Profiles in Engineering Leadership

Eta Kappa Nu's
First Century Eminent Members

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Table of Contents

Preface

2004 marks the 100th anniversary of Eta Kappa Nu. During its first century over 100 electrical and computer engineering leaders were elected to its highest grade: Eminent Member.

This book is intended as an inspirational history for electrical and computer engineering students and young electrical and computer engineers. Its purpose is to demonstrate how those profiled provided outstanding leadership in one or more of several areas: invention, education, professional society activities, government service, and the corporate world.

Among those included are Nobel Laureates Charles Townsend, Jack Kilby, and John Bardeen; pioneers Lee de Forest and Vladimir Zworykin; IEEE leaders Donald Glen Fink, Richard Gowen, and Jerome J. Suran; corporate founders William Hewlett and Simon Ramo; and leaders in government Vannevar Bush and Jerome Wiesner, to name but a few.

We are indebted to the IEEE Foundation for its generous support of this project, and to Frederik Nebeker, Senior Research Historian at the IEEE Center for the History of Electrical Engineering, who oversaw the research and writing of the book. Others who graciously provided supplemental material, read copy, or otherwise assisted include Berthold Sheffield, Larry Dwon, Eric Herz, Ronald A. Spanke, Jutta Willmann, Nancy T. Hantman, and Donald Christiansen.

Karl Martersteck
President, Eta Kappa Nu

A Brief History of Eta Kappa Nu

On September 23, 1904, two students at the University of Illinois met on the steps of the campus engineering building to consider the formation of an electrical engineering society. One of them, Maurice L. Carr, later recalled that their one enthusiastic agreement had been that such a society was needed; their views on exactly what the organization would achieve varied widely.

Five weeks later the founding group was complete. Besides Carr, it consisted of Charles E. Armstrong, Ralph E. Bowser, Carl K. Brydges, William T. Burnett, Hibbard S. Greene, Frank W. Winders, Edmund B. Wheeler, Milton K. Akers, and Fred D. Smith.

The original purpose of the society was to help electrical engineering graduates find employment and in other ways gain a foothold in their careers. Scholarship was not the only membership requirement. As Carr put it: "We did not propose to ignore scholastic standing . . . but we did not propose to debar a good man because he was not a good student in all subjects . . ." [Carr would undoubtedly include women were he making his statement today!]

The association finally settled on its name, Eta Kappa Nu, and qualifications for membership that exist to this day: The student must be in the upper quarter of his/her junior electrical/computer engineering class or the upper third of the senior class, requirements that are sometimes tightened. Other qualifications relate to ingenuity, imagination, practical innovation, and problem-solving ability. Characteristics that are also weighed include character and service to others.

As for the purpose of the organization, what emerged over the years was an amalgam of many suggestions. The association has proved an incentive to excel by recognizing the achievements of both students and working engineers. It has established rapport among faculty members, students, and alumni, and has encouraged engineers to become well-rounded.

The association's goals have changed throughout the years to

accommodate the times, as three long-time active members of Eta Kappa Nu agreed when they met in 1979, on the occasion of the 75th anniversary of Eta Kappa Nu. The three were Larry Dwon, the official historian, Berthold Sheffield, national publicity chairman of the association, and Roger I. Wilkinson, founder of the Outstanding Young Electrical Engineer Award. During the Depression of the 1930s Eta Kappa Nu's goal, especially in the alumni chapters, was to help its members find work, the three recalled, adding that the period was one they remembered with much warmth.

To function as more than just an honor society, Eta Kappa Nu members have served not only the electrical engineering profession, but society as a whole. Beginning with the college chapters, members are encouraged to carry out a variety of productive activities. Included are the tutoring of fellow students, the encouragement of K-12 math and science programs, and the organization of science fairs and exhibits for attendance by the general public. The alumni chapters have a dual obligation: to help fellow members in their professional lives and to guide college chapters.

The awards that Eta Kappa Nu presents annually cut a wide swath in the field of electrical engineering. They include the following:

- The Outstanding Young Electrical Engineers Award (established in 1936). The requirements of this recognition represent the qualities the organization encourages in all its members. Nominees are evaluated for technical achievements, service to the profession, and cultural achievements. Nominees for this award must be no more than 35 years old.

  When Eta Kappa Nu historian Larry Dwon analyzed more than 900 nominees' dossiers that had been submitted since the award was originated, he observed in the candidates a great capacity for and a genuine willingness to work hard, a strong desire to educate themselves over a wide spectrum of interests, an ability to set and pursue goals early in their careers, an ability to maximize their innate abilities, a facility for gaining cooperation from others, and a selflessness reflected in the contributions to society.

It is no surprise that among the winners of this award, several went on to be recognized for their subsequent contributions through even more prestigious awards, such as major awards of the IEEE or the U.S. government, or election to Eta Kappa Nu's highest grade, Eminent Member.

- Vladimir Karapetoff Award. This major award is presented annually to an electrical or computer engineering practitioner for an invention, discovery, or development that has demonstrated a significant and long-term positive impact on the welfare of society.

- The Zerby-Koerner Outstanding Electrical Engineering Student Award. Established in 1965, this award is given annually to one or more electrical/computer engineering students who typify the best balance of scholarship, service, leadership, and character.

- The C. Holmes MacDonald Outstanding Teacher Award. This was established in 1972 and is awarded annually to a teacher of electrical or computer engineering to recognize the central role of college professors in educating, motivating, and serving as a role model for future engineers. Recipients must be no more than 35 years of age.

- Distinguished Service Award. Initiated in 1971, this award is given to a member of Eta Kappa Nu who has rendered outstanding service to the association over an extended period of time.

- Eminent Membership. This is bestowed by Eta Kappa Nu upon those individuals who, by their technical attainment and contributions to society, have shown themselves to be outstanding leaders in the field of electrical engineering and great benefactors to society.

Eta Kappa Nu's major publication, *The Bridge*, began as a small four-page leaflet in 1906. It was then called the *Electrical Field*, and published twice a year. It was followed in 1910 by *The Year Book*, a 44-page booklet issued annually. In 1914, *The Bridge* became the

official name of the yearbook, with 160 pages, and in 1919 *The Bridge* became a quarterly publication.

Eta Kappa Nu's initiation ceremony stresses character development. Members must be willing to undertake hard and sometimes even disagreeable work.

"Do not make the false assumption that the world owes you a living," the initiate is told. "On the contrary, by virtue of your superior talents and extensive training, you owe it to your fellow men to aid and assist them whenever they need something that is within your power to give." When a job seems a bit too routine, they are urged to "make the most of the materials you have at hand, and strive to produce as creditable a product as is possible."

Adapted from the article "The secret society that never was," by John F. Mason, IEEE Spectrum [September 1979], with additions by Eta Kappa Nu Eminent Members Larry Dwon and Berthold Sheffield.

Origins of the Eminent Member Designation

The category of Eminent Member was proposed by three members of the Eta Kappa Nu National Executive Council, Morris Buck, B. F. Lewis, and Alton B. Zerby. It was approved in 1941 by means of an article in the Eta Kappa Nu constitution.

The article stated in part: "Eminent membership may be offered only to those individuals who by their attainments and contributions to society have shown themselves to be outstanding leaders in the field of electrical engineering and great benefactors to their fellow men." Today "electrical engineering" is construed to encompass electrical and computer engineering.

