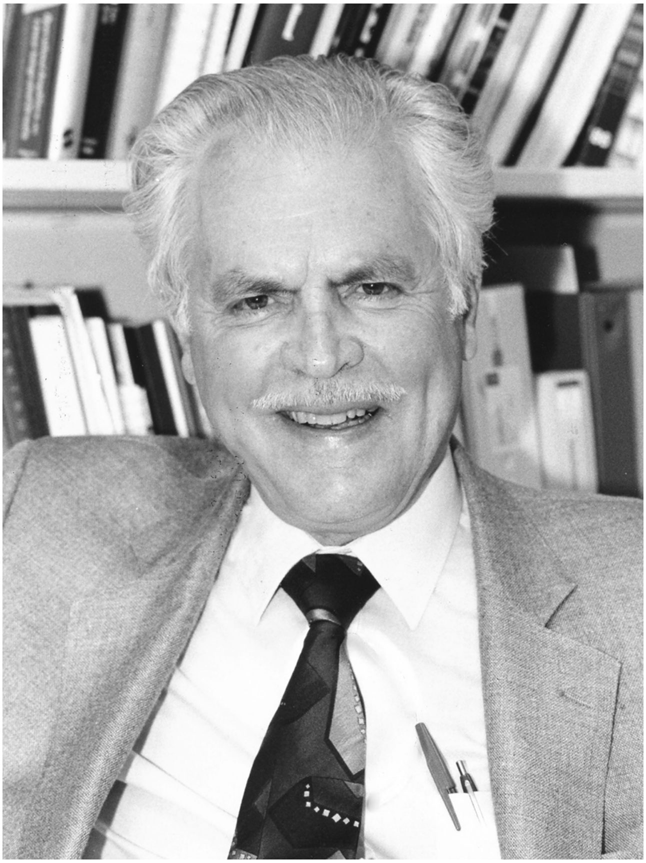
A symposium honoring Queneau was held on the occasion of his 80th birthday, sponsored by the Extraction and Processing Division of TMS (the Minerals, Metals & Materials Society), and the proceedings were published in two volumes, entitled *Extractive Metallurgy of Copper, Nickel, and Cobalt* (1993).

Paul was awarded 36 US patents for continuous converters and processes that use oxygen technology to extract nickel, copper, cobalt, and lead from their ores and concentrates, thereby achieving environmentally clean, energy- and cost-saving metal production. He was a fellow (1967) and past president (1969) of TMS, and past chairman of the Engineering Foundation. He received AIME's James Douglas Gold Medal, the Gold Medal of the British Institution of Mining and Metallurgy, the Robert Fletcher Award from Dartmouth's Thayer School of Engineering, and *Chemical Engineering*'s Kirkpatrick Award.

In 1949 he explored, mapped, and photographed, for the US government, the Perry River region of the Arctic by 13-foot canoe with artist and ornithologist Peter Scott and zoologist Harold Hanson. Among other tasks, they studied the nesting grounds of the Ross's goose, threatened with extinction. Scott wrote about the adventure in his book *Wild Geese and Eskimos: A Journal of the Perry River Expedition of 1949*, which included Paul's photographs.

Paul said that, although his military service was one of his life's proudest moments, he returned from the war a broken semblance of a man. It was only by the limitless devotion, love, and patience of his wife Joan that he was able to recover from the trauma of all that he'd seen. Years later as he was being honored by *Chemical Engineering* for his distinguished career, he threatened to turn down the Kirkpatrick Award unless editors agreed to publish a photo of both him and Joan, saying he owed his life to her and they could "find someone else" if they didn't want her in the cover portrait. In addition, with help from his former employer, INCO, he endowed Thayer School with the Paul E. and Joan H. Queneau Distinguished Professorship in Environmental Engineering Design.

Both avid lovers of nature, he and Joan bought a farm near Cornish, New Hampshire, where they spent their free time building ponds, making maple syrup, raising cattle, and living out Paul's boyhood dream of being a farmer.



IRVING S. REED

1923–2012

Elected in 1979

"For contributions to automatic detection and processing of radar data, multiple-error-correcting communications codes and digital computer design."

BY SOLOMON W. GOLOMB

IRVING STOY REED was born on November 12, 1923, in Seattle, Washington, and grew up in Fairbanks, Alaska, where he started college at the University of Alaska. He transferred to the California Institute of Technology (Caltech), where he earned his bachelor's degree (1944) and PhD (1949), both in mathematics with a minor in physics. Between degrees he served in the US Navy (1945–1946) as a radar technician on a ship in the Pacific. Afterward, while a graduate student at Caltech, he was involved in the development of one of the very first digital computers, the Northrop MADDIDA (Magnetic Drum Digital Differential Analyzer), used in aviation guidance systems.

From 1951 to 1960 he worked at MIT's Lincoln Laboratory, where he developed computer programming languages, the theory and analysis of radar systems—with applications to missile defense—and the Reed-Muller and Reed-Solomon codes for protecting the integrity of digital information. From there he went to the Rand Corporation in Santa Monica, California, where he continued to work on coded communications and radar systems. In 1963 he joined the faculty of the University of Southern California (USC), where he became the first holder of the Charles Lee Powell Chair in Electrical Engineering and Computer Science, which he held until his retirement in 1993, with the title of Powell Chair of Engineering Emeritus.

With a joint appointment in the Departments of Electrical Engineering and Computer Science, Reed was a founding member of both the Communication Sciences Institute and the Signal and Image Processing research groups. With a succession of talented graduate students, he worked to improve decoding algorithms for error-correcting codes and the data compression methods that became the basis for the jpeg image standard that is now ubiquitous for image storage and transmission.

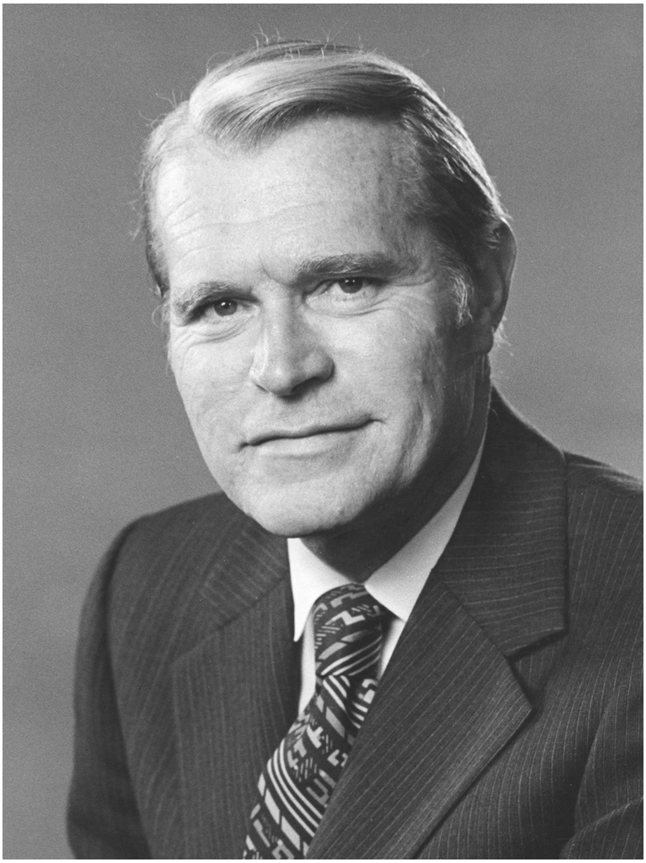
Reed had a wide range of knowledge and interests that spanned physics, electromagnetics, and aviation. As a mathematician, he realized that finite field theory had practical applications in what became known as algebraic error-correcting codes to preserve the integrity of both stored and transmitted digital information. (While others had only observed that the easiest algebraic codes had the structure of a commutative group, Reed observed that the codes he codeveloped with David E. Muller had the additional structure of a linear vector space, and that his subsequent Reed-Solomon codes had the further structure of linear algebra.) The codes he pioneered are now found almost everywhere—in CDs, DVDs, disk drives, PDAs, cell phones, iPhones, space communications, wired and wireless communications, and the computer networks that make up the Internet. It is fair to say that none of these would work without error-correcting codes.

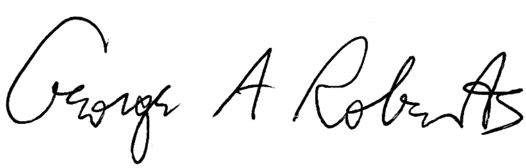
His many honors and awards include the following. He was elected a fellow of the Institute of Electrical and Electronics Engineers (IEEE; 1973) and a member of the NAE (1979). He received the Claude E. Shannon Award (1982) of the IEEE Information Theory Society (including delivery of the Shannon Lecture at the Society's 1982 meeting in Les Arcs, France); the IEEE Richard W. Hamming Medal (1989) "For contributions to multiple error-correcting codes, digital computer design, and automatic detection and processing of signals in noise"; the Charles Babbage Award of the Orange County Chapter of the IEEE Computer Society (1989) "for outstanding contributions to the evolution of computer technology and coding theory"; the Masaru Ibuka Consumer Electronics Award (1995), jointly with Gustave Solomon, for invention of the Reed-Solomon codes; and the IEEE Warren D. White Award for Excellence in Radar Engineering (2001). He was awarded honorary doctor of science degrees in 1998 from the Universities of Alaska and Colorado, and Caltech's Distinguished Alumnus Award (1992). He also received numerous research awards from USC, JPL, and NASA.

Reed was a listed inventor on a dozen US patents, author or coauthor of 12 books or book chapters, and author or coauthor of more than 200 papers in technical journals, spanning the 60-year period of 1944–2004.

Irving Reed died on September 11, 2012, two months shy of his 89th birthday, in Santa Monica, where he had lived since 1960. The technology he developed has brought important and lasting benefits to society, and he will long be remembered as one of the exceptional innovators of the twentieth century.

He is survived by his wife Bernice, two sons, ten grandchildren, and four great-grandchildren.




George A Roberts

GEORGE A. ROBERTS

1919–2013

Elected in 1978

"For technological advances, managerial leadership, and continuing role in professional activities."

BY ROBERT MEHRABIAN

GEORGE A. ROBERTS, 93, who was a pioneer in the field of steel manufacturing and helped turn the Southern California–based Teledyne Corp. into a Fortune 500 firm, died on February 15, 2013, of heart failure at a Dallas hospital.

George was born on February 18, 1919, in Point Marion, Pennsylvania. After high school, he enrolled in the US Naval Academy, where he met Henry Earl Singleton. Two years later he transferred to what is now Carnegie Mellon University and earned a bachelor's degree in engineering and, in 1942, a doctorate in metallurgy. While at Carnegie Mellon he worked at Bell Laboratories and learned about vacuum melting processes, which he later applied to the production of high-strength/high-temperature commercial alloys.

From 1941 to 1966 he worked at Vanadium Alloys Steel Company, also known as Vasco, where he advanced from research metallurgist to president in 1961 and chairman of the board of directors in 1964. During this period he published a number of papers and books on tool steels and was awarded several patents on alloy steels. He served the technical community in leadership roles—as president of the American Society for Metals (ASM), twice as president of Metal Powders Industries Foundation—made significant financial contributions to the ASM Materials Education Foundation, and served as its president and subsequently as a trustee. At the time of his death, the Education Foundation was on the threshold of reaching a total of 100 scholarships funded by Dr. Roberts.

He was awarded many honors in his illustrious career, including recognition as a fellow of the ASM, receipt of the ASM Gold Medal, designation as a fellow of the Metallurgical Society, and selection as the Howe Memorial Lecturer. He was elected to the National Academy of Engineering in 1978. He was also elected a trustee of Carnegie Mellon University while at Vasco and continued as a life trustee and then emeritus trustee.

I was privileged to know Dr. Roberts first at ASM, then through the years as a member of the National Academy of Engineering, while I was president of Carnegie Mellon University in the 1990s, and subsequently as a fellow board member and colleague at Allegheny Teledyne. We remained in close contact in the past 13 years as I have been fortunate to continue the Teledyne legacy at Teledyne Technologies.

At Carnegie Mellon we constructed the George A. Roberts Engineering Hall in the early 1990s, made possible through his very generous donation. I will always remember his quotes from the Bible, Andrew Carnegie, Blake, and Polybus at the dedication ceremony of his building. He mused about "surplus" and "enough wealth" and ended the day saying that at least he had avoided Carnegie's famous quote, "He who dies rich, dies disgraced."

Dr. Roberts' corporate career success mirrored his professional and philanthropic life. While at Vasco, he introduced Vasco Supreme, the first super-hard, high-speed steel that revolutionized many metalworking processes. Later, Vasco became the producer of 18 percent nickel maraging steels, which were used in high-strength/high-temperature applications. A number of years later I used liquid metal atomizing processes to study the microstructure of these alloys.

During the 1960s, as was happening at Teledyne (founded by Dr. Singleton in 1960), Dr. Roberts was growing Vasco through a series of acquisitions that included Allvac Metals Corporation, which specialized in vacuum melted alloys. He had already introduced vacuum melting at Vasco and through this acquisition the company became a major producer of high-purity vacuum melted cobalt, iron, nickel, and titanium-based alloys—vital in many aeronautical, space, and industrial applications. By 1965, the company had over $40 million in sales and was listed on the New York Stock Exchange.

George had maintained a relationship with his close friend Henry Singleton since their days in the Navy and for some time they had been talking about the possibility of combining Vasco metals with Teledyne. In 1966 they agreed to a merger. Dr. Roberts assumed responsibility for all operations of the company in 1966 while Dr. Singleton focused on capital allocation, including diversification into insurance companies, significant investments in a few public companies, and pioneering stock buybacks through major tender offers to Teledyne's shareholders. The new company ended the year with $257 million in sales. At the same time the pace of acquisitions picked up and by 1970 Teledyne had over $1.2 billion in sales. By the end of the major acquisition programs it was a corporation of some 130 companies, ranging from digital communication, complex metallic alloys, and consumer products to Teledyne Ryan Aeronautical, which produced the most advanced unmanned air vehicles (including the Global Hawk). By 1981 sales exceeded $3 billion and Teledyne continued its growth primarily through internal investments until its merger with Allegheny Ludlum Corporation in 1996. A detailed history of this amazing company, its merger to form Allegheny Teledyne, and subsequent breakup into three publicly traded companies (Teledyne Technologies, Allegheny Technologies, and Water Pik Technologies in 1999) is detailed in Dr. Roberts' 2007 book *Distant Force.*

George was closely involved with the many acquisitions that Teledyne made in the early years and able to convince founders of companies that their legacy would be in good hands at Teledyne. A testament to his personable style and leadership is that most of the company founders stayed with

Teledyne after the acquisition, often until they retired. I believe it is also important to recall his contributions to Teledyne through the eyes of his managers and colleagues, with whom I have consulted. He was gracious both with customers and with Teledyne's employees. His personal warmth was evident and he always showed a genuine interest in the people he met.

George's memory was legendary throughout Teledyne. At meetings or when visiting the operating companies, he would walk up to individuals, greet them by name, and remind them of prior interactions, even if they occurred many years earlier. It was not unusual for him to have a much better recollection of events associated with a business than the local managers themselves. He augmented his exceptional memory with his small notebooks, which were also legendary; he took careful notes and could refer to them to refresh his memory many years later.

George was a great believer in the value of applying advanced research to Teledyne's products. In 1975 he introduced the Teledyne Research Assistance Program to promote cooperative research between individual Teledyne companies and institutions of higher education. The companies were encouraged to propose research projects on subjects of interest to them, to be carried out in cooperation with selected universities. If approved, these projects were funded by the corporate office. Under this program, 320 projects were carried out, with participation by 80 Teledyne companies and 112 US universities. Today, Teledyne Technologies maintains this legacy through cooperative research programs with many universities.

George was always focused on planning for the future, but he was equally interested in incorporating lessons from the past. This was exemplified in a talk he gave to the managers of a Teledyne company that had just completed a record year with operating income among the highest in the corporation. He spent about five minutes congratulating the team on their achievements, and devoted the rest of the talk to the subject of change. He noted that market conditions are beyond our control, but good leaders can plan for contingencies and must react quickly when changes occur. His remarks proved to be prophetic. The Teledyne Company where he spoke primarily served the defense industry, and the talk was given a few years before the end of the Cold War, which ushered in an era of significantly reduced defense spending.

Finally, as George noted at the dedication of the George A. Roberts Hall at Carnegie Mellon University in 1995, he spent 53 years at essentially one company (26 years at Vasco and 27 at Teledyne). He quoted Mark Twain as his teacher when he said "Put all your eggs in one basket—and watch that basket!" We are all grateful that he watched the basket called Teledyne with such care, foresight, and integrity.

I will conclude on a personal note. I wrote to the board of directors of Teledyne Technologies about George's passing and Frank Cahouet, who has served on the board for several decades, responded with three simple yet elegant words: "A wonderful man." It is my honor to write about my dear friend, fellow metallurgist, and colleague, Dr. George A. Roberts, as we memorialize his many contributions as a scientist / engineer, business executive, societal leader, and major supporter of science and engineering education. He was truly *a wonderful man*.

George is survived by his wife Ellen, children, and grandchildren.

WARREN M. ROHSENOW

1921–2011

Elected in 1975

"For contributions to boiling and condensing liquid-heat transfer and the teaching of the concepts of heat and mass transfer."

BY ARTHUR E. BERGLES

WARREN MAX ROHSENOW, an outstanding engineering educator and heat transfer researcher, professor emeritus of mechanical engineering at the Massachusetts Institute of Technology (MIT), died on June 3, 2011, not long after celebrating his 90th birthday.