It was not until 1950 that the first Eminent Members were inducted. Other priorities during World War II and the years immediately following were thought to be at the root of the delay. Also, in the interim the criteria for selection and the process by which candidates were to be nominated and approved needed to be determined, and a ceremony befitting the honor had to be designed.

The first three Eminent Members were inducted by Eta Kappa Nu president Robin Beach. They were Vannevar Bush, Royal W. Sorensen, and Vladimir K. Zworykin. Assisting in the ceremony were Zerby, F. E. Sanford, E. B. Kurtz, T. W. Williams, and Eric T. B. Gross. The inductees were escorted by C. F. Dalziel, Everett M. Strong, and Eric T. B. Gross. An account of the event appeared in the March, 1950 issue of *The Bridge*.

Candidates for election to Eminent Member are brought to the Board of Governors by the Eminent Member Committee. Eminent Member candidates are judged for their leadership and accomplishments in one or more of several areas: innovation and invention, education, professional society activities, government service, and the corporate world.

Each Eminent Member-Elect is inducted at a ceremony conducted by the president of Eta Kappa Nu or his designee.

As Eta Kappa Nu approaches its 100th anniversary, 101 Eminent Members have been inducted since the inception of the honor. Another seven Eminent Members-Elect are awaiting induction.

Donald Christiansen, Chairman
Eminent Member Committee

Electrical Engineer,
Computer Pioneer, and Educator

Vannevar Bush

1950

Eta Kappa Nu Eminent Member

VANNEVAR BUSH was the conceptual creator of the hypertext system, which presaged the Internet's information highway. Born in Everett, Massachusetts on 11 March 1890, he began his academic career at Tufts College, where he earned his M.S. Degree in the time it usually takes to earn a bachelor's degree. Upon completion of his Ph.D. from MIT in 1917, Bush accepted a position at Tufts College as assistant professor. Two years later he joined MIT's Department of Electrical Engineering, where he worked for twenty-five years, teaching, designing analog computers, and developing theories that transformed information processing. In 1923 he became a professor of electric power transmission, and in 1932 he became the Vice President of MIT and Dean of the School of Engineering. Bush believed that government would benefit from the sound advice of experts. His efforts to create a relationship between the government and the scientific community, especially during World War II, transformed the way scientific research was conducted in the U.S. and fostered the environment in which the Internet was later created. Bush also held influential positions during World War II, including president of the Carnegie Institute in Washington, DC (1939), chair of the National Advisory Committee for Aeronautics (1939), and director of the Office of Scientific Research and Development, where he presided over contracts to 6,000 scientists involved in the war effort. This appointment allowed him to be a central figure in the development of nuclear fission and the Manhattan Project. In 1947, Bush was appointed director of AT&T, and one year later he became the director of Merck and Co.

Many consider his work on the Differential Analyzer, developed in 1935, to be Bush's most valuable contribution. Although massive, complex, and cumbersome, the Differential Analyzer was a groundbreaking development that showed the utility of analog computers. Bush also tremendously influenced military research. In 1940, he met with President Franklin Roosevelt and proposed the National Defense Research Committee (NDRC). This committee brought together government, military, business, and scientific leaders to coordinate military research. Bush was made chairman and given a direct line to the White House. Following the end of the war, he wrote a groundbreaking article, "As We May Think," which promoted the study of ways to augment human thought. In the article he described the creation of "Memex", a machine that expanded upon his invention of the Rapid Selector (a microfilm storage and information retrieval device), which would extend the powers of human memory. This system was very similar to modern hypertext. In the private sector, Bush was a cofounder of Raytheon, one of the United State's largest defense contractors. He was also president of the Carnegie Institute of Washington research organization from 1939 to 1955.

Bush's scientific contributions led to many awards and honors, including the Lamme Medal from the American Institute of Electrical Engineers (AIEE) in 1935, the Holley Medal of the American Society of Mechanical Engineers in 1943, and the National Medal of Science in 1964. Bush was named an AIEE Fellow in 1924, and Eta Kappa Nu named Bush its first Eminent Member in 1950. Bush died 30 June 1974. He was married to Phoebe Davis and they had two sons, Richard and John. ✦

Engineer, Educator,
and Inventor

Royal Wasson Sorensen

1950

Eta Kappa Nu Eminent Member

ROYAL WASSON SORENSEN was a leader in the field of high-voltage, long-distance electrical transmission, and he invented a vacuum switch for high-current electrical circuit. Born in a log cabin in Waubansee County, Kansas on 25 April 1882, he graduated from the University of Colorado in 1905 with a B.S. degree in electrical engineering. He then worked as a testman and a transformer designer for the General Electric Company in Pittsfield, Massachusetts. In 1910, Sorensen decided to leave industry and join the Throop Polytechnic Institute, which became Caltech in 1921. He taught electrical engineering from 1910 to 1952 at Throop/Caltech, serving as a lecturer, as a professor, and as head of the electrical engineering department. Sorensen researched for the U.S. military during World War I and World War II, and worked as a consultant for Pacific Light and Power, Southern California Edison, U.S. Electric and Manufacturing Company, and General Electric. A major proponent of graduate education in the engineering field, Sorensen conceived a plan for engineering graduate studies at Caltech. His dedication to Caltech and its students helped place the growing institution at the forefront of the advanced engineering education movement with a strong base in science and mathematics. Twice during his career, Sorensen traveled abroad at the behest of the U.S. government to help establish technological institutions in Japan and India. He was named professor emeritus in 1952, but continued to serve the Caltech community through his participation with volunteer, collegiate, and professional organizations.

In addition to Sorenson's role as an advocate of engineering graduate studies and his contributions to Caltech's strong position in the science and mathematics fields, he was one of the first to envision the potential of a grid-system to convey electrical power in large-scale and long-distance transmissions. His High Voltage Research Laboratory at Caltech, the first million-volt, 60 megahertz lab with a two million volt surge generator, was the only one of its kind in the nation, offering a place where power engineering problems could be solved. Built in conjunction with Southern California Edison, the laboratory signified Sorensen's premier position in the pioneering California power project and his vision for large-scale power engineering connections and grids. Sorensen designed the transformers used in the High Voltage Laboratory and conceived the million volt power's flow through four transformers in a chain/ cascade connection. The Hoover Dam project would attest to the importance of his guidance in the long-distance transmission of electrical current. In addition to his work with Southern California Edison and the High Voltage Laboratory, he invented a vacuum switch for high-voltage electrical systems in 1923. Although his invention would not become commercially feasible until vacuum technology and metallurgy advanced to state of reliability in the 1960s, the merits of Sorensen's original invention would be recognized by the placement of his vacuum switch in the Smithsonian Institution in 1962 for permanent exhibit.