Warren, or "Rosie" as he was often called, was born in Chicago on February 12, 1921, but lived in Fort Worth and Kansas City before moving back to Chicago and entering college. Attending various schools, he became an accomplished musician—particularly on drums and piano—and participated in many dance bands and orchestras. While he was heavily involved with accelerated academics, music, clubs, and sports, he still found time to earn his Eagle Scout badge before he graduated from high school at age 16.

He attended Northwestern University and received a BS in mechanical engineering in 1941. Of course, he continued to make music with the orchestra and marching band, filling in with anything that was needed, as well as many professional gigs. Continuing in mechanical engineering at Yale University, he earned a master's in 1943 and rapidly completed the requirements for the D.Eng., which was awarded in 1944.

He was an instructor during his graduate program, teaching mechanics, thermodynamics, and heat power engineering.

After graduating from Yale he received a commission in the US Navy, serving with the gas turbine division of the Naval Engineering Experiment Station to develop temperature instrumentation for a domestically produced gas turbine considered for ship propulsion. He wrote one of his early papers on thermocouple error when measuring hot gas temperatures. A number of other engineering problems related to the war effort occupied his attention during his two-year active service.

In 1946 he joined the MIT faculty, working in the Heat Measurements Laboratory, teaching undergraduate thermodynamics and heat transfer, and developing the first graduate courses in heat transfer at the institute. He published papers on improving gas turbine regenerators and began an extensive research effort on boiling heat transfer initially sponsored by the Office of Naval Research. The latter work focused on forced convection subcooled boiling, covering the entire range of heat fluxes, including burnout. This program led to the installation of two 36 kW motor generators for direct-resistance heating of the test tubes. To avoid physical destruction of the tubes, a dynamite-cap switch was developed to interrupt the current as the tube temperature rapidly increased at the initiation of burnout. The dynamite switch was lost to the mists of time, but the motor generators were used by many students for the next 60 years. A laboratory report series was initiated in 1950 to facilitate rapid dissemination of research results, and a steady stream of papers appeared in conference proceedings and in research journals. He was coauthor of the first report (1950) and the last, number 106 (1990).

Warren Rohsenow's most important paper started out in report form in 1951: "A Method of Correlating Heat Transfer Data for Surface Boiling of Liquids." The proposed method was simple but effective: The boiling curve for forced convection subcooled (surface) boiling was considered a superposition of single-phase forced convection and nucleate pool boiling.

The pool boiling component obtained by subtraction was then correlated by dimensionless groups. The exponent of each group was found to be approximately the same for many liquids, leaving only to be determined the lead constant, Csf, which depends on surface and fluid. In the past 50 years, many researchers have used this general approach. Testifying to the staying power of this approach, the paper earned him the ASME Classic Paper Award in 2002; he coauthored two related papers in 2004.

The laboratory was renamed the Heat Transfer Laboratory in 1956, with Professor Rohsenow as director. A wide variety of studies of very complex phenomena was undertaken: boiling and condensing of liquid metals, forced convection film boiling, thermal contact resistance, condensation of refrigerants, improvement of cooling towers, enhancement of heat transfer, and heat transfer in underground electrical cables. He was an author on more than 100 journal papers as well as several hundred conference papers, book chapters, and technical reports.

For many years, he headed the Thermal Science Division of the MIT Department of Mechanical Engineering. He was largely responsible for developing the graduate program in heat transfer, which was highlighted by his courses in conduction and convection heat transfer. He also had a much broader responsibility, serving as graduate officer of the department for nearly 30 years.

His research and teaching experience led to the 1961 textbook *Heat, Mass, and Momentum Transfer*, coauthored with H.Y. Choi. One of the first undergraduate heat transfer textbooks written, the book was used for many years in undergraduate and intermediate heat transfer courses at MIT. He was also senior editor and contributor to the definitive *Handbook of Heat Transfer* (1973), its two-volume successor, *Handbook of Heat Transfer Fundamentals* and *Handbook of Heat Transfer Applications* (1985), and the 3rd edition of the *Handbook of Heat Transfer* (1998). The typical handbook chapter summarized the fundamentals and gave a comprehensive list of formulas that could be used to estimate heat transfer coefficients. In 1960 he organized a two-week intensive summer course, Developments in Heat Transfer, that was offered for the next 16 years.

Professor Rohsenow's research primarily involved graduate students working toward their degrees, and he supervised more than 150 graduate theses in mechanical engineering, nuclear engineering, and ocean engineering. He was doctoral supervisor of more than 40 students, half of whom assumed professorships at leading universities,

A member of ASME since 1943, he chaired the Boston section (1955–1956) and the Heat Transfer Division (1961–1962). He was an early proponent of the International Heat Transfer Conferences, now held every four years. He was a founder and president of the International Center for Heat and Mass Transfer. He was a founding member of the editorial advisory board of the *International Journal of Heat and Mass Transfer* and served on the advisory boards of several other journals. He was a member of delegations establishing cooperative programs with other countries, notably the US-USSR Cooperative Agreement in Heat and Mass Transfer (1979).

Besides being an outstanding leader in heat transfer and thermal power research and education, he had deep insight into engineering challenges and technology development. He consulted for many major corporations, including courtroom appearances. In 1957, he cofounded Dynatech Corporation (initially Microtech Research) in Cambridge, Massachusetts, and served as chairman of its board of directors. The consulting and manufacturing company grew to 3,000 employees worldwide and was listed on the New York Stock Exchange before it was sold in 1997.

Warren Rohsenow's accomplishments were recognized with major professional society awards: the Pi Tau Sigma Gold Medal (1951), ASME Henry Hess Award in 1952, election to the American Academy of Arts and Sciences (1956), ASME Heat Transfer Memorial Award (1967), ASME Life Fellow (1969), AIChE and ASME Max Jakob Memorial Award (1970), NAE election (1975), ASME Centennial Medallion (1980), ASME Honorary Member (1988), and ASME Medal (2001). In 1997 the ASME Gas Turbine Committee of the Heat Transfer

Division awarded the first Warren M. Rohsenow Prize for the best conference presentation. In 2004 the first ASME Bergles-Rohsenow Young Investigator in Heat Transfer was recognized.

With all of this professional activity, it is a wonder that Rosie had time for other pursuits. But he surely did. On the piano, he led an ensemble that provided background music at many MIT functions. He enjoyed golf, tennis, skiing, and traveling. It could be said that his passion was getting to know people, and he made it a point to know professional and personal acquaintances as individuals. He and his wife, Towneley, gave impromptu concerts (she singing and he on piano) at professional meetings all over the world.

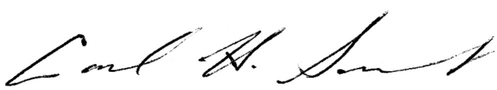
He was married to Towneley for 55 years until she passed away in 2001. They had moved from their suburban Boston home in Waban to Falmouth, Maine, in 1991. Rosie became increasingly disabled over the last 20 years of his life, but he adapted to his condition, with the major concessions being that he gave up sports, restricted traveling, and switched from the piano to the xylophone. He kept up a spirited correspondence with the aid of voice activation of his computer.

Warren Rohsenow is survived by five children and their spouses, four grandchildren, and five great-grandchildren. He was devoted to his family, always finding time to spend with family members. The Rohsenow household was cheerful and loving, invariably filled with music.

He retired from MIT in 1985 but his spirit lives on there. The laboratory was renamed in his honor in 1992: the Rohsenow Heat and Mass Transfer Laboratory. After an extensive renovation, it was again renamed in 2010, the Rohsenow Kendall Heat Transfer Laboratory.

In many respects, Warren Rohsenow's passing signals the end of an era. He helped create a golden age of research in heat transfer. The field was undeveloped in 1946 and much work needed to be done to design heat transfer equipment. He made the most of the opportunity during the next 50 years. Simplified models of heat transfer phenomena based on classical analysis are now no longer fashionable. Instead, computational fluid dynamics (CFD) codes have become the standard tool of research and industrial design.

With the passage of time, many pertinent studies performed decades ago are now sent into oblivion, removed from the reference lists of recent papers and textbooks. It can be asserted, however, that Warren Rohsenow's contributions to heat transfer will endure. Furthermore, his contributions as a person will continue to inspire students and researchers alike.



CARL H. SAVIT

1922–1996

Elected in 1995

"For advancing technology of geophysical exploration and providing leadership within the larger social and environmental context."

BY NORMAN NEIDELL
SUBMITTED BY THE NAE HOME SECRETARY

CARL H. SAVIT, an exemplary geophysicist, passed away on March 21, 1996, after a valiant battle with colon cancer. His lucid presentations during his career made him both known and respected throughout the geophysical world. He was such a visible and able spokesman for the profession and the industry that his technical and other accomplishments may not get their due.

His career progressed with purpose and direction. He was assistant for earth, sea, and air sciences to the president's science advisor as well as a scientist who authored 40 US patents, with corresponding patents in other countries. One of his patents describes the Society of Exploration Geophysicists' (SEG) standard "A" format, which is now so familiar that few recollect how it evolved. He also convinced the US government to adopt a position with regard to offshore seismic survey data that both ensured US rights of access (necessary for conducting lease sales and resource evaluations) and saved taxpayers hundreds of millions of dollars by eliminating the need for immense data storage. He was among the first to recognize the role of color displays and attributes computed from basic seismic data for interpretive purposes. His update of Dobrin's classic textbook *Introduction to Geophysical Prospecting* (1988) was a landmark in documenting and communicating the technology of his profession.

Carl was born in 1922 in New York and spent seven years of his childhood in Medellín, Colombia. Clearly a mathematical prodigy, he received his BS degree from the California Institute of Technology in 1942 (at age 20) and his MS degree, both in mathematics, a year later. While a graduate student, he worked briefly with the Army Air Corps in meteorology and later as an officer (second lieutenant) on upper atmospheric physics.

He married Sandra Kaplan in 1946, his lifelong sweetheart. In later years she served as his honorary executive assistant. In 1948 he joined Western Geophysical Co. of America, where he advanced from chief mathematician to senior vice president, technology. Thanks to his contributions and leadership Western always stood in the front ranks of geophysical technology.

Carl's insights were a remarkable guide to the future—he demonstrated an intuition that led him to focus on technology that was always ahead of the industry. For example, during the early 1950s he recognized a need to determine interval velocities from seismic data in a routine way and developed a method that could accommodate variable survey configurations. A specially prepared slide rule also treated computations for curved seismic reflection ray paths. Shortly thereafter he developed the first method of joint use of seismic reflection and refraction information, including a way to determine the normal depth to a refractor from unreversed profiles. Works of this type become an area for research and development many years later. Four or five of his patents during this period dealt with the first, and for many years only, practical method of accurately handling 24-fold common depth point (CDP) data from analog tapes.

Toward the end of the 1950s Carl was concerned with the role of seismic amplitudes and "bright spots" while most of the rest of the industry sought to obliterate such information in the name of improving reflector homogeneity and continuity. His papers in *Geophysics* and the *Oil and Gas Journal* document his foresight, which again is now second nature to us all. In 1960 he was named a Classic Author of *Geophysics.*

During the 1960s Carl's projects included the first use of multitrace reflection and refraction shooting (including CDP work) in the deep ocean as well as participation in the design and development of the first digital array processor by IBM. He then turned his attention to systems with large numbers of recorded channels and color displays of seismic data.

Carl recognized the talents of others and moved them along rapidly to benefit both their careers and the organization. Many prominent geophysicists owe him much for their success. Litton Industries (then parent company of Western) awarded him its Advanced Technology Achievement Award for precisely these reasons and in recognition of his scientific acumen.

He was always very active in industry and geophysical society affairs. He served as president of SEG and the International Association of Geophysical Contractors (IAGC), editor of *Geophysics* (the principal technical journal of SEG), general chairman of the SEG annual meeting held in Mexico City (no small logistical feat), and (starting in the 1960s) was a prominent spokesman for the industry in legal and governmental matters. He took a leave of absence from Western in 1970 and spent 14 months in Washington working on behalf of the industry. He received SEG's Kauffman Gold Medal in 1979 for his role as an "industry spokesman" and in 1980 was designated a SEG honorary member. He also served as President of the National Ocean Industries Association.

As a spokesman and representative of Western, SEG, the IAGC, and other activities, Carl was both charming and effective. He spoke a few words of many languages (including Russian) and was not shy about using this talent. He was a man of exquisite taste and well known in many of the finer restaurants. His personality and keen sense of humor made him a valued friend and confidante to many at all levels of any organization.

Carl is survived by his wife Sandra, son Mark, daughters Debby and Judi, eight grandchildren, four great-grandchildren, and a grateful profession. He was a great husband, father, grandfather, diplomat, patriot, scholar, scientist, teacher, innovator, and pioneer. Those who worked with him and all who knew him were privileged indeed.

A. RICHARD SEEBASS

1936–2000

Elected in 1985

"For fundamental contributions in aerodynamic theory related to development of computational fluid mechanics and for service in engineering education."

BY GEORGE H. BORN

A. RICHARD SEEBASS was one of the country's most respected engineering deans and probably the most energetic. He was born on March 27, 1936, in Denver, Colorado, the son of Alfred Richard Seebass Jr. and Marie Wright Seebass, and died in Boulder of pneumonia on November 14, 2000, at the age of 64.

After graduating from Smiley Middle School and East High School in Denver, Dick attended Princeton University, where he graduated magna cum laude in engineering in 1958 and then earned an MS degree in aeronautical engineering. He married Nancy Palm of Denver on June 19, 1958, and continued his studies as a Woodrow Wilson fellow at Cornell University, completing his PhD in aerospace engineering in 1962, when he joined Cornell's faculty as an assistant professor. By 1972 he was associate dean of Cornell's College of Engineering. In 1975 he joined the University of Arizona as a professor of aerospace and mechanical engineering and of mathematics, where he coestablished the mathematics program.

In August 1981, he became dean of the College of Engineering and Applied Science and professor of aerospace engineering sciences at the University of Colorado Boulder. He championed a formal development plan for the college and led a successful

Centennial Campaign that resulted in contributions of $52.2 million. Under his leadership, private gifts were committed to build the Gemmill Engineering Library, launch the Herbst Program of Humanities for Engineers, create the Lockheed Martin Engineering Management Program, and triple the college's scholarships. During his 13 years of stewardship, the college founded several research centers and increased research revenues from $3 million in 1981 to $36 million in 1994. The research centers include one of 18 National Science Foundation Research Centers, one of eight NASA Space Engineering Research Centers, and one of seven awards for Grand Challenge Applications. Furthermore, he expanded the faculty from 95 to 156, bringing in many new faculty of national distinction. His administration's strategic plan set ambitious goals for increasing underrepresented minority and women students and faculty in engineering, resulting in a doubling of their numbers during his tenure. In recognition of Dick's vision for undergraduate educational reform, the college's innovative Integrated Teaching and Learning Laboratory was dedicated to him when it opened in April 1997.

Professor Seebass also chaired the Department of Aerospace Engineering from August 1995 through May 1999, leading a complete reform of the undergraduate curriculum. The department graduated its first class with the new interdisciplinary, hands-on curriculum in May 2000. Many of his students have gone on to become outstanding engineers and researchers.

Dick Seebass was a nationally and internationally renowned aerodynamicist. He made important and extensive contributions to the analysis of unsteady, transonic flows and of shock-free, three-dimensional, supercritical flows. In addition, he advanced understanding of ways to minimize the effects of a sonic boom and helped to develop computational fluid mechanics and aerodynamics as a practical tool for designers and engineers.

His research earned him professional recognition and many prestigious awards. He was elected to the National Academy of Engineering in 1985 for his fundamental contributions in aerodynamic theory related to the development of computational fluid mechanics and for service in engineering education. In addition, he was awarded the Max Planck Research Prize (shared with Helmut Sobieczky, 1991), the American Institute of Aeronautics and Astronautics' William F. Durand Medal and Lectureship (1994), and the International Astronautics Federation's Frank J. Malina Medal (1994) for contributions to space education. He received the CU Boulder College of Engineering's Centennial Medal in 1993 and the University Medal in 1994.

When Dick came to CU Boulder in 1981, it was a return to the Rocky Mountains that he loved. Home at last, he enjoyed many years of hiking and fly fishing with family and friends near their cabin in Estes Park. During their last two years, he and Nancy traveled extensively around the world.

Dick is survived by sons Erik Seebass of San Francisco and Scott Seebass of Berkeley; sister Linda Johnson of Land O' Lakes, Wisconsin; and three grandsons. Nancy, his life partner, soul mate, and wife of 42 years, died on November 27, 2000.

Dick's unselfish pursuit of excellence, his commitment to preparing the engineers of the future, and his friendship with the many people whose lives he touched will be missed.

MICHAEL R. SFAT

1921–2012

Elected in 1994

"For initial studies on aeration in fermenters, novel developments in food biotechnology, and sustained industrial entrepreneurship."

BY MICHAEL SHULER

MICHAEL R. SFAT, a pioneer in biotechnology and bioprocess/biochemical engineering and former president of Bio-Technical Resources in Monitowoc, Wisconsin, died on October 16, 2012, at the age of 90.

Mike was born in Timisoara, Romania, on October 28, 1921, as Mircea Radu Sfat. He arrived in New York City on March 28, 1924, with his mother Emilia; his father Peter had preceded them. Because of a mix-up in paperwork Mike and his mother had to leave, go to Canada, and then reenter the United States in September 1924. Because his legal entry was after July 1, 1924, he was not eligible for US citizenship and during the first part of World War II was classified as an enemy alien. He became a naturalized citizen in 1944 while serving in the US Army.