Sorenson's contributions earned him the Distinguished Engineering Alumnus Award from Caltech in 1966. He was also actively involved with the youth, was instrumental in establishing the Cal Tech branch of the YMCA in 1916, and served on its Board of Directors into the 1960s. Later in life, he became involved with air pollution control and sat on the Joint Research Council on Power Plant Air Pollution Control from the mid-nineteen fifties until his passing. Sorenson was named an American Institute of Electrical Engineers (AIEE) Fellow in 1919, and Eta Kappa Nu named him an Eminent Member in 1950. He was married to Grace Milner, and they had four children. Sorensen died in his Pasadena, California home on 27 October 1965 at the age of 83. ✦

Inventor and Television Pioneer

Vladimir K. Zworykin

1950

Eta Kappa Nu Eminent Member

VLADIMIR K. ZWORYKIN was a pioneer in television camera tube technology, which underlay the development of all-electronic television. Born 30 July 1889 in Mourom Russia, Zworykin attended the St. Petersburg Institute of Technology where he earned his B.S. degree in electrical engineering in 1912. While studying in Russia he met and worked with Boris Rosing, who was experimenting with mechanical-scan television. Zworykin gave much credit to Rosing for inspiring his own interest in electronics and television. Following his graduation from St. Petersburg, he attended the College de France, where he studied theoretical physics and the X-ray under renowned Professor Paul Langevin. During World War I, he served as a radio officer in the Russian Army. Following the war, he immigrated to the United States and went to work for Westinghouse Electric Corporation. While working for Westinghouse he became a naturalized citizen and earned his Ph.D. from the University of Pittsburgh in 1926. In 1929, he joined the Radio Corporation of America (RCA), and in 1942 became Associate Research Director for RCA Laboratories. In 1946 he was named RCA's Director of Electronic Research. In 1947 he assumed the additional role as a vice president and technical consultant for RCA, a position he held until his retirement in 1954.

In 1923, Zworykin's research appeared to be paying off. He applied for a patent for the iconoscope camera tube and in 1924 demonstrated his invention to Westinghouse executives, who were unimpressed. In 1929, he was transferred to RCA, (Westinghouse held significant

stock holdings in RCA) and announced the development of the kinescope. These two inventions threatened the mechanical system of whirling perforated disks that dominated the earlier years of television development, and laid the foundation for color television. While at RCA, he also met and worked closely with David Sarnoff, who contributed to Zworykin's technical achievements. In 1940 he invited James Hillier to join his research group and oversaw Hillier's development of the electron microscope. During World War II, he and his colleagues developed infrared detectors that were used in sniper-scopes. Following his retirement from RCA, he became Director of the Medical Research Laboratory at the Rockefeller Institute in New York, where he was concerned with medical applications of electronics.

Zworykin remained active following his departure from the Rockefeller Institute in 1962, maintaining an office at the David Sarnoff Research Center. During his career he was awarded 120 patents and authored or co-authored six books on technology and television. A member of the National Academy of Sciences and the National Academy of Engineering, he received IRE's Morris Liebmann Award in 1934 for his contribution to television, the Rumford Medal from the American Academy of Arts and Sciences in 1941, the Lamme Medal from the American Institute of Electrical Engineers in 1949, IRE's Medal of Honor in1951, and the National Medal of Science in 1966. In addition, IRE established the Vladamir Zworykin Award in his honor in 1951. He was named an Institute of Radio Engineers Fellow in 1938 and an AIEE Fellow in 1945. Eta Kappa Nu named him an Eminent Member in 1950. Zworykin died on 29 July 1982 in Princeton, New Jersey. He was married twice and had two children. ✦

Electrical Engineer
and Research Director

Karl B. McEachron

1951

Eta Kappa Nu Eminent Member

KARL B. MCEACHRON was the first engineer to make a field investigation of the effect of a portable lightning generator on high voltage power lines. Born 17 November 1889 in Hoosick Falls, New York, McEachron's pioneering work on the effects of electrical storms on high-tension power lines made it possible to initiate new safety protocols. McEachron earned degrees in electrical and mechanical engineering from Ohio Northern University in 1913. In 1914, he went to work for the General Electric Company in Pittsfield, Massachusetts, but later that same year accepted a position teaching electrical engineering at Ohio Northern University. He remained there until 1918 when he became an instructor in electrical engineering, a research assistant, and later an associate at the Engineering Experiment Station of Purdue University. While there he earned his M.S. degree in 1920. He rejoined General Electric in Pittsfield in 1922 and headed up research and development in the lightning arrester department. In 1945, he became an assistant works engineer, and in 1949 he became the manager of engineering.

McEachron's initial work at General Electric entailed the application of laboratory methods to test insulators and protective apparatus on high-tension power lines. Specifically, he was working to discover a means of protecting power lines and generating stations from electrical storm damage. His research proved fruitful. He was the first to use cathode-ray oscillograms in recording the performance of lightning arresters. In 1929, he made the first field investigation of the effect of a portable lightning generator on high-tension power

lines. He also investigated traveling wave theory, utilizing a portable impulse generator and an oscillograph. In 1931, McEachron developed a material called Thyrite, which has the property of being an effective insulator when low voltages are applied and low resistance when high voltages are applied. This makes it an ideal material for lightning arresters. Thyrite is used today in a broad range of surge protectors, power supplies, and control circuits. In 1934, McEachron made another valuable contribution to the field of electrical engineering with the development of an impulse generator that could mimic the effect of natural lightning. The generator delivered 260,000 amperes, discharging at a rate of more than 30,000,000 kilowatts. This invention was the nearest anyone had come to producing lightning in a laboratory setting. This research led him to a more exacting analysis of lightning discharge and the first known oscillograms of direct lightning strokes simultaneously recorded on motion picture film. His research enabled the identification of a specific type of lighting bolt, the continuous stroke, which is an arc between a cloud and the earth persisting for a full half second or longer. McEachron's research greatly contributed to understanding the electrical processes involved in cloud to ground lightning, and how the methods used to arrest lightning strikes could be formulated.

McEachron's research contributions led to many awards and honors, including the Coffin Award from the General Electric Company in 1931, the Longstreth Medal of the Franklin Institute in 1935, and the Edison Medal of the American Institute of Electrical Engineers in 1949. He was a Fellow of the AIEE. Eta Kappa Nu named him an Eminent Member in 1951. Following his retirement from GE in 1953, he remained in charge of employee relations until his death on 24 January 1954. McEachron was married to Leila Emily Honsinger in 1914, and they had five children.✦

Electrical Engineer and Inventor

Soren H. Mortensen

1951

Eta Kappa Nu Eminent Member

SOREN H. MORTENSEN was a pioneer in self-starting synchronous motors and contributed to the development of large hydraulic and steam turbine driven generators. He was born in Eskelund-Jylland, Denmark, 4 November 1879. He earned his B.A. degree from the Ribe Latin School in Denmark in 1897 and his E.E. and M.E. degrees from Polytechnicum in Mittwida, Germany, in 1902. He immigrated to the United States in 1902 and took a job with the Westinghouse Electric and Manufacturing Co. Three years later, he accepted a position with the Allis Chalmers Manufacturing Co. in Milwaukee, Wisconsin, designing motors and generators. Mortensen became a naturalized citizen in 1910. His innovation while with Allis Chalmers was rewarded, as he was elevated to project design engineer at the Norwood Works and West Allis Plants. In 1942, he was promoted to chief electrical engineer. His career was interrupted following the outbreak of World War II. During the war he was a commissioned officer in the Danish Army, while also working on the Oakridge and Manhattan Projects. Following his discharge, he attended the Illinois Institute of Technology, earning his Ph.D. in electrical engineering in 1944. He retired from Allis Chalmers in 1952.