Mike entered Cornell in September 1938 at the age of 16 with a full scholarship to study metallurgical engineering in the School of Chemical Engineering (a five-year program). The curriculum was tough and the department director, Fred (Dusty) Rhodes, was somewhat dictatorial. Survival in the program was difficult and only about a third of entering students graduated in the program. Mike reported almost quitting to transfer to the University of Michigan, but decided to stay at Cornell. One benefit of Rhodes' direction was his foresight of the potential role of chemical engineers in food and biological processing. He allowed a few selected students to take courses and projects in food science (which at the time included a microbiology laboratory). Mike was one of these students and did his senior project on the design of food freezers.

Because of his enemy alien status Mike could not secure a job in the chemical industry after graduation, so he began his career as a research associate in Cornell's School of Nutrition. In that position he provided analytical support on projects involving freezing and dehydration of food for military use.

He entered the US Army on August 3, 1944, as a second lieutenant in the Corps of Engineers and later served as a special agent in the Counter-Intelligence Corps in occupied Germany. He became a naturalized US citizen and changed his name to Michael Rudolph Sfat. He was discharged in September 1946 and returned to Cornell, where he received his master's degree in chemical engineering the following year.

In 1947 he joined Merck as junior microbiologist in Rahway, New Jersey, where he worked with Bill Bartholomew, an influential chemical engineer, and Ed Karow, a microbiologist (Karow had worked with Selman Waksman at Rutgers who received the Nobel Prize for his role in the discovery of streptomycin). Antibiotic fermentations were exciting new technology, but batch-to-batch variability was problematic. Mike and Drs. Bartholomew and Karow began working with Richard Wilhelm, head of chemical engineering at Princeton, to define the physical characteristics essential to establish routine, successful factory fermentations. Mike made key contributions to enable the accurate scale-up from 5L laboratory fermenters to predict the performance of commercial-scale fermentations. This was his most critical contribution to engineering as it solved a difficult challenge in antibiotic fermentation.

Mike began his PhD studies with Wilhelm at Princeton in 1949 but had to abandon them in 1951 when he was transferred to Merck's Danville, Pennsylvania, facility. Nonetheless, while working with Wilhelm he coauthored two very influential papers on oxygen transfer and agitation in fermentations ("Oxygen transfer and agitation in submerged fermentations: Mass transfer of oxygen in submerged fermentation of *Streptomyces griseus*" and "Oxygen transfer and agitation in submerged fermentations: Effect of air flow and agitation rates upon fermentation of *Penicillium chrysogenum* and *Streptomyces griseus*," both published in 1950 in *Industrial and Engineering Chemistry*, vol. 42). These articles addressed major problems in achieving effective, reproducible fermentations and are classical papers in the field.

In 1952 Mike left Merck for Pabst Brewing Co., where, as director of the company's development pilot plant, he became involved in improving the brewing process and initiated work in what is now known as biotechnology. In 1954 he moved to the Rahr Malting Company in Nanitowoc, WI, and rose to vice president for research and development, a position he held from 1960 to 1969. In 1966 he received the Schwartz Prize for Brewing Technology for his innovations in the malting process.

In 1962 he was asked to be president of a spin-off, Rahr Bio-Technical Laboratories (RBTL). While initially focusing on the brewing industry, this new venture expanded its interests to a broad range of activities that constituted what became known as "biotechnology" (the term did not come into common use for another 20 years).

In 1969 RBTL was reorganized as Bio-Technical Resources (BTR) and Mike resigned as vice president at Rahr to become president at BTR. Processes pioneered by BTR under Mike's leadership include the development of a single-cell fermentation process to convert glucose to sucrose and the manufacture of various enzymes, particularly alkaline protease, which is now used in most detergents. In many ways, BTR was ahead of its time in pioneering biotechnological processes.

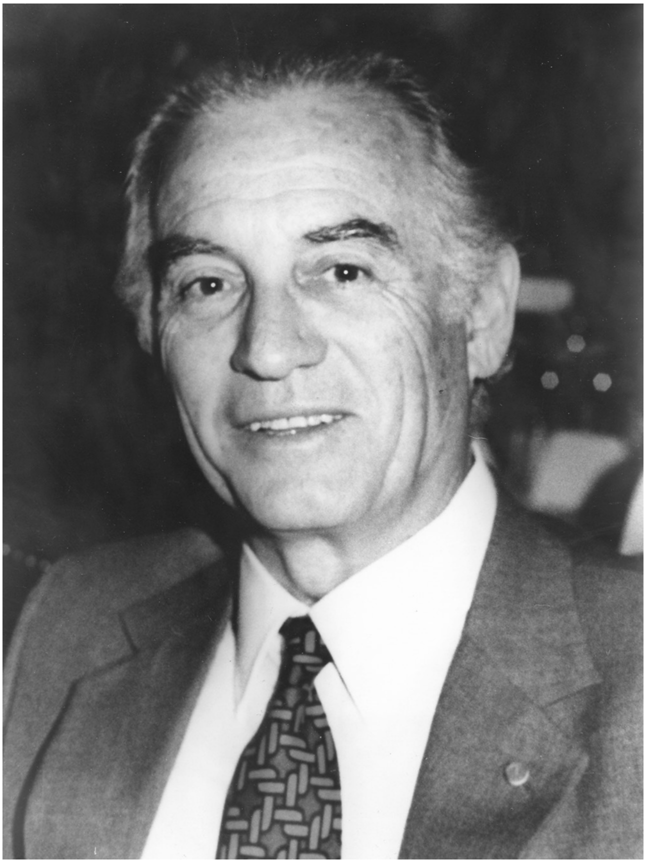
Mike retired as president in 1989 but continued to provide his wisdom and experience as president emeritus until 1996. He received the Distinguished Service Award from the College of Engineering at the University of Wisconsin in 1993.

His daughter Gail Ziemer wrote:

My father was an avid golfer, tennis player, jogger, downhill skier, and wind surfer and loved his life. He said many times that he felt so lucky as all of his goals for life had been met. He was truly self actualized. It may have sounded arrogant, but really it is very admirable as we all strive for that don't we? His passion was his career and that was his life. I know very few people who have such a passion for anything let alone [their] career. He made many contributions to his beloved Cornell as he felt the education attained was what lifted him to the heights his career took him. We buried him with his class jacket from Cornell and put a book of Cornell songs in the coffin with him.

Another passion was he incubated and developed barns. My daughter, nieces, and sister remember the seemingly endless trips in Wisconsin looking for a barn for him to buy! He finally found one near Manitowoc, bought it, and restored it together with the house and several other buildings. He then scouted for another building to bring on to the property. He added an event building that was used by a self-sustaining community education organization to which he donated the property. A room in the farm house is dedicated to my father in which hangs a bronze relief him.

Mike is survived by daughters Gail and Mary Anne Bauer and grandchildren Elizabeth Sergent (Gail's daughter) and Carolyn and Emma Bauer. His first wife, Jane, passed away in 1997.



JOSEF SINGER

1923–2009

Elected in 1981

"For contributions to knowledge of stability of reinforced thin-walled structures, international cooperation in mechanics, and design of Israeli aircraft."

BY DANIEL WEIHS

JOSEF SINGER, former president of the Technion–Israel Institute of Technology and founding faculty member and former dean of the university's Faculty of Aerospace Engineering, died on November 12, 2009, in Israel.

Josi, as everyone called him, was born in Vienna on August 24, 1923, the second of two sons (his older brother Michael was a well-known painter), to Zvi and Erna (née Isler) Singer, who had a jewelry business. The family moved to Berlin in 1929 and left in 1933, as the Nazi regime started its anti-Semitic actions, for what was then Palestine, settling in Haifa. Young Josi showed an early interest in aeronautics, joining the AeroClub where he became an instructor in 1940 and, upon reaching the minimal required age in 1941, received one of the first pilot's licenses in Palestine. He then volunteered to serve in the British war effort, as a cadet pilot and mechanic in the Royal Air Force. After the war, he joined the air branch of the Jewish underground defense forces, Hagana (which later became the Israeli Defense Forces).

He studied aeronautical engineering at the Imperial College London, earning his (first-class) BSc and DIC in 1948 and then, after several years as a technical officer in the Israeli Air Force (which he left with the rank of major), got his MSc in 1953 and PhD in 1957 from the Polytechnic Institute of Brooklyn (now the Polytechnic Institute of New York University, or NYU-Poly), under the supervision of Nicholas Hoff.

Josi was a founder of the Department of Aeronautical Engineering at the Technion, promoted to associate professor in 1961 and full professor in 1965. He was one of the designers of the unique "level engineer" concept, in which undergraduates got basic and advanced courses in a wide range of disciplines, as—this being (then and still) the only school of aeronautical engineering in Israel—its graduates had to be able to work in all disciplines. This unique approach, which was hard on the students, proved its value as the graduates from this department went on to found the highly successful Israeli aerospace industry, which is one of the top employment and export sectors of Israel. He served as dean of the Department of Aeronautical Engineering twice (1958–1960 and 1965–1967), including during the Six-Day War, in which air superiority was instrumental in bringing about rapid victory. This superiority was supported by engineers led by Josi, who had to improvise under the French embargo on aircraft and spare parts. He was subsequently elected president of the Technion and navigated the university through tough times from 1982 to 1986, in which the Israeli economy suffered triple-digit inflation.

Dr. Singer was a world-renowned expert on the design and applications of thin-walled structures, specializing in the phenomenon of buckling, in which a thin-walled plate or shell (such as an aircraft fuselage) suddenly collapses under compression. He authored over 100 research papers and was the lead author of the authoritative book *Buckling Experiments,* which appeared in two volumes, the first in 1987 and the second after his retirement, in 2000. Many of his graduate students became senior professors and engineers, in Israel and the United States.

As part of the post–Six-Day War push toward technological independence, Josi was seconded to the rapidly developing Israel Aircraft Industries (IAI), where he served as senior vice president and managed the engineering division from 1971 to 1973. He was responsible for all developmental projects and managed more than 1,500 people, most of them engineers. He pioneered the development of avionics; the Kfir fighter and the Commodore executive jet were some of the major projects initiated in those years. He was also a member of the board of directors for several years and at one point pro tem chairman of the company, which experienced phenomenal growth on his watch. In 1986 he was appointed chairman of the IAI board of directors, a position he held until 1988.

Josi had an extremely high standing in the international aeronautical engineering community, as indicated by his election to the presidency of the International Council of Aeronautical Sciences. This was no mean feat, being an Israeli in an organization that was affected by the political situation in the Middle East. In addition, among numerous professional honors bestowed on him were election as a foreign associate of the US National Academy of Engineering, member of the International Academy of Astronautics, foreign member of the French Air and Space Academy, and fellow of the American Institute of Aeronautics and Astronautics (AIAA) and Israel Society of Aeronautics and Astronautics, of which he was a founding member and long-time president.

He was honored with the International Council of the Aeronautical Sciences (ICAS) Maurice Roy Medal (1990), the Ludwig Prandtl Ring (1994), and the Wilhelm Exner Austrian medal (1994). As an NYU-Poly graduate, he was awarded in 2005 the school's Sesquicentennial Medal for his work in aeronautics and his leadership as president of the Technion. He also received honorary doctorates from Aix-Marseille University and the University of Glasgow.

Josi was an extremely personable man, a true gentleman of the Austrian tradition. He had many friends among his scientific colleagues all over the world, and was an ardent promoter of younger scientists and engineers (present writer included), always with an objective and kind word of advice based on experience. He was a wonderful family man to his wife, children, and grandchildren. He is sorely missed by all.

Sigurd A. Sjoberg

SIGURD A. SJOBERG

1919–2000

Elected in 1974

"For contributions to the advancement of aeronautics and manned space-flight technology."

BY RICHARD H. TRULY

The president, aboard Air Force One en route to Honolulu to welcome back to earth the crew of Apollo 13, stopped in Houston for the Presidential Medal of Freedom ceremony. Astronauts Jim Lovell, Jack Swigert, and Fred Haise had just survived the harrowing explosion of an oxygen tank, crippling their spacecraft during the translunar phase of their lunar landing mission. Sig Sjoberg's mission operations team, working around the clock with the Apollo 13 crew, brought them home alive.

As the National Aeronautics and Space Administration (NASA) director of flight operations at the Manned Spacecraft Center in Houston, Sig accepted the Medal of Freedom from President Richard M. Nixon on April 18, 1970, on behalf of the entire Apollo 13 mission operations team. On the platform were the Apollo 13 flight directors Gerry Griffin, Gene Kranz, Glenn Lunney, and Milt Windler, plus NASA Administrator Tom Paine. In part, the medal citation read:

> We often speak of scientific "miracles"—forgetting that these are not miraculous happenings at all, but rather the product of hard work, long hours and disciplined intelligence. The men and women of the Apollo 13 mission operations team performed such a miracle, transforming potential tragedy into one of the most dramatic

> rescues of all time.… The skill, coordination, and performance under pressure of the mission operations team made it happen. Three brave astronauts are alive and on Earth because of their dedication and because at the critical moments the people of that team were wise enough and self-possessed enough to make the right decisions.

In accepting the award, Sig was customarily brief:

> Mr. President, all of us here at the Manned Spacecraft Center and indeed people throughout the country and world who had the opportunity to participate in Apollo 13 are extremely grateful for this award. Thank God for the return of the astronauts. Thank you.

Sigurd Arnold Sjoberg was born on September 2, 1919, in Minneapolis. His father and mother had immigrated from Sweden and were married in Minnesota; shortly after their arrival, his father, John Anderson, decided there were too many Andersons around and changed the family name to Sjoberg. The Sjobergs raised their three children, Ralph, Berneice, and Sig, as all knew him, during the Great Depression. Ralph followed in his father's footsteps to become a plumber; Berneice became an architect, moving later to California; and Sig entered the University of Minnesota to study aeronautical engineering. He was a senior there when the Japanese attacked Pearl Harbor.

Upon graduation in 1942 he moved to Virginia and joined the Langley Aeronautical Laboratory of the National Advisory Committee on Aeronautics (NACA), where he conducted research on advanced high-speed aircraft. His interests, particularly in the fields of aerodynamic stability and control and automatic stabilization, were put to very good use in the war years evaluating numerous military aircraft. His research and numerous technical reports earned him wide recognition as an expert in the field of aircraft handling qualities.

Sig met Elizabeth (Betty) Ludwig, who was born in New Jersey and also worked at Langley, and they were married on September 22, 1946, in Hampton, Virginia. Their best man was Jack Paulson, who also became a renowned engineer at

Langley. Sig and Betty had three sons: Eric S., born in 1948; Stephen L., 1950; and Robert J., 1954.

In the late 1940s Sig was temporarily assigned to the NACA High Speed Flight Station in Edwards, California, legendary home of the X-planes. His work on the X-1, X-1B, and X-2 led to his assignment as NACA project engineer on the Douglas D-558, after which he returned to Langley.

With his experience and renown, Sig was chosen to travel to France in the autumn of 1957 to evaluate several North Atlantic Treaty Organization European-built fighter aircraft. In October, as he was finishing up the evaluations, the Soviet Union stunned the world by launching the world's first satellite, Sputnik. The following year President Eisenhower signed the Space Act that created NASA and directed the new space agency to incorporate all the programs, facilities, and personnel of NACA. The Mercury Project was announced that same year.

At NASA Langley, the Space Task Group was formed to prepare for and operate Mercury and was headed up by Bob Gilruth, who had hired Sig into NACA in 1942 and was also an aeronautical engineer from the University of Minnesota. Gilruth brought Chris Kraft and Max Faget into the task group; later, all of them would be elected to the National Academy of Engineering.

In Gene Kranz' book *Failure Is Not an Option: Mission Control from Mercury to Apollo 13 and Beyond* (2009), he described his first meeting with Sig upon joining the Space Task Group in Langley:

> I was taken immediately by his friendliness and sincerity. Just talking to him brought a smile, but as I listened to him I saw a depth, a passion, that frequently broke the surface like a trout taking to a fly.

NASA announced the selection of America's seven Mercury astronauts in March of 1959. Sig became the operations coordinator of the flight operations division and assistant to the chief of flight operations, his NACA friend of many years, Chris Kraft. Sig took on the challenge of integrating telemetry data, launch support, spacecraft recovery, and range instrumentation between NASA and various aerospace contractors to create a support system for the project. He also worked on developing mission rules and procedures for each Mercury flight in the blockhouse control center at Cape Canaveral, where Kraft was NASA's first flight director. Sig and the Space Task Group team were inventing mission operations as they went, providing invaluable wisdom for what would come in the years ahead.

On May 25, 1961, President John F. Kennedy addressed a nationally televised joint session of Congress on "Urgent National Needs" in which he declared

> I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to Earth.

At the time of the speech, the Soviet Union had already flown Yuri Gagarin in earth orbit, while the fledgling NASA had struggled to keep up by launching Alan Shepard on his 15-minute suborbital flight. Sig later summed up the feelings of those in the Space Task Group about Kennedy's announcement in his NASA oral history: "We were floored."

Floored or not, the torrid pace picked up. Within the next two years, Mercury was a success and the newly built Manned Spacecraft Center (MSC) south of Houston replaced the Space Task Group. Sig moved to Houston, continuing as Kraft's assistant and as deputy of flight operations. Drawing on his experience with Mercury, he took over the technical and managerial leadership for the new Mission Control Center's conceptual design, development, and implementation. He also had a leading role in the formation of NASA's worldwide tracking, support, and recovery network, including the establishment of tracking stations and ships.

The two-man Gemini project followed Mercury and was a crucial stepping stone in the development of rendezvous and docking knowledge for the Apollo lunar landing effort to follow. Sig said in his NASA oral history that Apollo would not have been possible without the accomplishments of Gemini. He would never have said that Gemini's accomplishments would not have been possible without his contributions. But it's true.

After the triumphant Apollo 11 lunar landing mission by Neil Armstrong, Buzz Aldrin, and Mike Collins in July 1969, Chris Kraft moved up to become the MSC deputy director and Sig took over as director of flight operations. During Sig's tenure, NASA flew the Apollo 12, 13, and 14 missions to the Moon. When Bob Gilruth retired from NASA in 1972, Kraft became director of the newly named Lyndon B. Johnson Space Center (JSC), with Sig as deputy director, a position in which he served until his retirement from NASA in 1979.

Sig's years as JSC deputy director saw a succession of successful space missions, a transformation of NASA and JSC, plus the engineering and space operations planning for NASA's future. Apollo was completed with the 15, 16, and 17 lunar missions. The Skylab space station flew three long-duration missions of 28, 56, and 84 days, and the Apollo Soyuz Test Project, a docking mission with the Soviet Union, plowed new ground in international cooperation, accomplished in the very depths of the Cold War. Perhaps most importantly, Sig's long experience was invaluable in overseeing the engineering and planning preparation for the Space Shuttle, a program that was to span more than three decades of NASA spaceflight.

After his retirement from NASA, Sig spent several years leading the Houston office of the OAO Corporation.

In addition to the Presidential Medal of Freedom, Sig received the NASA Distinguished Service Medal (1971), three NASA Exceptional Service medals (1967, two in 1969), the American Astronautical Society's Space Flight and William Randolph Lovelace II Awards (1977 and 1978, respectively), and the VFW National Space Award (1978). He was elected to the National Academy of Engineering in 1974, and received an honorary doctor of science degree from DePauw University. He spent many years as the US delegate to the Fédération Aéronautique Internationale, which oversees international world records in aviation and spaceflight.

Sig Sjoberg, a revered aeronautical engineer, a pioneer in America's space program and former deputy director of the Johnson Space Center, died on March 26, 2000, in Clear Lake, Texas, at age 80.

Author's Note

In writing this tribute I relied on many sources, particularly from records of the NASA Johnson Space Center in Houston. A special thanks to Betty and Eric Sjoberg for their gracious help. Most of all, I depended on my memories of a great leader who it was my privilege to work for when he was deputy director of JSC. – Vice Admiral Richard H. Truly, US Navy (ret.)

Lawrence H Skromme

LAWRENCE H. SKROMME

1913–2012

Elected in 1978

"For expansion and application of agricultural engineering technology coordinated with human resources in reproductive service to humankind."

BY CHERLYN SKROMME GRANROSE, INGA SKROMME HILL,
AND KAREN SKROMME SEQUINO
SUBMITTED BY THE NAE HOME SECRETARY

LAWRENCE H. SKROMME, a 34-year member of the National Academy of Engineering, Section 12, died on December 3, 2012, at the age of 99. He pioneered the use of teams of design, production, and service engineers working with marketing specialists to create a unique and highly efficient engineering system that earned him recognition and praise throughout the industry.

He was born on August 26, 1913, in Roland, Iowa, to Austin G. and Ingeborg (Belle) Holmedal Skromme. He graduated from Kelley High School in 1931 with an agriculture scholarship for his work in Future Farmers of America and earned his degree in agricultural engineering, with honors, from Iowa State University in 1937. During his college years he worked daily on his parents' farm, riding to classes with a neighbor who was the vocational agriculture teacher.

After college he worked as design and test engineer at Goodyear Tire and Rubber Co. and assistant chief engineer at Harry Ferguson, Inc., where he designed tow motors for aircraft carriers during World War II and then plows and farm implements for Ford-Ferguson tractors.

Hired as Sperry New Holland's chief engineer in 1951, Mr. Skromme reorganized the engineering division, separating testing and design. Promoted to vice president of engineering in 1961, he oversaw global engineering for New Holland until his retirement in 1978.

He then became a consulting agricultural engineer for the US Agency for International Development and World Bank, supervising agricultural mechanization projects in developing nations. He also gave back to the community as one of the founders of the Lancaster Farm and Home Foundation, serving as both director and president, as an officer and director of the Lancaster County Agricultural Land Preservation Board, and as a member of the Pennsylvania Governor's Commission on Agriculture and Land Preservation.

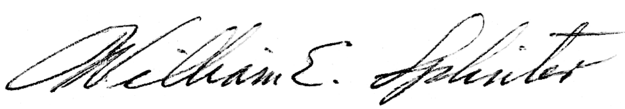
In addition to his NAE membership, Mr. Skromme was a registered professional engineer and active in many professional societies. He was president and fellow of the American Society of Agricultural Engineers (now the American Society of Agricultural and Biological Engineers) and received its John Deere Gold Medal in 1974. He was a member of the American Society for Engineering Education, International Association of Agricultural Engineers, National Society of Professional Engineers, Phi Kappa Phi, and Tau Beta Pi. He served on the advisory board of the US Congress Committee on Science and Technology, the research advisory committee of the US Department of Agriculture, and the Engineers Joint Council of New York City.

He was married to Margaret Gleason Skromme, a graduate of Iowa State in home economics, for 73 years, and they shared passions for birds, gardening, antiques, and family life. In addition to antique furniture and household goods, Mr. Skromme was interested in antique wrought iron, farm implement seats, and agricultural paper memorabilia. He donated the latter to Iowa State University, where it is freely available online (www.lib.iastate.edu/arch/rgrp/21-7-227.pdf).

He and his wife also traveled together to many countries as part of his interest in food production in developing nations. Several trips included visits to his family homestead in the Hardangerfjord region of Norway and he was proud to pass on customs of his Norwegian heritage to his family.

After his retirement he spent many happy hours fishing, playing baseball, and growing sweet corn with his grandchildren and great-grandchildren. Despite his basic attitude of humility rising from his Iowa roots, he never lost his competitive spirit at the family game table whether playing bridge or Spinner.

He is survived by his wife; daughters Cherlyn S. Granrose, PhD, Inga Baird Hill, PhD (Jerry), and Hon. Karen Nash Sequino (Anthony); grandchildren Jonathan Granrose, Karen Friend, Kristin Nicola, Beth Henderson, Caitlin Teague, Jay Nash, Wendy Moyal, and Lawrence Sequino; 14 great-grandchildren; and brother Robert Skromme. He was preceded in death by brothers Arnold and Austin Skromme, sisters Glendora, Judith Beaty, and Margaret Thompson, and granddaughter Kathleen Granrose Rodriguez Thorne.



WILLIAM E. SPLINTER

1925–2012

Elected in 1984

"For invention and development of safer aerial spray systems and improved harvesting systems which have promoted a better environment and stronger agriculture."

BY RON YODER
SUBMITTED BY THE NAE HOME SECRETARY

WILLIAM (Bill) ELDON SPLINTER, George Holmes Professor Emeritus of Biological Systems Engineering at the University of Nebraska-Lincoln, passed away on September 26, 2012, in Lincoln. Forward thinking, innovative, tenacious, and a strong and effective leader for melding biology and engineering, he was inducted into the NAE in 1984.

Bill was born on November 24, 1925, on his grandparents' ranch five miles northwest of North Platte, Nebraska. He was raised on an irrigated farm near North Platte, and his early life experiences shaped his thinking throughout his life and had a significant impact on his career as an engineer. "My life has been a series of fortunate events and this was the first," he wrote in a history of the Biological Systems Engineering Department (formerly the Agricultural Engineering Department) at the University of Nebraska. "The responsibility and skills I learned on the farm have been the foundation for my professional career."

Bill earned his bachelor's degree in agricultural engineering from the University of Nebraska in 1950 before matriculating at Michigan State College (now Michigan State University), where he earned an MS in 1951, followed by his PhD in 1955, both in agricultural engineering. During this period he also served in the US Navy reserve, as a yeoman at the end of

World War II and as a radar man on a destroyer during the Korean War.

His second fortunate event "followed a lengthy argument with my advisor in mechanical engineering over having to take a required course in economics. In desperation, I think, he asked me just what I wanted to do. With my farm background I thought designing tractors would be something I could do. He suggested I check with the Agricultural Engineering Department, which was a branch of engineering I had never heard of, but I talked to Professor E.E. Brackett. I had now found people who spoke my language."

The third fortunate event in his life "was being offered a scholarship by Professor A.W. Farrall…to attend Michigan State to work on an MSc degree…. The key thing I learned from Dr. Farrall was not to be hesitant in trying out new ideas."

"Fortunate event number four was being hired by Professor Wallace Giles…in 1954, directly as a research associate professor, Department of Agricultural Engineering, North Carolina State University [NCSU], with a research budget of $3,000 per year. My responsibility was to mechanize the production of flue-cured tobacco to eliminate the need for over 460 man-hours per acre of backbreaking work under high temperature and humidity conditions…. We were among the first to conduct human factors engineering studies of the effort required and the accuracy of workers using a mechanical transplanter." Other research on mechanizing the production of tobacco to improve the efficiency of production and to reduce the drudgery followed. "I think we accomplished the task for which I had been hired. Then the medical profession determined that smoking tobacco was a serious health hazard. So much for being a second Eli Whitney," Bill wrote.

He advanced to the rank of professor at NCSU and pursued his interest in applying engineering science to biological systems, conducting research with his students on the mechanical harvesting of cabbage and sweet potatoes. He also maintained collaborations with Henry Bowen at Michigan State University on increasing deposition of agricultural sprays and dusts on target plant surfaces by applying electrostatic charges. In his deposition research he developed an air curtain nozzle that was highly efficient for both sprays and dusts, resulting in one of the six patents he received for developments while at NCSU. Because he and several other faculty members in the department were using basic biological science in their research, the NCSU Agricultural Engineering Department changed its name to Biological and Agricultural Engineering in 1965, becoming the first department in the discipline to do so.

"My fifth fortunate event was being hired to head the agricultural engineering program at the University of Nebraska-Lincoln [UNL] in 1968," Bill wrote. While attending a professional meeting out of state he received a telephone call from University of Nebraska President Durwood Varner telling him to hire five irrigation engineers for the agricultural engineering faculty. These hires and their work resulted in an extensive irrigation engineering educational program throughout Nebraska and were the catalyst for the state's becoming a leader in irrigated agriculture—it now has more irrigated acreage than any other in the country. This intensive irrigation activity led to a $50 million private gift and the establishment in 2010 of an institute with global reach, focused on the management of water in agriculture—the Robert B. Daugherty Water for Food Institute.

Bill led the University of Nebraska's Agricultural Engineering Department in becoming very involved in sponsored research. He had written successful competitive grant proposals at NCSU and wrote successful research proposals at the University of Nebraska and then teamed with able faculty members to conduct the research. The graduate program also expanded considerably under Bill's leadership, adding a PhD program in 1971.

"Fortunate event number six was my election as president of ASAE (American Society of Agricultural Engineers)…. I had served on numerous committees but this was a new challenge that I enjoyed very much." As president (1978–1979) he greatly increased involvement with other national and international engineering organizations, and worked with

Bob Tweedy (later ASAE president, 1981–1982) in creating the ASAE Foundation to support special Society initiatives.

"Fortunate event number seven was the surprise letter in 1984 indicating that I had been elected to the National Academy of Engineering. There were only two agricultural engineers serving as members at that time. This was a 'mule entered in the Kentucky Derby' situation but I helped organize and served as the first chairman of Section 12, Special Fields." He was the first engineer from Nebraska elected to the NAE (at his death he was one of two), and was quite active on several Academy committees.

"In 1988 my eighth fortunate event was my selection as associate vice chancellor of research" at the University of Nebraska. When the vice chancellor left the position two years later, Bill was named interim vice chancellor for a year, and then vice chancellor. He was instrumental in increasing research funding and led the move of the university from a Carnegie Category II to a Category I research institution. "Hopefully it can be claimed that my team set the stage for the major sponsored research program that exists today," he wrote. There is little doubt that this is the case.

Although he officially retired in 1993, a significant portion of Bill's career remained. He served twice as interim dean (or, as he said, "intermittent dean") of the University of Nebraska College of Engineering (1994–1995 and 2001–2002). In 2002 he was interim director at the University of Nebraska State Museum, and from 1999 until early 2011 he was director of the Lester F. Larsen Tractor Test and Power Museum. Bill and others felt strongly that the original Nebraska Tractor Testing Laboratory building (established as part of the Agricultural Engineering Department by the state legislature in 1919 and built in 1920) should serve as the museum. Unfortunately there were holes in the roof—as big as ten feet across, according to Bill—and the exterior of the building was in disrepair. Bill took on the challenge of raising funds to restore the building to house the collection and established an endowment to provide operating funds.

As a result of Bill's leadership, the laboratory was recognized as an ASAE historic site in 1980, and the Lester F. Larsen Tractor Test and Power Museum was dedicated in 1998. It was important to Bill that the museum be known not only for the evolution of the agricultural tractor but also as an educational facility, tracing the evolution of food production from human to animal to gasoline engine power. The exhibits end with the transition in the late 1950s to diesel engines as the primary power source for agricultural tractors.

In 2004 the agricultural engineering annex in the UNL Biological Systems Engineering Department was dedicated as the Splinter Laboratories. The facility, built under Bill's direction in 1979, houses the current Nebraska Tractor Testing Laboratory, teaching and research laboratories, and a precision machine shop for fabricating research equipment. Bill called this "the most significant professional recognition of my career" and said "the facility has special meaning to me as I had laid out the design to specifically house the major noise-generating functions of the department.… The building has proven highly functional—good engineering design if I say so myself," he wrote.

Bill's support of the University of Nebraska never waned. He and his wife Eleanor established a student scholarship fund and an endowed professorship in the Biological Systems Engineering Department. The month he died he was revising and updating the history of the department and working to arrange a meeting with a potential donor for support of the museum.

Bill had great vision and could see the whole picture, even as he focused on specific parts to move his vision forward. He was a strong supporter of changing the Agricultural Engineering Department's name to Biological Systems Engineering, a change that was made official in 1990. Along with the change of the department name, UNL became the first department to develop an ABET-accredited degree in biological systems engineering. These changes occurred after Bill had become vice chancellor of research, but he had laid the groundwork for them over the previous 20 years. His vision led to the development of a curriculum melding engineering and biology that has increased undergraduate enrollment tenfold.

Throughout his career Bill was also involved in international projects and activities in many countries—Southern Rhodesia, South Africa, India, Colombia, Chile, Russia, Mexico, Italy, China, Germany, Australia, Morocco, Ireland, Japan, Taiwan, Singapore, Egypt, Greece, and Switzerland.

Bill received many professional awards and recognitions throughout his career. He was a fellow of the ASAE, NSPE, and AAAS. He received two of the highest honors bestowed by the ASAE: the John Deere Gold Medal in 1995 and the Massey Ferguson Educational Gold Medal Award in 1978. The USDA recognized him with its National Creativity Award, presented by the National Extension Association. In addition, he received many state, university, and regional recognitions, including election to the Nebraska Hall of Agricultural Achievement and the Pioneer Irrigation Award. He was also proud of being recognized with the Floyd S. Oldt Boss of the Year Award by the UNL Office Professionals Association, and in 2001 UNL selected him for the George Howard–Louise Pound Distinguished Career Award. He was a member of many academic honorary societies: Sigma Tau, Tau Beta Pi, Alpha Epsilon, Pi Mu Epsilon, Sigma Pi, Sigma Xi, Gamma Sigma Delta, and Phi Kappa Phi.

Bill loved to fly, and was soloing soon after high school. His flying allowed him to visit the western portions of Nebraska to meet with employees in Scottsbluff and North Platte, and to travel extensively around the US while he was ASAE president. He had flown nearly 5,000 hours with an instrument rating when installation of a pacemaker ended his flying days. He also incorporated his interest in engineering and energy into his personal residence, designing and having built a house with solar heating in which he and his second wife, Betty, were living at the time of his death.

His daughter Kathy Splinter-Watkins shared her recollections:

> Dedicated to family as much as to work, he would fly the whole family to professional conferences where he attended meetings.

Eleanor and the kids participated in tours or family events set up by the conference. Those were the family vacations. Bill also included children in his trips to the tobacco fields, to veterinary labs to see the glass-sided cow, to irrigated fields, and to the Nebraska family farmyard with all the animals and corn silos. He was enamored of nature, pointing out various animals or birds in the air. His sense of humor was ever present as he would keep his kids busy by asking them to count numbers of cattle by their legs and divide by four.

He read books to his children as they propped on the arms of his easy chair. Family dinners often included international graduate students and were catered to their various cultural and religious requirements. Thanksgiving meant "all inclusive."