In 1949, Mortensen published a textbook, *Electric Machine Design*, which greatly contributed to the understanding of electrical engineering technologies, including motor and generator design. He also held several patents for his development of self-starting motors and hydraulic driven alternators. Throughout his noted career, Mortensen earned many awards and honors, including the American

Institute of Electrical Engineers Lamme Medal in 1944, for his work on synchronous motors and large turbine driven generators. Eta Kappa Nu named him an Eminent Member in 1951. Mortensen was married twice; both spouses pre-deceased him. He had two children, Mary and Dan. ✦

Mathematician
and Research Engineer

Joseph Slepian

1951

Eta Kappa Nu Eminent Member

JOSEPH SLEPIAN'S research with Westinghouse Electric Corporation produced significant inventions in power transmission and control. Born in Boston, Massachusetts on 11 February 1891 to Russian immigrants, Slepian entered Harvard University at the age of 16 and received his B.S., M.S. and Ph.D. in mathematics in 1911, 1912 and 1913 respectively. Taking advantage of a one year post-doc, he traveled to Germany, where he received advanced training at Göttingen University in Germany and at the Sorbonne in Paris, France. In 1915, he returned to the U.S. and taught mathematics at Cornell University before joining Westinghouse in 1918. Slepian's move to Westinghouse proved quite fruitful. He advanced quickly as Head of the General Research section in 1922, Research Consulting Engineer in 1926, and Associate Director for Research from 1938 until his retirement in 1956.

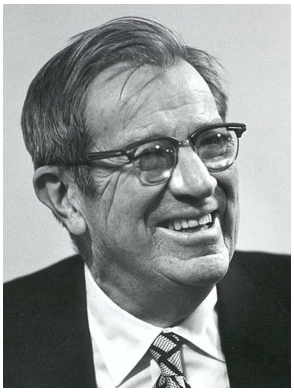
While at Westinghouse, Slepian's research contributed greatly to advancements in electrical power transmission and electrical circuitry. His research on arc behavior led to a long list of developments that would improved power transmission. In 1919 Slepian produced his first patent for Westinghouse for "circuit interrupters," followed by the Autovalve Lightning Arrester developed in the early 1920s, which soon replaced conventional electrolytic arresters. His early research on arresters led to the development of the first air power circuit breaker, Deion Circuit Breaker, which raised arc voltage distribution while avoiding thermionic hot-spot emission. Slepian then turned his attention to the

problem of mercury rectifiers, which produced unacceptable "arc-backs" . His thorough analysis solved this problem with the development of the Ignitron. The Ignitron extinguished arc-backs and then initiated anew the mercury arc on each operation cycle, without appreciable lag time. In the early 1930s, Slepian and Leon R. Ludwig developed a model of their "ignitron" control, which controls currents a million times greater that an electric arc. This discovery was made using pencil lead and proved to be capable of initiating and controlling electric arcs.. In 1927, Slepian was granted a patent pertaining to particle accelerators, which made use of induced electrical fields. This eventually led to Slepian's x-raytube. With the onset of World War II, he was invited to join research on the atomic bomb, and he made important contributions to its development. He also served as a consultant to the Office of Scientific Research and Development.

Although he had left the academe, Slepian never lost his passion for teaching. He organized informal courses at Westinghouse on a variety of topics, including vector analysis, theories of electricity and magnetism, and kinetic theory of gasses. His lectures to Westinghouse colleagues led to the publication of his book *Conduction of Electricity in Gases,* which became a classic used by physicists and educators throughout the world. Slepian remained with Westinghouse until 1951 when he suffered a cerebral hemorrhage. Although he was plagued with muscular paralysis, he maintained his position with Westinghouse until his retirement in 1956. Slepian earned many awards and honors including the Franklin Institute's John Scott Medal in 1932, American Institute of Electrical Engineers (AIEE) Lamme Medal in 1942, and the Edison Medal in 1947 for his development of the Lightning Arrester, Deion circuit breaker and Ignitron. Slepian was named an AIEE Fellow in 1927 and an Institute of Radio Engineers (IRE) Fellow in 1945. Eta Kappa Nu named him an Eminent Member in 1951. Slepian died at his home in Pittsburgh, Pennsylvania on 19 December 1969. He was married to Rose Myerson, and they had two sons, Robert and David. ✦

Educator, Engineer,
and 'Father of Silicon Valley'

Frederick Terman



1951

Eta Kappa Nu Eminent Member

FREDERICK TERMAN'S extensive contributions to electrical engineering through his writing, teaching, and university administration helped lay the foundation for the success of Silicon Valley. Terman was born 7 June 1900 in English, Indiana. Because his father, the famed psychologist, Lewis Terman, believed in progressive education, Terman did not enter school until age nine. Terman's family moved to Stanford in 1912, where his father became a co-developer of the Stanford Binet Intelligence test. In 1920 he graduated from Stanford University with a B.S. degree in chemistry. In 1922, after switching fields, Terman earned his M.S. in electrical engineering. He finished his doctorate in 1924 at MIT, where he worked with renowned engineer Vannevar Bush. Upon completion of his doctorate, he was offered an instructor's position at MIT. However, he became deathly ill with tuberculosis and spent the next year fighting for his life. Despite his illness Terman taught part time at Stanford and managed to co-author a book on transmission line theory. Following his recovery, he became a full professor and head of the Department of Electrical Engineering in 1937. For forty years Terman worked diligently as a researcher, teacher, textbook author and administrator to build up an electronics program that allowed Stanford to become a bastion of creative energy, expert teaching staff , and classic textbooks.

In 1927 Terman was in charge of Stanford's radio communications program. Early in his career he recognized that although research was encouraged and often required in university science courses, it was

not supported among those that taught engineering. Under his encouragement, Stanford developed a well-equipped communications laboratory so that students could do more than research. Because funds were not easily attained, Terman used royalties from textbooks he wrote and from patentable improvements to existing inventions. The first five of his seven books had been published, and won the acclaim of thousands of engineers and future engineers. In time, more than 600,000 copies would be published in nine different languages. According to Terman, his books "reflect his interest in the systematic organization of knowledge, and his desire to find simple quantitative ways to treat each topic." His ability to understand very complex material and present it in his books, articles, and teaching in a way that students could easily grasp contributed to the success of his textbooks.

Terman also served as president of the IRE in 1941. In 1942, he left Stanford to head the Radio Research Lab at Harvard University during World War II, where he worked on the newest developments in radar technology. In 1946 he returned to Stanford as Dean of Engineering. He also played a key role in setting up the Stanford Industrial Park in 1951. Terman encouraged his students to launch businesses in what would become “Silicon Valley”, earning him the informal accolade, "Father of Silicon Valley". Among those who heeded Terman’s advice were Bill Hewlett and David Packard, the founders of the Hewlett-Packard Company. Between 1955 and 1965 Terman served as Stanford’s provost and was named vice president in 1959. In 1955 he was the first recipient of the Education Medal of the AIEE.

Terman retired as provost in 1965 but continued to serve as a part-time consultant to Stanford's president, and designed and carried out several studies on school and department budgets, faculty planning, benefits and retirement. He also served as a consultant or advisor for the Institute of Defense Analysis, the Defense Science Board, the President's Scientific Advisory Committee, and the Navy, Air Force, and Signal Corps. He continued his devotion to the development of higher education in science and engineering, both in the United States and abroad, though his work with the Southern Methodist Foundation for Science and Engineering, the Korean Institute for Advanced

Science, and a U.S. Office of Education mission to the U.S.S.R. In the 1970s he served as chairman of the IEEE History Committee, and was instrumental in helping pave the way for the creation of the IEEE Center for the History of Electrical Engineering. Terman earned many awards and accolades, including the IEEE Founders Medal in 1963, the Stanford Alumni Association's Herbert Hoover Medal for Distinguished Service in 1970, and the National Medal of Science in 1976. He was also named an IRE Fellow in 1937 and an AIEE Fellow in 1945. Terman was elected an Eminent Member of Eta Kappa Nu in 1951. He married in 1928 and had three sons. He died in 1982 at the age of 82. ✦

Engineer, Educator,
and Author

William H. Timbie

1951

Eta Kappa Nu Eminent Member

WILLIAM H. TIMBIE spearheaded the educational movement in electrical engineering at MIT for many years. Born in Pittsfield, Massachusetts 20 August 1877, Timbie attended Williams College and graduated with an A.B. degree in 1901. He joined the Pratt Institute of Brooklyn as a teacher in 1902, and in 1911 moved to the Wentworth Institute of Boston, where he served as head of the applied science department. He left Wentworth in 1918 to join the United States War Department as editor-in-chief of the Committee on Education and Special Training. In 1919, Douglas C. Jackson, head of the newly formed Electrical Engineering department at MIT, brought the young Timbie and another promising engineer, Vannevar Bush, into the fold as associate professors of electrical engineering and industrial practice. While Bush headed up introductory courses in electrical engineering, Timbie led the cooperative program, an important facet of Jackson's policy on engineering education structured to match industry needs. He led the cooperative internship program for almost thirty years, from 1919 to 1947, creating an important link between students, MIT, and industry. In 1923, he became a full professor at MIT and in 1945 he chaired the department of electrical engineering. Timbie retired from MIT in 1947 as Professor Emeritus, capping a long and prodigious career as an electrical engineering educator.

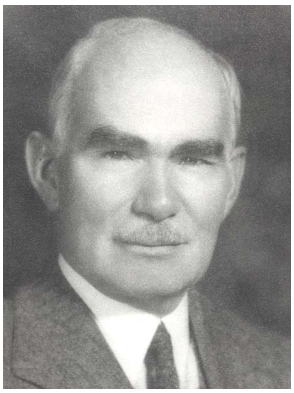
In addition to his important role in the MIT electrical engineering community as head of the cooperative internship program, Timbie also authored a series of seminal texts on electricity. These texts

embodied one of his most significant contributions as an educator and demonstrated his noteworthy ability to translate complex engineering concepts to students. Timbie's 1922 collaboration with Vannevar Bush, *Principles of Electrical Engineering*, and its accompanying answer booklet, circulated widely through the 1950s and is still in use. The content of the text demanded knowledge of advanced physics and calculus, while simultaneously emphasizing the utility of applied engineering practices, demonstrated through 500 illustrative problems. The text was translated into many other languages and appeared in four different editions. Timbie authored many other significant works on electricity including: *Electrical Measurements in Direct and Alternating Currents* in 1913, *Alternating Current and Its Application to Industry*, co-authored with Henry Harold Higbie in 1916, *Industrial Electricity* in 1925, *Elements of Electricity* in 1930, *Basic Electricity for Communications*, and *Essentials of Electricity* with Arthur Pike in 1953. Timbie's career as an educator lasted over thirty years. His education as a classicist, rather than an engineer, scientist, and mathematician, shaped his conceptions about a more humanistic engineering education and the constructive way in which engineering problems should be taught.

Timbie was active in several organizations. He belonged to the Eastern Association of Physics Teachers, and served as its president in 1914. He was named a Fellow of the American Institute of Electrical Engineers (AIEE) in 1924 and served as its vice president in 1935. He was a member of the Institute of Radio Engineers (IRE) and the Society for Engineering Education. Eta Kappa Nu named him an Eminent Member in 1951. Timbie died in 1953. ✦

Entrepreneur and Inventor

Lee De Forest



1952

Eta Kappa Nu Eminent Member

LEE DE FOREST is well known for his invention of the three-electrode amplifier and his other contributions to radio. De Forest was born 26 August 1873 in Council Bluffs, Iowa. When De Forest was six years old he and his family relocated to Talladega, Alabama where his father served as the president of Talladega College for African Americans. His father's acceptance of this position brought a tremendous amount of criticism by citizens who resented the education of black students. De Forest later entered a college preparatory school in Massachusetts for two years and in 1893, he enrolled at the Sheffield Scientific School at Yale University. He graduated in 1896 and pursued his PhD, which he completed in 1899. De Forest's doctoral dissertation was on the "Reflection of Hertzian Waves from the Ends of Parallel Wires"; his research began a long career in radio. His first job was with Western Electric Company in Chicago. In 1902, he founded the de Forest Wireless Telegraph Company. When his business venture failed in 1906, he created the de Forest Radio Telephone Company, which also collapsed in 1909. De Forest rose above these setbacks, achieving ground breaking contributions in radio technology through freelance inventing.

De Forest's first noted success came in 1907 when he patented the "Audion". This device was capable of detecting sensitive wireless signals. De Forest inserted a grid into the center of a two-element vacuum tube. Applying voltage to the grid controlled the amount of a second current flowing across the tube. By 1913, AT&T installed Audions to boost voice signals as they crossed the US

continent. Soon the Audion was being used in radios as well. In 1912, he developed the first radio frequency oscillator using a feedback circuit with his vacuum tube Audion. He did not realize the value of his discovery. By the time he applied for a patent in 1915, it had already been patented. De Forest sued and won. Unable to promote his business interests, he reluctantly sold his patents to major communications firms, most notably AT&T. Throughout the 1920s and 1930s, De Forest continued to work on several other inventions. In 1920, he succeeded in developing a sound-on-film optical recording system called Phonofilm. In the 1930s, De Forest developed Audion-diathermy machines for medical applications and during WWII he conducted research for Bell Telephone Laboratories. In 1959, he went into semi-retirement working a few hours a day.

De Forest was a physically energetic man evidenced by his climb of Mount Whitney for the fifth time when he was 70. Although he faced many disappointments during his noted career, he finally received long awaited recognition for his inventions. In 1938, he was elected honorary President of the Veteran Wireless Operators Association and called the "Father of Radio" by RCA president David Sarnoff. De Forest earned many awards during his tumultuous and diverse career including the Institute of Radio Engineers (IRE) Medal of Honor in 1922, "For his development of the three-electrode vacuum tube," and the American Institute of Electrical Engineers (AIEE) Edison Medal in 1946 "For pioneering achievements in radio and for the invention of the grid controlled vacuum tube with its profound technical and social consequences." In 1989 he was inducted into the Radio Hall of Fame. Eta Kappa Nu named him an Eminent Member in 1952. De Forest died 30 June 1961.✦

Engineer, Inventor,
and Mathematician

Edward C. Molina

1953

Eta Kappa Nu Eminent Member

EDWARD C. MOLINA was instrumental in the development of direct dialing long distance telephony. He was born 13 December 1877 in New York City. Upon graduation from high school, and lacking the funds to enter college, he found a job as night dynamo tender for the local power company, and in 1898 was hired as a member of the inspection department at the Western Electric Company. Between 1901 and 1918, he worked with AT&T in its Department of Development and Research. In 1919, he became a switching theory engineer with Bell Telephone Labs in New York City. During World War II he was assigned to the Division of War Research at Columbia University.