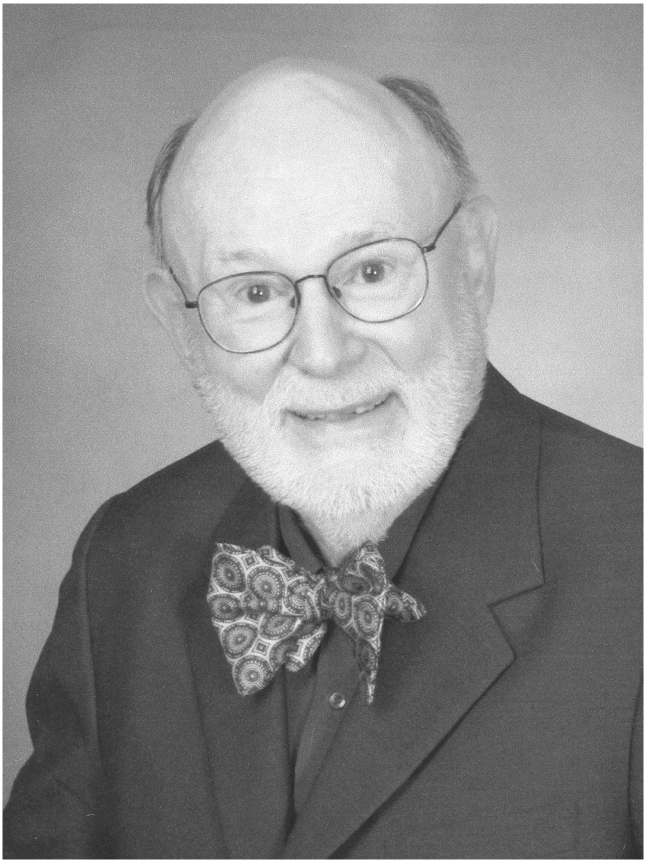
Bill was a master of learning and teaching. His interests were diverse, from art to music to science to health. He loved flying and traveling, hunting and sailing, reading and gardening. He was interested in all cultures and nationalities, all animals large and small.

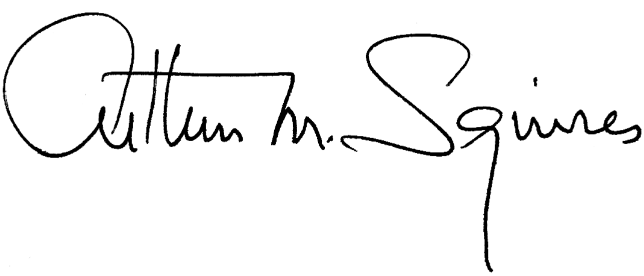
Lest the picture is painted too perfectly, Bill definitely had his opinions and they were not to be crossed. He expected his family to take his word as the truth. But he brought in many different perspectives from circumnavigating the world four times. He was always eager to learn more as his projects from work would spill over into home life.

Bill was terribly proud of his family. All four children completed college degrees, two with master's, and have good careers. After Eleanor passed away in 1999 he kept in contact with each of his children with weekly phone calls. He was fortunate to fall in love again. He totally accepted Betty's family as his own, so now he had four more children. All ten of his grandchildren are achieving much that he would be proud of and are following in his footsteps.

In addition to Betty, Bill is survived by his sister Donna Marie, two sons and two daughters (from his marriage to Eleanor), three sons and a daughter (Betty's children), and ten grandchildren.

Many of us, both family and work associates, who have known Bill Splinter consider that one of our most "fortunate events."





ARTHUR M. SQUIRES

1916–2012

Elected in 1977

"For contributions to the research and understanding of coal gasification and the recovery of organic chemicals from coal.

SUBMITTED BY THE NAE HOME SECRETARY
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ARTHUR M. SQUIRES, University Distinguished Professor (emeritus), Virginia Polytechnic Institute and State University, died on Friday, May 18, 2012, at his home in Blacksburg, Virginia, after a long illness. He had served industry 25 years as a chemical engineer: in the first four participating in design, construction, and start-up of the Manhattan Project's gaseous diffusion plant at Oak Ridge, Tennessee; in the remainder focusing primarily on fossil fuel technologies. He then spent 19 years on chemical engineering faculties at the City College of New York and Virginia Tech. He also sang professionally with the New York Pro Musica Antiqua for nearly 20 years.

Arthur Squires was born in Neodesha, Kansas, on March 21, 1916, the third son and fourth child of Charles Loren and Vera Moore Squires. He attended elementary and high school in Higginsville and Columbia, Missouri, respectively, and in 1938 the University of Missouri granted him an AB with distinction in chemistry. In 1947 he completed a PhD in physical chemistry under John Kirkwood at Cornell University.

During World War II Squires was a chemical engineer on the Manhattan Project. Under the mentorship of Manson Benedict, he participated in the design and construction of K-25, the gaseous diffusion plant at Oak Ridge, where fissionable material for the first atomic bomb was produced, by enriching U-235 from 0.7 percent in natural uranium to higher concentrations. Although Squires rarely talked about this period of his life, family members recall that he said he traveled back and forth between Oak Ridge and New York City with his briefcase handcuffed to his wrist.

After the war Squires advised Union Carbide Co. (K-25's operator) and the US Army about what levels of concentration of U-235 would be sensible for a partial K-25 plant to ship and in what amounts. He helped Carbide organize a process analysis department, and with Cuthbert Daniel instituted a statistically controlled material balance. This work became important in supporting a decision to increase the concentration level in K-25's product from 35 percent to 90 percent (bomb grade) without danger of accumulating a critical mass of U-235 and creating a nuclear chain reaction in the K-25 high-end equipment. Consequently the Army was able to stop using the more expensive electromagnetic separation to carry K-25's product to bomb level.

But in 1950, during visits to other nuclear sites operated by the Atomic Energy Commission, Squires learned that none was conducting a material balance of its dangerous fissionable material under even remotely comparable statistical control. Believing nuclear electricity would be too dangerous for the often careless, forgetful human animal to use and that nuclear technology's only viable applications would be military, he left the field.

A major focus of the next 21 years of service to industry (the last 8 as a self-employed consultant) was in technologies related to fossil fuels. He then served on the chemical engineering faculties of the City College of New York (9 years) and Virginia Tech (10 years), where his research related to control of emissions from the use of coal. He remained active on this topic until his death, having filed for three patents in the past year.

His contributions were recognized in his election to the National Academy of Engineering, and he was a fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science.

Puzzled by the several major, expensive failures of United States governmental efforts to advance technology after WWII, Squires became interested in management. In his 1986 book *The Tender Ship*, he developed criteria for recognizing good and bad governmental management of technological change. This book received favorable reviews in both *Nature* and *New Scientist*.

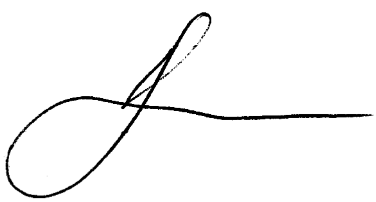
Dr. Squires enjoyed life to the fullest and was a highly informed enthusiast of the performing and visual arts, attending concerts, opera, dance, theater, and exhibitions throughout his life and around the world. A trained and accomplished tenor, he was perhaps most involved with music. In late 1946, he joined the Cantata Singers, a choral group led by Bach scholar Arthur Mendel. In 1950 he also joined the (David) Randolph Singers, and in 1953 he became a founding member of Noah Greenberg's Pro Musica Antiqua, singing and playing the viola da gamba with this group well into the 1960s and performing in two medieval liturgical plays, *The Play of Daniel* and *The Play of Herod,* for which the ensemble was perhaps best known. He also built and played one of the first kit harpsichords.

He was an avid collector of art, with special interests in Yoshi Toshi woodcuts, Walter Clark landscape sketches, and George Rickey mobiles, among many others. He had recently grown to love and support the American Shakespeare Center and Blackfriars Playhouse in Staunton, Virginia.

Always an avid reader of anthropological literature, Squires became curious about human evolution and devoted a number of years to its serious study. A member of the Human Behavior and Evolution Society and the International Society for Human Ethology, he presented papers at meetings of both societies. In 2011 he published a short book titled *From Toumai to G. Stein and O. Wilde,* an unconventional story of hominin evolution. At his death he left a manuscript in progress, "The left hand of love," which offers a more detailed account of human evolution.

Dr. Squires is survived by his partner and loving companion John Jussi Korzeniowski, and will also be much missed by his many nieces and nephews and their extended families: Shirley

Wilhelm Jondro, Carlyle, Illinois; Conrad Squires, Nahant, Massachusetts; Jenny Wilker, Asheville, North Carolina; Robert Andrew Squires, Berlin, Vermont; Mary Ann Grassit, Everett, Washington; Beverley McKeeman, Simsbury, Connecticut; Donald Squires, Boston; Michael Squires, Los Angeles; David Bess, New Orleans; William Bess, Albuquerque; and Gordon Bess, Fenton, Missouri.



WILLEM P.C. STEMMER

1957–2013

Elected in 2012

"For coinvention of directed evolution and development of protein therapeutic platforms."

BY LORI GIVER AND FRANCES ARNOLD

WILLEM (Pim) STEMMER, a pioneer in the field of protein engineering and founder of multiple biotech companies, died of cancer on April 2, 2013, at the age of 56.

Pim was born in Holland and attended the Institut Montana in Zugerberg, Switzerland, graduating in 1975. He received his *doctoraal* in biology from the University of Amsterdam in 1980, followed by a PhD in biology in 1985 from the University of Wisconsin, Madison. As a postdoctoral researcher in the laboratory of geneticist Fred Blattner at Wisconsin, Pim displayed random peptide libraries on phage coats and expressed antibody fragments in bacteria. This experience with newly emerging biomolecular engineering techniques formed the basis for much of his future work. He founded his first company, Genetic Designs, in 1985 to develop new peptide phage display, antibody expression, and codon-based synthesis techniques for biotechnology.

Two years later he joined Hybritech and extended his work in antibody fragment engineering to applications in cancer treatment. In 1992 he moved to the Affymax Research Institute, where, as distinguished scientist, he developed the DNA shuffling technology that was the basis for his next company, Maxygen, which he cofounded in 1997 with Alejandro Zaffaroni, Russell Howard, and Isaac Stein.

Pim's DNA shuffling technology was a revolutionary method for evolving single genes, gene families, operons, biosynthetic pathways, and even whole viruses using repeated cycles of in vitro recombination. The protein products coded by these novel genes could then be screened for desired properties. This process, combining key elements from computer science (genetic algorithms) and classical breeding with state-of-the-art molecular biology, made it possible to use directed evolution to tailor-make novel protein products for specific applications. The method was essentially "sex in a test tube." At Maxygen, Pim and his colleagues applied the technology in numerous fields (including pharmaceuticals, chemistry, and crop traits) and developed an extensive portfolio of patents that in 2003 was ranked #1 in pharma/biotech by MIT's *Technology Review.* Three daughter companies—Verdia (purchased by Dupont in 2004), Perseid (purchased by Astellas in 2011), and Codexis (IPO in 2010)—were spun out from Maxygen to further apply DNA shuffling to the areas of agriculture, pharmaceutical proteins, and chemicals.

Refocusing on antibodies, in 2001 Pim developed the avimer technology and founded Avidia Inc. in 2003. Avimers are antibody mimetics, with multiple binding sites linked by rigid peptide linkers. Research at Avidia focused on the development of avimers as potential therapeutics, and the company was bought by Amgen in 2006.

Ever the pioneer, Pim cofounded Amunix with Volker Schellenberger in 2006 and together they developed the XTEN technology for extending the half-lives of biopharmaceuticals. By spinning out two product-focused companies (Versatis in 2009 and Diartis in 2011), Pim was able to preserve broad access to the XTEN technology via Amunix while enabling the rapid clinical development of XTEN-based products.

Pim held more than 100 US patents and was an author on at least 70 scientific publications. He thought deeply about the intersection of the scientific, commercial, and legal realms, as exemplified by his 2002 gem "How to publish DNA sequences with copyright protection" (*Nature Biotechnology* 20:217). His many honors included selection for the Ada Doisy

Lecture, conferred by the University of Illinois at Urbana-Champaign in 2000; the American Chemical Society's David Perlman Memorial Lectureship in 2001; and the NASDAQ VCynic Award in 2005. The rapidly growing impact of his contributions to directed enzyme evolution, both at and beyond his companies, was recognized by the NAE's Charles Stark Draper Prize in 2011. The following year Pim was elected to the National Academy of Engineering; he was very honored by his election, which he felt was good closure to his career.

Pim is survived by his mother, wife, son, daughter, and sister. He will be deeply missed by his many friends, colleagues, and all who were fortunate to work with him and enjoy his boundless passion for science and the creative process.

JOHN AVERY TILLINGHAST

1927–2011

Elected in 1974

"Leadership in the development and utilization of advanced systems of generation and transmission."

BY JAMES J. MARKOWSKY

JOHN A. TILLINGHAST, a leader in the development and implementation of advanced power generation cycles and high-voltage transmission systems, died on May 7, 2011, at the age of 84.

John was born in New York City to Charles C. and Dorothy Tillinghast. He attended the Horace Mann School, where his father was headmaster, and then studied at Columbia University while serving in the US Navy V-12 program (from 1944 to 1952). In 1948 and 1949 he earned BS and MS degrees, with honors, in mechanical engineering.

Upon graduating he was hired by American Electric Power Service Corporation (AEP), where his career spanned 30 years. As a young project engineer, he was involved in the first supercritical steam-generating unit in the United States. Soon identified as an up-and-coming engineer, in 1953–1961 he participated in the study, R&D, and construction of the first 345 KV and 765 KV high-voltage transmission systems, and in 1958 he led an R&D study by ten electric utilities to design the first magnetohydrodynamic power plant. He quickly rose at AEP to become chief mechanical engineer, chief engineer, and in 1967 executive vice president of engineering and construction.

The 1960s were a technically exciting time at AEP, and John's technical capabilities and curiosity were the driving force in his direction of studies for the next generation of supercritical fossil and nuclear reactors along with implementation of the 765 KV transmission system. From 1967 to 1975, he directed the planning, engineering, purchase, and construction of 10,000 MWe plants, which included five double-reheat 800 megawatt (MW) and three single-reheat 1,300 MW supercritical pressure coal units (the largest in the world), and two 1,100 MW pressurized water reactor nuclear units along with the installation of 1,400 miles of 765 KV high-voltage transmission.

His technical and professional curiosity also drove AEP to pursue enhancement in both power generation and ultra-high-voltage transmission technology. The resulting enhancements include the establishment of development programs for 2,000 KV ultra-high-voltage transmission and a pressurized fluidized bed combustion combined cycle.

In 1972 he was elected director of American Electric Power Co., the parent holding company, and in 1975 vice chairman of the board in charge of engineering and construction, a position he held until his retirement in 1979.

When he left AEP he joined Wheelabrator Frye Inc. as senior vice president of technology. He also held various executive positions in the Allied Advanced Technology Group, Allied Signal International, Science Applications International Corp., TITEC, Great Bay Power Corp., BayCorp Holdings Ltd., and served on the board of directors of Cogentrix Energy, Inc. In these activities John's professional knowledge and expertise spanned alternative energy projects, cogeneration, and other innovative technologies, and he holds a patent for a generative unit control system.

In addition to his election to the National Academy of Engineering, John was a fellow of the American Society of Mechanical Engineering. He also gave generously of his time to support nonprofit and professional organizations. He chaired the National Research Council (NRC) Energy Engineering Board (1986–1993), and served on the NRC Commission on Engineering and Technical Systems and Committee on

Alternatives to Indian Point for Meeting Energy Needs. He was an Elder of the reformed Church of Bronxville, New York, and a member of the United Church of Christ of North Hampton, New Hampshire.

John was a devoted husband and father. He was predeceased by his wife of 52 years, Mabel, and grandson Steven Ryan. He is survived by daughters Katherine Brickley and husband John of Hampton, New Hampshire; Susan Trainor and husband John of Rye, New Hampshire; and Abigail Ryan and husband Sidney of Chesapeake, Virginia; grandchildren Christopher Ryan and wife Tara, Kathleen Trainor, John Trainor, and Sarah Brickley; great-grandchild Shawn Ryan; his brother David of New York City; several nieces and one nephew.

John's faith and strength of character made him a trusted friend, advisor, and mentor to many. He will be greatly missed.

Charles E. Treanor

CHARLES E. TREANOR

1924–2012

Elected in 1990

"For contributions to the physics of high-temperature gases, hypersonic flight, and flow lasers and for innovative research management."

BY PAUL MARRONE
SUBMITTED BY THE NAE HOME SECRETARY

CHARLES TREANOR, pioneer in fluid dynamics and hypersonic research, died at age 87 in Rochester, New York, on May 27, 2012. He was born in Buffalo, NY, on October 22, 1924, one of nine children in a hard-working Irish family, and lived most of his life in the Buffalo area, moving to Rochester in 2008 to be near family.

Chuck, as he was known, attended Catholic grammar and high school and after graduation worked briefly at a local deli several hours a day, seven days a week. As World War II became larger in scope with United States participation, he entered the Air Force and was sent to Yale University for training in meteorology. But the military had a greater need for radio technicians, and he was posted to the University of Minnesota to study radio operation and repair. He served in the China-Burma-India Theater and, with a group involved in the early use of helicopters for rescue work, helped rescue pilots who had crashed in the Himalaya Mountains.

After leaving the Air Force, he returned to the University of Minnesota, where he earned his bachelor's degree in physics in 1948. Upon returning home, he attended the University at Buffalo (UB), where he earned his PhD in physics in 1956. His thesis on molecular radiation and spectroscopy laid the groundwork for his future technical contributions.

Chuck began his professional career at the Cornell Aeronautical Laboratory (CAL) in Buffalo, one of the elite not-for-profit research laboratories in the United States, and spent his entire career there and at its successor entities, including Calspan. He joked that his early analytical work could be described as "subsonic and unclassified," as he investigated areas such as raindrops interacting with airfoils and air flow in ducts.

His physics background led him to the new and challenging field of high-temperature chemically reacting flows and molecular radiation that accompanied hypersonic and space-oriented research in the United States at the time. Under the direction of Abraham Hertzberg, the Aerodynamic Research Department at CAL became a world leader in hypersonic research with the development of short-duration test facilities (i.e., shock tubes and shock tunnels).