After high school, Molina began a course of self study that enabled him to achieve landmark inventions in telephone switching. AT&T's patent attorney described his Translating and Selecting System patent as "one of the most fundamental inventions on which [he had] ever filed." It made possible great advantages of subscriber numbering and trunking flexibility which made feasible metropolitan telephone networks and nationwide toll dialing. He also developed automatic systems to monitor network performance. His greatest recognition, however, came in the field of mathematical probability, as applied not only to the telephone network, but for setting up inspection programs and for the design of experiments. At the end of the second world war, Molina responded to a plea for instructors to teach returning veterans, accepting a full time lectureship in mathematics at Newark College of Engineering (now the New Jersey

Institute of Technology). He continued in that role and in 1952 was awarded an honorary D.Sc. from NCE.

During his career Molina gave technical assistance and personal encouragement to a great number of young people, possibly as a response to the difficult road he had traveled in reaching the top of his profession. He earned many awards and was involved with numerous science and technology organizations. In 1952, he was awarded the prestigious Elliott Cresson Medal by the Franklin Institute. He was a Fellow of the American Institute of Electrical Engineers, a Fellow of the Institute for Mathematical Statistics, a Fellow of the American Statistical Association, a Fellow of the American Society for Quality Control, and a Fellow of the Royal Economic Society in London. Eta Kappa Nu named him an Eminent Member in 1953. Edward Molina died on 29 April 1964. He was married to Virginia Costales for 63 years and they had two children, Antonio and Teresa. ✦

Inventor and University Dean

Harold Pender

1953

Eta Kappa Nu Eminent Member

HAROLD PENDER was one of the first researchers to measure accurately the magnetic field produced by a moving electrical charge. Born in Tarboro, North Carolina on January 13, 1879, he earned his B.A. degree and Ph.D. in engineering from Johns Hopkins University in 1898 and 1901 respectively. Following graduation he worked as an instructor for the McDonough School in Baltimore, Maryland and for Syracuse University. In 1903 he received a grant to attend the University of Paris, where he duplicated experiments he performed at Johns Hopkins that demonstrated quantitatively the magnetic field around a moving electrically charged body. Following his return to the United States he briefly worked for Westinghouse in Pittsburgh, Pennsylvania. Between 1905 and 1909 he worked with Cary Hutchison in New York, at the same time serving as secretary and treasurer of the McCall Ferry Power Company in New York City. In 1909 Pender was appointed Professor of Electrical Engineering and Head of Laboratories at MIT. In 1914 he left MIT and became Director of the Department of Engineering at the University of Pennsylvania. In 1923 he was appointed the first Dean of the Moore School of Electrical Engineering and held this position until his retirement in 1949.

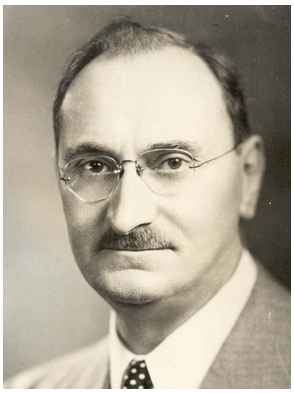
Pender's distinguished career involved experimental research on electric and magnetic fields. His measurements of the magnetic fields created by moving electrical particles coupled with Pender's applied research in electrical power transmission provided important contributions to the field of electrical engineering. During his tenure

at the University of Pennsylvania, he authored five technical books in the areas of electromagnetic field and circuit theory and in electrical machinery. *Pender's Handbook of Electrical Engineers* was a mainstay for electrical engineers over several generations. In 1924 Pender co-founded the International Resistance Company (IRC), and in 1932 he developed and patented the composition resistor. As Dean, Pender encouraged faculty research, and under his direction the Moore School constructed a differential analyzer, which was used for solving problems in power engineering and in ballistics. This work contributed to the building of ENIAC, the first large-scale all electronic digital computer, built at the Moore School and completed in 1946.

Following Pender's retirement in 1949 he remained a consultant to the University. He also served as a consulting engineer to the Pennsylvania State Department of Health, American Telephone and Telegraph, General Motors Corporation, and the Ball and Roller Bearing Company in Danbury, Connecticut. He remained a director of the International Resistance Company until 1959. Pender was a Fellow of the American Institute of Electrical Engineers, the National Academy of Sciences, and the Franklin Institute among others. He was named Eta Kappa Nu Eminent Member in 1953. Pender was married to Ailsa Craig, and they one son, Peter. Harold Pender died in Kennebunkport, Maine on 5 September 1959 at the age of 80. ✦

Electrical Engineer
and Engineering Executive

Charles A. Powel



1953

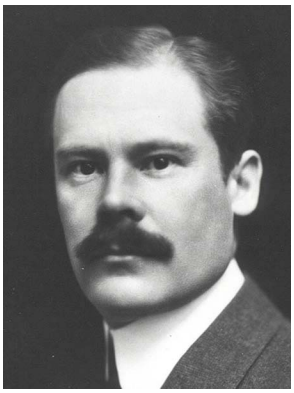
Eta Kappa Nu Eminent Member

CHARLES A. POWEL'S research and management skills helped forward the electrical utility engineering field. Born in Rouen, France, on 30 July 1884, he was educated in Switzerland, where he earned his degree in electrical engineering from the Technical Institute of Bern in 1905. That same year he began his career in electrical engineering in the application engineering department of Brown-Boveri & Co. in Baden, Switzerland. In 1911 he was sent to Japan as resident engineer for the company. Following the outbreak of World War I, Powel traveled to England where he worked with the British Army Ordnance Department. A year later he became a member of the British War Mission to the U.S. In 1919, Powel joined Westinghouse in East Pittsburgh as an engineer in the central station section of the general engineering department. In 1935, he was appointed manager of central station engineering and in 1938, he was made manager of the industry-engineering department. In 1940, he was placed in charge of all the Westinghouse Headquarters engineering departments. In 1945, on leave of absence from Westinghouse, Powel became chief of the machinery and optics branch of the U.S. military in Berlin. Upon his return to Westinghouse he was named assistant to the vice president of engineering. In 1948, he was sent as part of the Stillman Industrial Survey Mission to China in the role of power consultant. When he retired from Westinghouse he became a lecturer on the staff of the electrical engineering department of MIT.

Powel was also active in the American Institute of Electrical Engineers (AIEE). He served on numerous AIEE committees, including the Lamme Medal, 1939-1942; Standards, 1939-1944; Education, 1942-1944; and Edison Medal, 1943-1948. He was also a member of the AIEE board of directors from 1936 until 1940. He became an AIEE Fellow in 1941 and was the organization's President from 1944-45. Powel authored *The Principles of Electrical Utility Engineering* in 1955, as well as numerous articles. His interest in fostering the careers of younger engineers was evident in the subject matter of some of his writings, as, for example, *Mathematical Training for Young Engineers, The Engineer and His Future,* and *The Romance of Engineering.* Eta Kappa Nu named him an Eminent Member in 1953. Powel died in 1972. He was married to Blanche Brownrigg.✦

Inventor and Radio Pioneer

Ernst Alexanderson



1954

Eta Kappa Nu Eminent Member

ERNST ALEXANDERSON'S research was paramount in developing a system that brought voice and music to radio receivers. He was a prolific inventor in the fields of radio, television, power transmission, electric railways, radar, and computers. Born on 25 January 1878 in Uppsala, Sweden, he developed an interest in electrical engineering early in his life. In 1900, he graduated from the Royal Institute of Technology in Stockholm and spent one year in Germany engaged in advanced studies in electrical engineering before coming to the United States in 1901. In 1902, he joined the General Electric Company (GE) in Schenectady, New York, where he remained for 46 years. While working for GE, in 1906 Alexanderson developed some of his most important inventions, including the self-exciting alternator and high-frequency alternators for radio. That same year he constructed a 2kW, 100kHz alternator that laid the foundation for radio broadcasting. For the next ten years, Alexanderson worked to perfect his inventions. Following the formation of the Radio Corporation of America (RCA) in 1919, he joined RCA as the first chief engineer of the company and divided his time between GE and RCA for years. In 1921 he served as president of the Institute of Radio Engineers (IRE). Alexanderson remained with GE until his retirement in 1948.