Chuck, now a leader in theoretical and analytical studies, partnered with Walter Wurster and the pioneering experimental staff at CAL to investigate high-temperature flows. He authored some 100 papers and reports on molecular radiation and excitation mechanisms for such species as O_2, N_2, NO, CO, and CO_2 and ions important in high-temperature airflows and planetary atmospheres. Of particular interest were the mechanisms for the interaction of vibrational excitation with dissociation in diatomic molecules. He developed the CVD and CVDV (coupled vibration-dissociation-vibration) models to accurately describe experimental results from strong shock waves in various gases.

The numerical techniques developed by Chuck were incorporated in computer programs to predict very complex thermophysical and thermochemical flows, and a number of these important programs were distributed to approximately 100 research laboratories throughout the international research community. As part of this work, Chuck developed a numerical integration technique for coupled differential equations with greatly different time constants, allowing rapid solutions for very complex gases with many species and excitation mechanisms. This work was extended to include gas-dynamic lasers and solar-powered lasers. The physics community has referred to aspects of his contributions to the understanding of the inner workings of excited molecules as the Treanor distribution and Treanor equation.

Chuck's analyses are critical for predicting modern aerospace flows such as fluid flow and radiation (vehicle reentry from lunar mission); determination of shock-wave strength and location (combustion efficiency in scramjet-powered vehicles); exhaust nozzle performance (rocket engine efficiency); energy distribution in key species (advanced molecular lasers); and species identification in specialized flows (manufacture of molecules in shock-wave-induced flow devices). His work integrating fluid flows with molecular excitation and radiation mechanisms gives confidence in predicting such highly diverse flows.

Chuck was a leader in both basic and applied research, and this leadership manifested itself in a number of ways. As vice president/chief scientist for the corporation at CAL/Calspan, he continued his own technical work and oversaw both the quality of ongoing scientific research and the development of new research programs. Recognizing the importance of the long-standing relationship between CAL and the UB School of Engineering, he worked to strengthen the ties as an adjunct professor and advocate for student participation in CAL's unique laboratories and programs.

When CAL was purchased by Arvin Industries of Indiana, Chuck was concerned that the loss of the large nonprofit research center would also mean the loss of an important "industry spin-off" center in western New York. Over the preceding 25 years former CAL employees had harnessed research program ideas and techniques to create more than 20 local companies, a number of which have grown much larger than CAL/Calspan and achieved worldwide recognition.

Chuck worked with the presidents of the University at Buffalo, Arvin Industries, and the new Arvin/Calspan to start an independent nonprofit organization to continue this critical role in western New York. The Calspan-UB Research Center (CUBRC), formed in 1983, assumed responsibility for a number of the big CAL laboratories and was one of the first laboratories in the United States to combine an educational institution and a for-profit organization. New local companies are being established involving engineering students in its advanced facilities. Chuck was the first director/president of CUBRC and his technical and management leadership nurtured its formative growth and early success. He retired from that position in 1988.

He was an inspiration to fellow researchers and encouraged them toward advanced education, backing a number of PhD students at several universities (he was a visiting professor at Stanford University in the late 1960s). He was a leading member of professional organizations, including Sigma Xi. He was a fellow of the American Physical Society (APS), chairman of its Division of Fluid Dynamics, associate editor of the *Physics of Fluids* journal, and, as cochair of the 1988 Annual APS Fluid Dynamics Conference, a central figure in attracting this prestigious conference to western New York, bringing international researchers and prominence to UB. He was also a fellow of the American Institute of Aeronautics and Astronautics (AIAA) and chaired its Technical Committee on Plasma Dynamics.

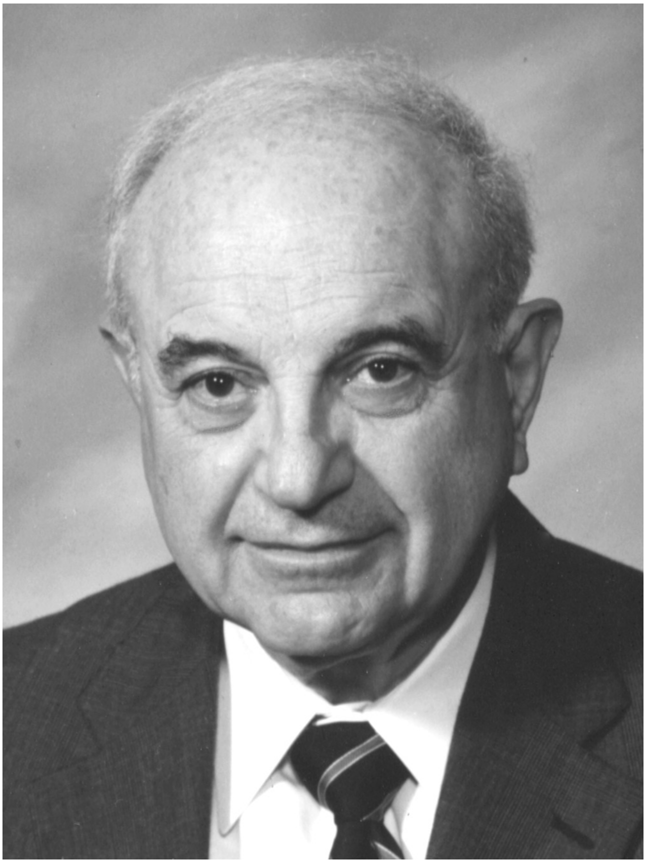
Chuck Treanor received many honors during his career. He was elected to the National Academy of Engineering in 1990. He received the AIAA Fluid Dynamics Award and the AIAA Niagara Frontier Section Outstanding Aerospace Achievement Award. He was an early recipient of the Clifford C. Furnas Memorial Award for distinctions that bring honor to UB, and he was elected to the Western New York Aviation and Space Hall of Fame in recognition of his technical accomplishments and the impact of his work in advancing the aviation and space sciences.

Chuck balanced his considerable technical skills and achievements with love of family and a lifelong passion for baseball. He inherited his love of the game from his father, who played third base for the Pullman Corporation baseball team, and he was a faithful season ticket holder for the AAA Buffalo Bisons in the New York Mets farm system. From his vantage point behind home plate he meticulously scored each inning. For a number of years, he and his wife Ruth visited the team's spring training camp in Bradenton, Florida.

Chuck also treasured his Irish heritage and ancestral home. He was a founding member and president of the western New York chapter of the Ancient Order of the Hibernians. For many years, he wrote a column on Irish politics for the *Irish Times*. He loved Irish tunes and could be heard singing accompanied by his brother James Treanor, MD, on the piano. Perhaps his greatest Irish contribution to western New York is the beautiful monument to the men and women who came to Buffalo in the wake of the Irish potato famine of the mid-19th century. The monument, a central obelisk and family-named bricks, is surrounded by 32 stones representing the 32 counties of Ireland, each stone selected from the quay in County Cork where the ships left the Irish shore and headed for America. It is situated at the newly developed downtown Buffalo Harbor and Waterfront. Chuck was the central figure in the project, heading a large fundraising effort and traveling to Ireland to help select the stones and arrange transport to Buffalo.

Chuck Treanor was a quiet man, and a humble one, with a powerful intellect and an instinctive feel for the physics behind observed phenomena. He enjoyed debating technical points and surrounded himself with highly capable people. He was a true leader in both the technical and managerial arenas, and in his quiet way delivered thoughtful advice on all topics. He made all of us better scientists and persons. He will be missed by all who knew and worked with him, and by all others who benefited from his life.

Ruth died in 2003. Chuck is survived by one daughter and four sons.



BERNARD A. VALLERGA

1921–2013

Elected in 1987

"For unique achievements and novel applications in asphalt technology: pavement design, rehabilitation, and recycling; hydraulic revetments; membranes; and soil stabilization."

BY FRED FINN AND CARL MONISMITH

BERNARD (Barney) VALLERGA was born on December 11, 1921, and died at age 91 on January 5, 2013. He contributed in significant ways to his chosen profession and was a devoted mentor to many young engineers. His NAE citation describes his work as "unique" and, in addition to his professional achievements, the man himself was unique in many ways—in his personal charisma, in his service to his country, and as a loyal friend. He was a perennial optimist who never saw a problem he could not solve. He had an endless number of stories and was known for a firm hand shake.

After graduating from Fremont High School in Oakland, California, where he was elected student body president, he earned BS and MS degrees in civil engineering at the University of California, Berkeley. He was elected to Chi Epsilon and Tau Beta Pi, both scholastic engineering honorary societies, while at Berkeley. He advanced from Second Lieutenant to Captain in an Ordinance unit of the US Third Army in Europe during World War II, landing a few days after D-Day.

Barney began his engineering career as an assistant professor in civil engineering at Berkeley, where he taught and conducted research until 1953. Based on his research in asphalt technology and his communication skills he was offered a position with the Asphalt Institute as managing engineer for its

Pacific Coast Division, covering California, Arizona, Nevada, Oregon, and Washington branch offices in key locations in each state.

In 1956 he established, with the assistance of F.N. Hveem, materials engineer with the California Division of Highways, the Pacific Coast Conference on Asphalt Specifications. This was the forerunner of such conferences in other sections of the country that together resulted in uniform asphalt specifications with improved physical properties to the benefit of both users and producers of asphalt on a national scale.

In 1962 Barney was hired as vice president of Golden Bear Oil Company in Bakersfield, California, where he was in charge of marketing and research of the company's specialty products for use in the paving industry. He remained with Golden Bear until 1964, when he joined Fred Finn and Fritz Rostler to establish the consulting firm of Materials Research and Development Inc. (MR&D) in Oakland. In time MR&D joined with Woodward, Clyde Consultants, and Barney served as a vice president. In 1972 he started his own highly successful private consulting firm until he retired at the age of 77. Actually, Barney never really retired as he remained in contact with friends, colleagues, and associates until his health prevented him from further interaction.

Barney was honored by virtually every organization in which he was a member. He was designated an honorary member of the American Society of Civil Engineers and the Association of Asphalt Paving Technologists, and elected to the NAE and the Roll of Honor of the Asphalt Institute. He was a founding member of the International Society for Asphalt Pavements, and served on the National Research Council Committee for the Study of the Regulation of Weights, Lengths, and Widths of Commercial Vehicles; Panel for the Project to Develop an Asphalt Handbook; and Panel on Peer Review of Applications for the University Transportation Centers Program.

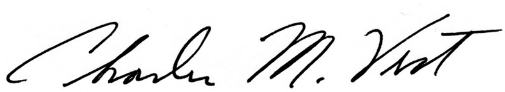
As evidenced by his NAE citation Barney contributed to a broad range of research and development in the field of asphalt technology and recognized the importance of early implementation. He applied research for the use of asphalt membranes for canal linings, use of rejuvenating emulsions for maintenance of asphalt pavements, application of asphalt mixes for offshore oil drilling, and studies to improve specifications of virgin asphalt for mixtures to increase the service life of pavements.

Because of our close ties with Barney professionally and personally, we offer here a few remarks about his role in our lives.

I (Fred Finn) first met Barney in 1947 when I returned from WWII and enrolled at Berkeley as a graduate student and teaching assistant in civil engineering. He was my boss then and became my personal guide and counselor for at least 40 years, during which I transferred, changed employment, or went into private practice as a consultant. Barney provided guidance in each of these decisions, counseling not only as a colleague but mainly as a friend, for which I and my family are, and always will be, grateful. I know of many other young engineers whose successful careers can be attributed to Barney's professional guidance and personal advice. The quality of his teaching, guidance, and encouragement is not included in his NAE citation, maybe it should be. It was certainly an important virtue that made him "unique" to me.

Like Fred, I (Carl Monismith) wish to add that I was fortunate to meet Barney and gain knowledge, insight, and experience while working with him over the years. I also likely would not have developed my close friendship with Fred Finn as well as a number of other outstanding engineers.

The four Vallerga children were born and raised in the Bay Area. It is rare in these days, when families tend to disperse, that they remained close, in both place and heart, which is a compliment to Barney and Doris, his wife of 68 years.



CHARLES M. VEST

1941–2013

Elected in 1993

President of the National Academy of Engineering 2007–2013

"For technical and educational contributions to holographic interferometry and leadership as an educator."

BY JAMES J. DUDERSTADT AND PAUL E. GRAY

CHARLES MARSTILLER VEST, former president of the National Academy of Engineering, president emeritus of the Massachusetts Institute of Technology, and one of the nation's leaders in higher education, engineering, and national science policy, died on December 12, 2013, at the age of 72.

Chuck Vest was born on September 9, 1941, in Morgantown, West Virginia. Throughout his life, he credited much of his professional success to the simple values and emphasis on family that he learned as a boy growing up in Morgantown.

While studying for his degree in mechanical engineering at West Virginia University, he met Rebecca McCue on a blind date. They married and, after graduating in 1963, made their way to the University of Michigan in Ann Arbor, where they lived, worked, and raised their family for 27 years.

Chuck earned his MSE in 1964 and his PhD from Michigan in 1967. He joined the faculty of the university's Department of Mechanical Engineering as an assistant professor, teaching in the areas of heat transfer, thermodynamics, and fluid mechanics, and conducting research in heat transfer and engineering applications of laser optics and holography. He and his graduate students developed techniques for making quantitative measurements of various properties and motions from holographic interferograms, especially the measurement of three-dimensional temperature and density fields using computer tomography. He was promoted to associate professor in 1972 and full professor in 1977.

In 1981 Chuck began a series of leadership appointments. As the senior associate dean of engineering he played a major role in moving the College of Engineering from its Central Campus location to new facilities on the university's North Campus. He went on to become dean of engineering (1986–1989) and then provost and vice president for academic affairs at Michigan. His performance and visibility in this new role soon attracted the attention of other universities seeking leadership, and MIT put before him "a call to national service" as their president. As he was preparing to leave Michigan, he left important words of advice:

> Above all, I hope that the University of Michigan will forever set its central agenda to be excellence in research, scholarship, and education. It is my belief that the nation needs a small number of universities truly committed to excellence and to the education of an elite. But I think of this elite in a somewhat Jeffersonian sense. That is, it must be accessible. Admission to it must be available to people from all segments of our society and earned through dedication, hard work, and talent, not through race or social position.

In 1990 Chuck was elected the 15th president of the Massachusetts Institute of Technology, where he served with great distinction for nearly 14 years. His predecessor, Paul Gray, noted: "Chuck came to lead MIT at a difficult time for American higher education. In 1990, many in Washington had come to feel that the nation's universities had not acted as wise stewards of their federal funding. He made frequent trips to Washington as an ambassador not only for MIT but indeed for academia as a whole—and he did so supremely well."

Chuck rapidly became an important national and international figure in higher education, helping to influence policy and to set the national agenda for science and technology at the very highest levels of government. As president of MIT, he was active in science, technology, and innovation policy; building partnerships among academia, government, and industry; and championing the importance of open, global scientific communication, travel, and sharing of intellectual resources. During his tenure MIT launched its OpenCourseWare (OCW) initiative; cofounded the Alliance for Global Sustainability; enhanced the racial, gender, and cultural diversity of its students and faculty; established major new institutes in neuroscience and genomic medicine; and redeveloped much of its campus. Again quoting Paul Gray:

> Chuck strengthened the Institute academically and financially, greatly expanded our facilities, and dramatically enhanced the stature and the image of the Institute with government, with industry, and with the larger academic community. The life motto of Karl Taylor Compton, MIT's ninth president, was: "Leave every campground better than you found it." Chuck did just that here, with style, with extraordinary energy and with integrity.

As he stepped down from his MIT presidency, Chuck observed:

> Serving as president of a major research university is not a sandbox ambition for any child—I remain frankly astonished at the road that led me here. But looking back at that road—the bends and dips, the forks and unintended shortcuts—I'm struck by how little one can predict at the journey's outset and by how much of life comes down to how one handles the points where the roads cross. I am also overwhelmed with the sense of how much I owe to the insight, imagination, inspiration, and judgment of the many, many gifted people I have been lucky enough to work with at MIT.

In 2007 Chuck was elected to serve as president of the National Academy of Engineering. Under his leadership the NAE promoted the Grand Challenges for Engineering, a set of 14 critical challenges for engineers in the 21st century that, if achieved, will improve the quality of life for humankind. This effort spawned a number of Grand Challenges Summits at universities around the United States and has contributed to improved public understanding of the value and importance of engineering advances to the well-being of the nation and the world.

In 2009 he launched the annual NAE Frontiers of Engineering Education symposium series, aimed at identifying and propagating innovative approaches to engineering teaching and learning. He also presided over the international expansion of the NAE's Frontiers of Engineering program in 2013 to include partnerships with China and the European Union. He initiated a major new NAE effort to understand and address changes in global manufacturing-design-innovation value chains and their implications for US employment, education, and competitiveness. And under his leadership the NAE in 2011 undertook a novel partnership with the US Institute of Peace to consider how the application of technology and of knowledge and methods from engineering and science can serve the goals of conflict prevention, peacemaking, and peacekeeping.

In addition to strengthening and augmenting the strategic programs of the NAE, Chuck Vest exercised his visibility as NAE president to great effect, playing a prominent role nationally and internationally in illuminating forces reshaping the landscape of engineering research, practice, and education, and in defining the attributes future engineers will require to compete and lead in the emerging global economy.

He served on the board of directors of DuPont for 14 years and of IBM for 13 years, and was vice chair of the Council on Competitiveness for 8 years. He also served on various federal committees and commissions, including the President's Committee of Advisors on Science and Technology (PCAST) during the Clinton and Bush administrations, the Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction, the Secretary of Education's Commission on the Future of Higher Education, the Secretary of State's Advisory Committee on Transformational Diplomacy, and the Rice-Chertoff Secure Borders and Open Doors Advisory Committee. In addition, he served on the boards of several nonprofit organizations and foundations devoted to education, science, and technology.

Chuck was awarded the Arthur M. Bueche Award in 2000, the 2006 National Medal of Technology by President Bush, and in 2011 both the Vannevar Bush Award from the National Science Board and the Robert Fletcher Award from Dartmouth University. He received honorary doctoral degrees from 18 universities.

Perhaps the best way to understand Chuck's remarkable character is to recall his comments at Michigan when his selection as president of MIT was announced:

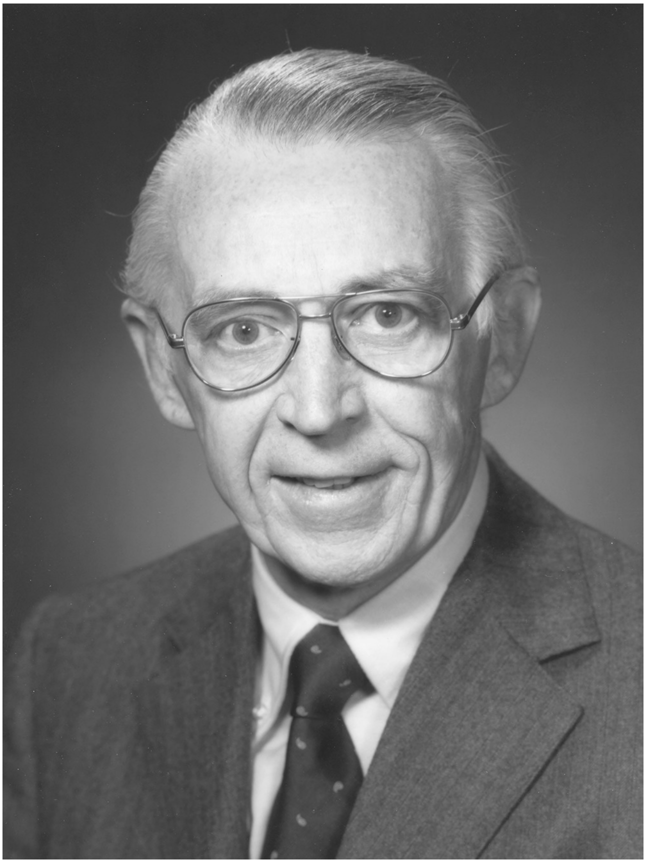
> Among the many notes of congratulations I have received on this appointment, one really sticks out in my mind. It was a brief note I had from Paul McCracken, one of the most distinguished members of our faculty. That letter said, almost in its entirety, "Boy from West Virginia becomes president of MIT: The American Dream."

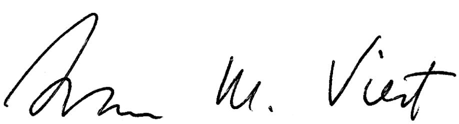
Despite his distinguished professional career, Chuck's greatest love and accomplishment was his family. He was a devoted husband and father who was immensely proud of both his children and his grandchildren. Together with Becky, they created a warm and loving home where they raised their family with the same simple values that served him so well on his own life's journey.

Throughout Chuck's years in Cambridge and Washington his most cherished time was spent at his home on Lake Winnipesaukee, New Hampshire, where he enjoyed paddling in his kayak, pursuing his passion as a voracious reader and, most importantly, spending time with his beloved wife, children, and grandchildren. Travel and long walks with Becky were also among his favorite pastimes.

He is survived by his wife, Becky; daughter and son-in-law, Kemper Vest Gay and John Gay; son and daughter-in-law, John and Christina Vest; and grandchildren Mary and Robert Gay and Ameri and Charles Vest.

Chuck Vest will be remembered as one of the great leaders of higher education through his service to Michigan and MIT. His presidency of the National Academy of Engineering and his role as a leader of American science, engineering, and technology will be viewed as immensely important to both the prosperity and security of our nation.





IVAN M. VIEST

1922–2012

Elected in 1978

"For contributions to design of structures, including composite construction, earthquake resistance, and load factor design specifications."

BY JOHN W. FISHER

IVAN M. VIEST, retired consultant, died on February 11, 2012, at the age of 89. He was born on October 10, 1922, in Bratislava, Slovakia, one of three children of Ivan G. and Maria (Zacharova) Viest. His father was a mechanical engineer with the Slovak Railroad and became president of its operations in 1936. In his teens Ivan acquired a love of hiking, often with his father, as well as skiing in the Tatry Mountains of Slovakia. His family lived most of his life in Bratislava, except for three years (1933–1936) when his father was promoted to the railroad director in Kosice. After high school in Bratislava Ivan entered the Slovak Technical University in 1941. Toward the end of World War II, he took part in the Slovak National Uprising against the Slovak quisling government and joined the Czechoslovak army in 1945. The end of the war allowed him to complete his studies and he received his degree in civil engineering in October 1946.

Ivan immigrated to the United States in April 1947, after completing his civil engineering studies at the Slovak Technical University in Bratislava. He had been awarded a graduate scholarship by the Rotary Clubs of Georgia to attend the Georgia Institute of Technology. After graduation from Georgia Tech with an MSCE in June 1948, he joined the Department of Theoretical and Applied Mechanics at the University of

Illinois at Urbana-Champaign in September 1948 as a research assistant. He completed his PhD degree in October 1951, with research on the shear strength of reinforced concrete and the strength of long reinforced concrete columns. He was put in charge of the reinforced concrete research in 1953 as research assistant professor in the Department of Theoretical and Applied Mechanics. He became a citizen of the United States and was promoted to research associate professor in 1955. He started studies on composite steel-concrete members in 1954, on the use of stud shear connectors to provide the means of connecting the concrete slab to steel beams to create the composite system. These studies resulted in the American Association of State Highway Officials (AASHO) adopting his design procedures in 1956, where they were immediately used in bridge design and construction.

Ivan left the University of Illinois in 1957 and accepted a position as bridge engineer at the Highway Research Board of the National Academy of Sciences, as AASHO had requested the Academy to carry out a multiyear research project into the performance of highway pavements and bridges at the AASHO Road Test in Ottawa, Illinois. The project demonstrated that (1) passages of heavy vehicles could produce fatigue failures in highway bridges as predicted by laboratory fatigue tests; (2) vehicle impact on bridges is a function of the vehicle characteristics, roadway roughness, and bridge characteristics; and (3) basing the design of bridges on their ultimate strength rather than solely on the conditions of everyday service was practical and economical. Ivan was a recognized expert in the area of composite construction, which led to the publication of his first book by McGraw-Hill, *Composite Construction in Steel and Concrete,* which he coauthored with R.S. Fountain and R.C. Singleton in 1958.

On completion of the AASHO Road Test research program, Ivan joined Bethlehem Steel Corporation as a structural engineer in the new Sales Engineering Division in 1961, where he worked for 21 years, attaining the position of assistant manager in 1974. The division provided customers with job-specific and general information on economic applications of structural steel. Ivan also served as Bethlehem's representative on the American Iron and Steel Institute (AISI) Engineering Subcommittee that initiated and promoted significant research on steel structures, particularly for earthquake resistance, and improvements in the design and performance of steel structures. The occurrence in the 1960s of catastrophic earthquakes in Turkey, Skopje, Macedonia, and Alaska served to initiate these studies. Ivan was one of the five-member AISI team sent to evaluate the Skopje and Alaskan earthquakes and their impacts on various types of structures.

Ivan continued with industrywide research on steel structures and its focus on ultimate strength design throughout his career at Bethlehem Steel and as a consultant. He became a member in 1961 of the American Institute of Steel Construction (AISC) Specification Committee, as a result of his expertise in composite construction, and served in that capacity for 40 years. His work with the AISC specifications, where he promoted research and development, led to basically new procedures considering load and resistance factor design for buildings and bridges. He served in many offices and technical committees of the American Concrete Institute, Reinforced Concrete Research Council, Engineering Foundation, American Society of Civil Engineers (ASCE), International Association for Bridge and Structural Engineering, American Institute of Steel Construction, American Iron and Steel Institute, and the Transportation Research Board of the National Academies.

His professional achievements were recognized by the ACI Wason Medal for Materials Research in 1956, the ASCE Walter L. Huber Civil Engineering Research Prize in 1958, and an ENR Construction award in 1972. He was elected to the National Academy of Engineering in 1978 for "contributions to design of structures, including composite construction, earthquake resistance, and load factor design specifications." He was elected a distinguished member of the ASCE in 1980 and received the Ernest E. Howard Award in 1991. He was honored with a Doctor Honoris Causa from the Technical University of Kosice in the Slovak Republic in 2002 as part of the celebrations marking the school's 50th anniversary.

After his retirement from Bethlehem Steel in 1982, Ivan started a new career as a private consultant, opening IMV

Consulting in 1983. He first managed the AISI-FHWA joint research project on Structural Modeling for Autostress on behalf of the engineering firm Wiss, Janney, Elstner. He also served as an expert witness in several cases and as an expert for New York engineering firms such as Ammann & Whitney for the Williamsburg Bridge cable rehabilitation.

He also devoted significant time to projects such as researching and writing books, including *The First 75 Years: A History of the Engineering Foundation*, which he coauthored with historian Lance Metz in 1991, and *75 Years of the Lehigh Valley Section of ASCE*, which he coedited with ASCE member Harold Clemmer in 1997. As editor in chief he coordinated preparation of the book *Composite Construction Design for Buildings*, published by McGraw-Hill in cooperation with ASCE in 1997. He wrote his autobiography, *An Immigrant's Story*, published in 2006 by the Xlibris Corporation.

After the fall of communism he made his first visit to Bratislava in 1990, reestablishing personal contacts with relatives and friends. He also translated into English and annotated the handwritten diaries of his uncle, General Rudolf M. Viest, who was a member of the Czechoslovakia government in exile in London during World War II and became commander of the Army in Slovakia in 1944. His uncle was captured by the Germans in 1944 and died in Berlin in 1945. The translation, entitled *Call to Arms Came in 1938*, followed closely the original text and was published in 2009.

Outside of his engineering activities, Ivan was an avid golfer and traveler. He was a member of the Saucon Valley Country Club, where he started golfing in 1973, and enjoyed dinners and luncheons with friends and regular golfing partners into 2011.

He met his wife, Barbara Kay Stevenson, in 1952 as she was completing her studies in chemistry at the University of Illinois. They married in May 1953. She preceded him in death on January 24, 2012. His older sister, Zora Jana Viestova, died in Slovakia after an accident in 2002. He is survived by his younger sister, Tatiana Maria Simkova, her daughter Tatiana Mikusova, and several nieces and nephews, all in Slovakia.

HENNING E. VON GIERKE

1917–2007

Elected in 1976

"For pioneering in the effects of noise, sonic boom, and vibration on humans; leadership in bionics; and invention of acoustic devices."

BY KENNETH M. ELDRED AND WILLIAM W. LANG

HENNING E. VON GIERKE, an eminent acoustical engineer and scientist, died March 10, 2007, at the age of 89. He did pioneering work over more than five decades on the transmission, action, and human perception of all types of mechanical energy from infrasound, vibration, impact, and blast through the audible spectrum to ultrasound in air as well as in tissue.

Henning von Gierke was born in 1917 in Karlsruhe, Germany, the son of Edgar von Gierke, a doctor and pathologist, and Julie Braun. In the late 1930s he began studying electrical engineering and acoustics at the Technical Universities in Karlsruhe and Munich, receiving a Diplom Ingenieur in 1943 and a Doktor of Engineering (communications engineering, acoustics) in 1944 from the Technical University at Karlsruhe. For his thesis he studied pure tone sound radiation from gas jets under Professor Herman Backhaus, an important researcher on sound radiation from musical instruments and loudspeakers. He then applied his knowledge of the physical instabilities of the gas jets to understand the mechanisms that enable a human to whistle. Many years later marine acousticians studying the sounds of dolphins adapted his results to marine mammals. His combined interest in physical principles governing mechanical processes and human responses formed the basis of his professional career in studying the interaction of acoustical, mechanical energy with the human organism.

The outstanding results that Henning achieved were due to a combination of several key qualities. He was a true teacher who, through quickly focused and deeply probing questions, stimulated his associates to think and to think logically. His scientific curiosity led to the development of several patented devices and to the answers to many scientific questions. A key to the success of many of his endeavors was his remarkable ability to quickly define the central core of a complex issue and then lead others in developing solutions, using both experiment and theory in balance. To these qualities he added the realization that one of the most important responsibilities of scientists is to see that scientific results are applied in a correct and timely manner. He had the energy, patience, and dedication to lead the development and adoption of national and international standards addressing human safety, health, and well-being with respect to noise, vibration, shock, and impact.

In 1947 Henning, together with several colleagues from the Helmholtz Institute, came to the United States as part of Operation Paperclip to work for the Army Air Corps in the Bioacoustic Section of the Biophysics Branch of the Aero Medical Laboratory at Wright Field, near Dayton, Ohio. His early years at Wright Field were dedicated to understanding the magnitude and effects of aircraft noise on humans. His research on intense aircraft noise exposures defined new data on human tolerance limits, noise-induced hearing loss, auditory pain, and hearing protection, all of which stand today. In 1957 he introduced with others the equal energy hypothesis as the time-intensity tradeoff for the Air Force hearing conservation regulation. He later chaired the International Standards Organization (ISO) working group that prepared and obtained consensus for the adoption of ISO 1999, which used the equal energy rule as the basis for determining the relationship between occupational noise exposure and an estimate of the resulting hearing impairment.

To address the noise problems of residents near air bases, he spearheaded the ten-year development of a comprehensive procedure for predicting aircraft noise exposure near airports, estimating community response, and land use planning for the Air Force, which was published in 1964. His methods provided the basis for the procedures in use today. In the early 1970s, he chaired the Environmental Protection Agency task force charged with meeting the Congressional mandate to "identify levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety." The findings in the task force's "Levels" and "Criteria" reports have provided the basis for nonoccupational noise criteria in the United States for the last 40 years.

One of Henning's first research studies at Wright Field was an investigation of the effects of high-intensity ultrasound on humans. Although the press had speculated on an "ultrasonic sickness," the research soon demonstrated that there was no significant effect of airborne ultrasound on the hearing of humans and that any annoyance was eliminated by wearing hearing protectors. The results of measurements of the acoustic absorption of the skin led to mechanical impedance measurements and fundamental studies of the physics of vibrations in human tissue. The results of these studies, understood only after analyzing the roles of transverse shear waves, compression waves, and surface waves in body tissues, enabled calculation of some of the unknown physical parameters of tissue. This whole body of information enabled Henning to develop, among other things, a lumped parameter model of the helmet-earmuff-earplug system which is still in use. Several models of other aspects of the human mechanical system were developed, which helped to explain and unify the results of vibration and impact experiments over the infrasonic and sonic frequency ranges accumulated over the years by researchers on both animals and humans.

Henning's work led to the development of human tolerance criteria for vibration and shock that were used as the basis for a comprehensive set of ISO safety and performance consensus standards for vibration exposure. His studies are documented in over 160 publications on noise exposure and its effects on biodynamics of human exposure to impact, crash and vibration loads, vestibular effects, and protection against hazardous force environments.

Henning's laboratory grew from the bioacoustics section to a branch that he headed and expanded in 1956 to a division that would be called the Biodynamics and Bioengineering Division of the Armstrong Aerospace Medical Research Laboratory. He directed this division from 1956 to 1988, when he retired to become its technical advisor. He was an inspiring leader and teacher not only for the division's research scientists but also for top scientists from around the world who came to work in the laboratory with its unique facilities for periods of a few weeks to years.

From the 1950s on Henning provided consultations to many organizations, including the Army on impulsive noise and blast; the Navy on underwater noise exposure; NASA on radiation of rocket noise and blast and the effects of noise, acceleration, and motion on astronauts, ground personnel, and communities; the FAA on airport noise; the EPA on the full range of environmental noise issues; and the automotive industry on noise and impact. He was a clinical associate professor in the Department of Preventive Medicine at Ohio State University and a clinical professor in the Department of Community Medicine at Wright State University.

Henning was a member of the Acoustical Society of America (ASA) for 45 years, a fellow since 1956, and its president in 1979–80. He was the leader in the development of the Society's Standards Program, chairing the Committee on Bioacoustics and serving as the first ASA standards director. For many years he organized and led the US delegation to the ISO TC/43 Technical Committee on Noise, and for 30 years he chaired the ISO TC/108 Subcommittee SC4 on human exposure to mechanical shock and vibration. He was a member and chairman of the National Research Council Committee on Hearing, Bioacoustics, and Biomechanics and was actively involved with several of its working groups. He was a member and past president of the International Commission on Biological Effects of Noise, a member and chairman of the American National Standards Institute Acoustical Standards Management Board, and a member of the Institute of Noise Control Engineering and the Aerospace Medical Association.

The honors and awards received by Henning clearly reflect his international stature and identify some of the organizations that he served so well. He was a fellow and vice president of the Aerospace Medical Association and received its Eric Liljencrantz Award in 1966, the Arnold D. Tuttle Award in 1973, and the John Paul Stapp Award in 2004. He was an elected member of the US National Academy of Engineering, the International Academy of Aviation and Space Medicine, and the International Academy of Astronautics. He received the Department of Defense Distinguished Civilian Service Award and its Meritorious Executive Presidential Rank Award for outstanding government service, and in 1981 the Distinguished Executive Award by the President on the United States. He was awarded the Commander's Cross of the Order of Merit of the Federal Republic of Germany, the Acoustical Society of America's Distinguished Service Citation, its Silver Medal in Noise and its Gold Medal Award, the H.R. Lesser Award by the American Society of Mechanical Engineers, and the Rayleigh Medal from the UK Institute of Acoustics.