The Alexanderson Alternator provided the basis for radio broadcasts, experiments, and finally transoceanic communication. In 1917, a transmitter was installed in a transatlantic station in New Brunswick, New Jersey and used to communicate during World War I. For the

next five years Alexanderson's work at both RCA and GE was fruitful. He contributed to broadcasting technology through the use of multiple-tuned antennas on Long Island in New York. A strong proponent of television, he greatly contributed to television research. In 1927, using mechanical disk scanning techniques, Alexanderson initiated broadcasts to several homes in the Schenectady, New York, area. In 1928, he invented the radar altimeter, a forerunner to radar systems developed by the British and others more than a decade later. During the 1930s, he developed inventions pertaining to direct power transmission and electric power conversion. In 1944, he worked on analog computers for use with military radar systems. Throughout Alexanderson's career he accumulated 344 patents, third only to Thomas Edison and Elihu Thompson, the founders of GE.

Following his retirement from GE in 1948, Alexanderson continued as a consultant for several years. In 1952, he wrote an important paper for the *Proceedings of the IRE* on control applications of transistors. His contributions to broadcasting technology led to many awards, including the Medal of Honor from the IRE in 1919 for long distance radio communication, AIEE's Edison Medal in 1944, and the Royal Danish Medal in 1946.In 1992 a definitive biography of Alexanderson, by James Brittain, was published by Johns Hopkins University Press. Eta Kappa Nu named him an Eminent Member in 1954. He was a Fellow of the IRE, the AIEE, and the IEEE. Twice widowed, Alexanderson had a son, Verner, and three daughters, Amelie, Edith, and Gertrude. At age 71 he married Thyra Oxehufwud. He died in 1975 at the age of 97. He had received his final patent two years earlier, at the age of 95. ✦

Electrical Engineer, and
Radio and Television Executive

Walter R. G. Baker

1954

Eta Kappa Nu Eminent Member

WALTER BAKER'S work in television provided a major step toward television standardization in the United States. Born 30 November 1892 in Lockport, New York, he was fascinated with the world of electronics and radio. He graduated from Union College in Schenectady, New York, in 1916 with a degree in electrical engineering. He earned his M.S. degree in electrical engineering from Union College in 1919. During World War I, while in graduate school, he worked for General Electric on radio technology for the military. Between 1921 and 1929, Baker contributed to the design of radio broadcast transmitters and also had administrative responsibility for radio products produced by GE. In 1929, he joined the Radio Corporation of America (RCA) in Camden, New Jersey. In 1935, Baker returned to GE as manager of the radio-television facility in Bridgeport, Connecticut. In 1941, he was appointed a vice president of GE, heading its electronics division. In 1956, the Electronics Division was reorganized into the Defense Electronics Division and the Electronic Components Division. Baker was named consultant to C.W. La Pierre, executive vice-president of the company's electronic, atomic and defense systems group.

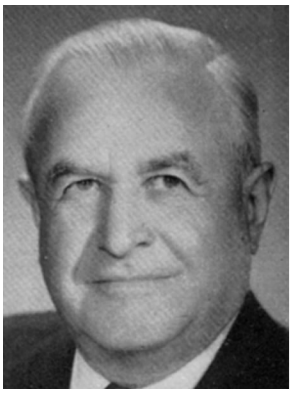
During the mid 1930s, the Radio Manufacturers Association (RMA) established two television committees -- one on channel allocations and one on technical standards -- to research and prepare written reports to the Federal Communications Commission (FCC). Baker presided over both, whose recommendations were adopted by the FCC in 1936. The FCC adopted proposals including channel width,

aspect ratio and frame-rate. During the early 1940s, Baker served as chairman of the National Television System Committee (NTSC) and played a decisive role in mediating conflicting scientific approaches to the development of broadcast television picture technology. When the 441-line picture recommended by the RMA in 1936 produced disagreement between RCA and its competitors Zenith, Philco, and Dumont, Baker organized and chaired the NTSC in an effort to attain consensus. After protracted meetings over several months, he facilitated a compromise of 525 lines as suggested by fellow committee member Donald Fink. This number fell between the 441 favored by RCA and the 800 lines desired by Philco. This standard became the basis for an explosive growth in the television industry following World War II. Baker also chaired the second NTSC from January 1950 to July 1953. The FCC accepted the committee's recommended standards for compatible color television. In 1954 Baker published a paper on the use of television for educational purposes. Noted television engineer Fink wrote, "too much credit for the enduring quality of television broadcasting cannot be given" to Baker.

In 1957, Baker retired from GE and served as vice-president of research for Syracuse University until his death in 1960. He was awarded two honorary doctorates, one from Union College in 1935, and another from Syracuse in 1951. Throughout his career, Baker earned many awards and honors, including the Institute of Radio Engineers (IRE) Medal of Honor in 1952, the Electronic Industries Association's Medal of Honor in 1953, and IRE's Founders Award in 1958, awarded only on special occasions to those who provided outstanding leadership in the electronics and communications field. He was a Fellow of IRE and AIEE and served as IRE president in 1947. Eta Kappa Nu named him an Eminent Member in 1954. He died on 30 October 1960. ✦

Utilities Executive

James B. Black



1954

Eta Kappa Nu Eminent Member

JAMES BLACK was the principal architect of the current operating structure of Pacific Gas and Electric (PG&E) and played a central role in the consolidation of Great Western Power and PG&E. Born 6 May 1890 in Sycamore, Illinois, he attended the University of California, where he earned his B.S. degree in 1912. After graduation, he accepted a position with Great Western as a service inspector. By 1922 he had become general manager, and one year later at the age of thirty-three, he was named vice-president and general manger of Great Western. In 1924 the North American Company, a large New York investment firm, obtained stock control over Western Power. In 1926, Black relocated to New York, where he served as vice-president of North American and its newly acquired subsidiary, Western Power. One year later, he was named president. The North American Company management now set it sights on acquiring PG&E. Black however, dissuaded them from this objective, and the company therefore formulated a new strategy under Black's guidance. North American traded its holdings in Great Western and Great Western San Joaquin Light and Power for PG&E stock. The negotiations took several years but in the end it paid off. On 29 March 1930, PG&E delivered its stock shares to North American for 114 millions dollars. In return, PG&E acquired control of Great Western Power, San Joaquin Light and Power, and Midland Counties Public Service. PG&E now served all of Northern and Central California. In 1935, Black was elected to the PG&E board of Directors. Later that year, he was named President of PG&E. He held this position for twenty of the most formative years in the company's

history. Following his retirement in 1955, he served on the Board of Directors until his death.