In 1950 Henning married Hanlo Weil, the daughter of two noted artists. He was a devoted husband and father, and later a warmhearted grandfather. He had an avid interest in the musical, athletic, and educational activities of his children and grandchildren, and was never at a loss for advice and support. As a senior citizen he entered the computer age with great enthusiasm, maintaining lively and often stimulating email relationships with friends, family, and former colleagues. In his retirement he was committed to working for the Friends Care Community in his hometown of Yellow Springs, Ohio. He was instrumental in its founding and, as a member of the board, was involved in its expansion to include assisted living, independent living, and future apartments. He enjoyed strategic planning for the Friends Care Community and brought considerable energy to its board, even in the last year of his life.

He is survived by his daughter, Karin, and her husband, Peter Croton, and their children, Lukas Henning and Johanna Maruko. His wife passed away in 2007 and he was preceded in death by his daughter Susi, who passed away in 2002.

Joseph E. Warren

JOSEPH E. WARREN

1926–2012

Elected in 1993

"For contributions to development of fractured reservoir mechanics and application of economic risk analysis."

BY R. LYNDON ARSCOTT

JOSEPH E. WARREN, a distinguished petroleum engineer, passed away on June 16, 2012, at age 85. He served in the Navy (1943–1946) and then pursued a BS degree in petroleum engineering at the University of Pittsburgh (1951). After working for a few years at the Stanolind Oil Company in Tulsa, he continued his studies at Pennsylvania State University, where he completed his MS (1954) and PhD (1960) in petroleum engineering.

At Penn State, Joe became interested in computers in the early days of the UNIVAC II and developed numerical techniques to simulate oil and gas reservoirs. When he joined Gulf Oil Corporation's Research and Development Company (GR&DC) in Harmarville, Pennsylvania, in 1956, he recruited and trained a digitally oriented reservoir engineering group to perform major reservoir studies and evaluations. His pioneering work in the early 1960s included water flooding, miscible displacement, in situ combustion, hydraulic fracturing, and the behavior of naturally fractured reservoirs. He published a number of papers with fellow researchers including P.J. Root, J.H. Hartsock, H.S. Price, and F.F. Skiba.

In 1963 Joe was appointed general superintendent of reservoir development for Kuwait Oil Company, with which Gulf had a contractual agreement. He evaluated operations, recommended organizational changes in oil field operations, installed the first computer system, and discovered deeper reservoirs in the giant Burgan field based on systematic analysis of old logs. He also directed studies for a new mammoth tanker facility.

In the late 1960s he worked with G. Rowan to use statistical techniques to develop a systems approach to oil and gas operations. At the time, the oil industry was building very large crude carriers that needed carefully planned storage systems to optimize the scheduling of crude shipments. Joe developed network models for port facilities, fleet schedules, and refinery capacity in some of the world's major oil-exporting terminals. He also published and made numerous presentations on decision analysis in exploration and production of oil and gas.

From 1966 to 1969, as director of the production division and later the exploration and production division of GR&DC, Joe was a prime supporter of an innovative R&D project that involved pumping fluid containing steel particles at high pressure (10,000 psi) to drill into deep, hard rock formations. The project solved numerous technical challenges such as the development, with Halliburton, of a pump intensifier capable of pumping abrasive, laden, viscous drilling mud up to 15,000 psi; a drilling bit and nozzles that could withstand the severe abrasion from the high-pressure abrasive fluid; and a surface separation system to separate fine formation particles from the viscous fluid. The project was field tested but did not become commercial because of the high cost; and because it was company confidential very few papers were published on the technical accomplishments.

In 1970 Joe was appointed vice president of Santa Fe International Corp. and president of Santa Fe Minerals Company, with responsibility for worldwide exploration, production, transportation, and joint venture activities. He played a leading role in the development of the Thistle Field in the UK North Sea and negotiated concession agreements in numerous countries, including Tunisia, Egypt, Cameroon, Yemen, and Burma. He also developed the "total project" concept, whereby an equity position could be secured in a newly discovered field through a package comprising planning, project management, construction and drilling services, and financing.

After his tenure at Santa Fe, Joe consulted for Gulf Oil and many other companies on a wide range of oil and gas industry issues. He had a special aptitude for the evaluation of oil and gas fields. His sound understanding of fluid flow in porous media was combined with insightful economic reasoning and an acute ability to apply statistical analysis to estimate the value of a field and the risks involved in its development. He also had extensive experience as an expert witness and participated in a number of arbitrage hearings, as both a witness and an arbitrator.

In 1988 he cofounded and then chaired a small oil and gas company called Frontier Resources International, with interests in Africa, the Middle East, and the United States.

Joe willingly shared his knowledge through more than 50 technical papers and multiple presentations. He had a keen intellect, read widely, and loved to debate anything and everything. He was an excellent writer and started a column for the *Journal of Petroleum Engineering* called "In my opinion," in which the follies of oil companies and producing countries were elegantly exposed. After each article, the staff and board members of the Society of Petroleum Engineers (SPE) would receive comments that were either enthusiastically supportive or aggressively opposed to Joe's view. He made people think and he generated a great deal of discussion.

He was an active supporter of SPE throughout his career. He was awarded the society's Anthony F. Lucas Gold Medal in 1984 and its highest honor, honorary membership, in 2009. He served as a distinguished lecturer and as senior technical editor of the *Journal of Petroleum Technology*. In 1993, he was elected to the National Academy of Engineering for his contributions to petroleum engineering.

He is survived by children Kevin and Sean Warren, Sheila Anderson, Brendan Warren, and Siobhan Foster; grandchildren Shea, Taylor, Casey, Devin, Connor, Cameron, Aidan, and Liam; and brothers Jeffrey and James Warren. His wife Lois M. predeceased him.

Michael Yachnis

MICHAEL YACHNIS

1922–2012

Elected in 1985

"For innovative design of naval installations, deep ocean simulating, and hyperbaric facilities."

ANGELICA LOWER AND ANTHONY YACHNIS
SUBMITTED BY THE NAE HOME SECRETARY

MICHAEL YACHNIS, former chief engineer of the Naval Facilities Engineering Command, died on June 24, 2012, at the age of 90.

Michael was born in Athens, Greece, in the working-class neighborhood of Gargaretta, in the shadow of the Acropolis and Filopappos Hill, on March 22, 1922. The youngest of seven siblings, he grew up playing on the surrounding hills, singing in the church of St. John, and spending summers with his cousins at nearby Kavouri beach.

His dreams of becoming a Greek Orthodox priest were overtaken by the desire to defend his country, and in 1940 he entered the Greek Military Academy, the Scholi Evelpidon, to study civil/structural engineering. His education was sidelined, however, by the German occupation in April of 1941. His ability to think on his feet and to put together teams of experts to solve specific problems may have been a direct result of his military service and survival during World War II, which included his participation in the Battle of Crete as a 19-year-old academy cadet, his capture and imprisonment by the Germans, his release and return to Athens to fight and to work with British Intelligence on troop movements, and his participation in the National Resistance and Greek Civil War of the late 1940s against the communists.

Michael resumed his education after the wars and received a bachelor's degree in civil engineering from the Greek Military Academy in 1948, working as an army engineer building roads in Northern Greece (which included laying minefields) and constructing housing for the Greek army. He attained the rank of major and, having learned English from his British and American allies, traveled to the US Army Corps of Engineers School at Fort Belvoir, Virginia, in the early 1950s.

It was during this time that he met his future wife, Athena Spyropoulos, gave up his commission, and immigrated to the United States. The couple was married in 1953. Their son Anthony was born in 1957 and their daughter Angelica in 1960.

Settling in Washington, DC, he started working for the US Navy's Bureau of Yards and Docks' Chesapeake Division as the structural engineering branch manager in 1956 and continued his education at the George Washington University, where he earned his MSc in civil engineering in 1956, a master's in engineering administration in 1962, and a DSc in civil engineering in 1968.

He loved sharing his knowledge and experiences, and so he became an adjunct professor of civil engineering and taught several generations of students topics such as ocean engineering, special structures (e.g., antennas, floating platforms), and design and cost analysis of civil engineering structures. He stressed the practical aspects of engineering by giving students the opportunity to read actual design drawings, do quantity take-offs and cost estimates, and explore nondestructive testing. A popular field trip for his students was to the National Bureau of Standards (now the National Institute of Standards and Technology) to observe the latest structural testing methods.

A dedicated public servant, Michael worked his way up through the ranks at the Bureau of Yards and Docks, later the Naval Facilities Engineering Command (NAVFAC), to become chief engineer in 1972. In that position, he provided the highest level of interdisciplinary engineering and design consultation and expertise to all components of the Navy, other federal agencies, and private industry. He assembled and led a team of engineering consultants that could mobilize at a moment's notice and travel anywhere in the world to solve the most complex and difficult facilities engineering challenges. He and his consultants were dubbed the "SWAT squad" by NAVFAC's former chief of civil engineers, RADM Albert R. Marschall. The team consisted of consultants in special structures, metallurgy, petroleum fuels and energy, geotechnical and pavements, waterfront facilities, antenna systems, hyperbaric facilities, roofing systems, weight handling equipment, earthquake engineering, and environmental engineering.

In 1985 Yachnis compiled *Lessons Learned from Design and Construction of Naval Facilities* (NAVFAC P1010), with short descriptions of the wide array of projects his team had solved and the resulting savings to the government (more than $100 million). Here are a few noteworthy examples: development of a first-of-its-kind concept for simultaneous drydocking of two nuclear submarines in Pascagoula, Mississippi, saving $10 million and enabling the earlier return of submarines to operational areas; development of a creative method of load test and stress analysis to determine the structural adequacy of the Aircraft Test and Evaluation Facility in Patuxent River, Maryland, saving $1.5 million; development of an innovative technique to repair underground fuel storage tanks in Sasebo, Japan, saving $4.1 million; design of a prototype method for repairing the base insulator on the 1,200-foot tower at the Naval Communications Station in Annapolis, Maryland, saving $900,000 and averting interruption of vital fleet communications; evaluation of the structural adequacy of Graving Dock No. 3 at Mare Island Naval Shipyard in Vallejo, California, resulting in the design of a cost-effective repair scheme that saved $1.3 million; and development of a unique method for testing the 40-foot-diameter autoclave used to cure the Trident submarine Fiberglas sonar dome, saving $500,000 and preventing serious disruption of critical operational schedules. Efficient, cost-effective solutions to tough engineering problems were the hallmark of Yachnis' work and established his reputation as the "go-to guy" at NAVFAC.

In addition to his consulting team, he chaired the Technical Review Board for graving docks, marine railways, and vertical lifts, and the System Certification Board for manned and unmanned hyperbaric facilities. He represented NAVFAC at conferences all over the world, giving papers on topics such as seismic design and underwater structures. He holds a patent for an original method of drydocking ships and submarines.

Yachnis received many honors and awards, beginning with five medals for Distinguished Military Service from the Greek Army. He was awarded the Goethals Medal from the Society of American Military Engineers (1972), the George Washington University Alumni Achievement Award (1976), the DC Council of Engineering and Architectural Societies' Engineer of the Year (1980), the Senior Executive Service Achievement Award and Presidential Rank Award for Distinguished Executive in the Senior Executive Service (both in 1982), and the Department of Defense Distinguished Civilian Service Award (1985). He was elected to the National Academy of Engineering in 1985.

In 1974, he decided to make a lifelong dream come true: he became a Greek Orthodox priest, volunteering through a special Archdiocesan program for lay persons. Fr. Michael served the Dormition of the Virgin Mary Greek Orthodox Church in Winchester, Virginia, from 1975 to 2004, traveling with his wife Athena from their home in DC every Sunday to perform the liturgy and visit the sick. For nearly 30 years he provided his love and spiritual guidance to the community of Winchester, oversaw several projects to enlarge the church facilities, and aided in fund raising for the church throughout the DC area. He performed most of the duties of a professional parish priest for only gas money, a car, and lunch. He also helped perform services for the Greek community in Ocean City, Maryland, on his summer vacations. He was much beloved by the Greek community for his many years of selfless volunteer service.

Fr. Michael's hobbies included watercolor painting, walking, and following international soccer. An avid fisherman, he enjoyed reciting the Divine Liturgy while waiting for the next bite. He especially enjoyed spending time with his family and was an exceptionally proud grandfather.

He is survived by his wife of 57 years, Athena; Anthony, a neuropathologist in Gainesville, Florida, where he and his lovely wife Wanda have two children, Michael and Kathryn; and Angelica, a civil engineer who lives in Alexandria, Virginia, with her wonderful husband Robert Lower and sons Joseph and Anthony.

APPENDIX

Members	Elected	Born	Deceased
John E. Anderson	1991	March 12, 1929	November 4, 2012
David H. Archer	1989	January 20, 1928	June 24, 2010
Richard E. Balzhiser	1994	May 27, 1932	December 23, 2012
Jeffrey S. Beck	2011	October 23, 1962	April 7, 2012
Michel Boudart	1979	June 18, 1924	May 2, 2012
Harry E. Bovay Jr.	1978	September 4, 1914	May 24, 2011
Robert A. Charpie	1975	September 9, 1925	October 13, 2011
Bernard L. Cohen	2003	June 14, 1924	March 17, 2012
W. Gene Corley	2000	December 19, 1935	March 1, 2013
Dale R. Corson	1981	April 5, 1914	March 31, 2012
Thomas M. Cover	1995	August 7, 1938	March 26, 2012
Charles A. Desoer	1977	January 11, 1926	November 1, 2010
Anthony G. Evans	1997	December 4, 1942	September 9, 2009
Sheldon K. Friedlander	1975	November 17, 1927	February 9, 2007
E. Montford Fucik	1974	January 25, 1914	April 6, 2010
Tasuku Fuwa	1979	August 2, 1915	November 23, 2013
Alan N. Gent	1991	November 11, 1927	September 20, 2012
Donald W. Gentry	1996	January 18, 1943	July 2, 2012
Norman A. Gjostein	1990	May 26, 1931	April 5, 2006
James N. Gray	1995	January 12, 1944	January 28, 2012
Wilson Greatbatch	1988	September 6, 1919	September 27, 2011
William A. Gross	1996	November 17, 1924	February 20, 2011
Andrew R. Hileman	1999	August 28, 1926	February 3, 2012
Jan Kaczmarek	1977	February 2, 1920	October 18, 2011
Charles H. Kaman	1967	June 15, 1919	January 31, 2011
Stanley Kaplan	1999	August 29, 1931	June 6, 2011
James R. Katzer	1998	September 30, 1941	November 2, 2012
Helmut Krawinkler	2012	April 6, 1940	April 16, 2012
Benson J. Lamp	1998	October 7, 1925	September 14, 2012
James F. Lardner	1985	May 24, 1924	December 17, 2012
Yao Tzu Li	1987	February 1, 1914	August 14, 2011
Hans W. Liepmann	1965	July 3, 1914	June 24, 2009
John Lowe III	1974	March 14, 1916	January 2, 2012
Bruce T. Lundin	1976	December 28, 1919	January 24, 2006

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Members	Elected	Born	Deceased
Lucien C. Malavard	1980	October 7, 1910	March 2, 1990
William McGuire	1994	December 17, 1920	January 31, 2013
Harold L. Michael	1975	July 24, 1920	August 2, 1999
Harold Somers Mickley	1978	October 14, 1918	December 3, 2011
Yasuo Mori	1986	February 24, 1923	March 20, 2012
Richard B. Neal	1979	September 5, 1917	November 22, 2012
David Okrent	1974	April 19, 1922	December 14, 2012
Charles R. O'Melia	1989	November 1, 1934	December 16, 2010
Robert J. Parks	1973	April 1, 1922	June 3, 2011
Paul E. Queneau	1981	March 20, 1911	March 31, 2012
Irving S. Reed	1979	November 12, 1923	September 11, 2012
George A. Roberts	1978	February 18, 1919	February 15, 2013
Warren M. Rohsenow	1975	February 12, 1921	June 3, 2011
Carl H. Savit	1995	July 19, 1922	March 21, 1996
A. Richard Seebass	1985	March 27, 1936	November 14, 2000
Michael R. Sfat	1994	October 28, 1921	October 16, 2012
Josef Singer	1981	August 24, 1923	November 12, 2009
Sigurd A. Sjoberg	1974	September 2, 1919	March 26, 2000
Lawrence H. Skromme	1978	August 26, 1913	December 3, 2012
William E. Splinter	1984	November 24, 1925	September 26, 2012
Arthur M. Squires	1977	March 21, 1916	May 18, 2012
Willem P.C. Stemmer	2012	March 12, 1957	April 3, 2013
John Avery Tillinghast	1974	March 30, 1927	May 7, 2011
Charles E. Treanor	1990	October 22, 1924	May 27, 2012
Bernard A. Vallerga	1987	December 11, 1921	January 5, 2013
Charles M. Vest	1993	September 9, 1941	December 12, 2013
Ivan M. Viest	1978	October 10, 1922	February 11, 2012
Henning E. von Gierke	1976	May 22, 1917	March 10, 2007
Joseph E. Warren	1993	August 19, 1926	June 16, 2012
Michael Yachnis	1985	March 22, 1922	June 24, 2012