Black served on multiple advisory boards including U.S. Steel and Del Monte Properties and also served on the board of trustees for the Ford foundation. Eta Kappa Nu named him an Eminent Member in 1954. Black was married to Katharine McElrath and they had three children, James, Charles, and Katheryn. Black died on 20 March 1965 at the age of 74 in San Francisco, California. ✦

Radio and Television Pioneer

Alfred N. Goldsmith

1954

Eta Kappa Nu Eminent Member

ALFRED N. GOLDSMITH was a radio pioneer and contributor to motion-picture and television technology. Born in New York City on 15 September 1888, Goldsmith received his B.S. degree from the College of the City of New York (CCNY) in 1907. He remained there teaching courses in radio engineering while completing his Ph.D. from Columbia in 1911. While teaching at CCNY, he took a position in radio consulting for the United States Department of Justice. Between 1915 and 1917, he also acted as consultant to the General Electric Company. In 1917, he was named Director of Research for the Marconi Wireless Telegraph Company of America. When the Radio Corporation of America (RCA) purchased the company in 1919, he became director of research for RCA and later served as Vice-President and General Manager. Although Goldsmith left CCNY in 1919, he was conferred a lifetime appointment as associate professor of electrical engineering. Goldsmith's tenure with RCA spanned twelve years. In 1931, he decided to become an independent consultant.

Between 1919 and 1927, Goldsmith invented the first commercial radio with two control knobs and a built in speaker. In addition, he devised a way to overcome "fading", a problem plaguing radio reception. Goldsmith implemented the "diversity reception" system based on simultaneous reception by two antennas. Following his departure from RCA in 1931, he worked diligently as an inventor. In 1932, he was elected President of the Society of Motion Picture and Television Engineers. From this point on, Goldsmith's research

would make vast contributions to television technology. In 1941, he patented a “flickerless” system for television broadcast, which provided an image on the receiver free from distracting movements. Goldsmith also developed the first commercial color television tube to be used worldwide. In 1942, he patented a micro facsimile system that allowed messages to be recorded on film and could be stored for long periods of time and retrieved. This was not possible with earlier systems because copy quality decayed rapidly with time. Throughout the 1940s and 1950s he remained as an advisor to RCA while involving himself in many other engineering organizations.

In recognition of his many contributions to television and radio, Goldsmith received numerous honors and awards including the Institute of Radio Engineers’ (IRE) Medal of Honor in 1941 and its Founders Award in 1954; the Progress Award of the Society of Motion Picture and Television Engineers in 1956, and the Institute of Electrical and Electronics Engineers (IEEE) Haraden Pratt Award in 1972. In addition, Goldsmith was Robert Marriott's fellow representative of The Wireless Institute in its merger with the Society of Wireless Telegraph Engineers to form the IRE in 1912. He was the first editor of the Proceedings of the IRE and remained in that position for 42 years. He was also made a Fellow of the IRE in 1915 and served as Secretary in 1918, President in 1928 and on the Board of Directors for the entire 51 years of the IRE's independent existence. Eta Kappa Nu named him an Eminent Member in 1954. Goldsmith remained active up until his death on 2 July 1974 at his home in St. Petersburg Florida. He was married to Maud Johnson.✦

Electronics Researcher
and Research Director

Mervin J. Kelly

1954

Eta Kappa Nu Eminent Member

MERVIN J. KELLY played a principal role in making Bell Laboratories a prominent research facility. Born 14 February 1895 in Princeton, Missouri, he was sixteen when he graduated from high school as class valedictorian. Kelly's early life ambition was to become a mining engineer. He attended the University of Missouri's School of Mines and Metallurgy at Rolla and graduated with a B.S. in 1914. In 1915, he received his M.S. degree from the University of Kentucky and a Ph.D. in physics from University of Chicago in 1918. Kelly then accepted a position with Western Electric as a research physicist. He remained there until 1925 when he joined the newly created Bell Telephone Laboratories. Between 1928 and 1934, he became Director of Vacuum-Tube Development at Bell Laboratories. During this time he obtained seven patents pertaining to vacuum tube technology. In 1941, he was made Executive Vice-President, and in 1951 he became President.

In the mid 1920s, Kelly worked in a small research group that was a precursor to Bell Telephone Laboratories. His first project was to find a way to make new types of vacuum tubes commercially feasible. Under his leadership, the research group developed the first water-cooled tubes. This work was a boon to transoceanic radiotelephony. During the mid 1930s, Kelly, serving as Director of Research, concluded that Bell Research needed to shift its emphasis to more fundamental areas. As a result of this new approach, he hired theoretical physicists, who at this time were thought of more as teachers than as researchers. Although this research was temporarily

halted during World War II, Kelly's emphasis on new technologies fostered the development of the transistor. Nobel Prize winner and transistor inventor William Shockley worked with Kelly and emphasized his great influence and passion in his Nobel Prize acceptance speech.

Following his retirement in 1959, Kelly acted as a consultant to International Business Machines Corporation (IBM), Bausch and Lomb, Ingersoll-Rand, and the Kennecott Copper Corporation, and he served as a special consultant to the National Aeronautics and Space Administration. He was a member of the advisory committee to Science Manpower, Chairman of the subcommittee for the Secretary of Commerce on the National Bureau of Standards, chairman of the task force on research for the Hoover Commission, and chairman of the Department of the Navy Naval research advisory committee. During his career Kelly earned many awards including, the Presidential Certificate of Merit in 1947, the Medal of Industrial Research in 1954, the John Fritz Medal for achievements in electronics in 1959, and the Hoover Medal in 1961. Kelly was named an American Institute of Electrical Engineers (AIEE) Fellow in 1931 and an Institute of Radio Engineers Fellow (IRE) in 1938. Kelly held several honorary degrees and was a member of the National Academy of Science. He also held several honorary degrees. Eta Kappa Nu named him an Eminent Member in 1954. Kelley died at his second home in Port Saint Lucie, Florida on 18 March 1971. He was married to Katherine Milsted, and they had two children, Mary and Robert.✦

Engineer and AIEE President

Everett S. Lee

1954

Eta Kappa Nu Eminent Member

EVERETT LEE is known for his research with General Electric and for his years of service in the engineering profession. Born 19 November 1891, he earned his B.S. degree in electrical engineering from the University of Illinois in 1913 and his M.S. degree in electrical engineering from Union College in 1915. As a graduate student he taught electrical engineering at Union College while working as a lab assistant for General Electric in Schenectady, NY. During World War I, Lee served as first lieutenant. He returned to GE in 1919 and steadily worked his way up, serving as an assistant laboratory engineer by 1928. In 1945, Lee was named Consulting Laboratory Engineer for GE. In 1951, he became the editor of the *General Electric Review*, a position he held until 1958.

Lee is also known for his years of service and representation on multiple committees. He was named an American Institute of Electrical Engineers Fellow (AIEE) in 1930 and represented AIEE on the division of engineering and industrial research of the National Research Council between 1936 and 1939. In addition, he was an active member of the American Standards Association, the American Society for Engineers, and the Institute of Radio Engineers. In 1948, Lee was named AIEE President. Eta Kappa Nu named him an Eminent Member in 1954. ✦

Electrical Engineer and Educator

Ellery B. Paine

1954

Eta Kappa Nu Eminent Member

ELLERY PAINE was a catalyst for key developments in joining sound and film. Born near Woodstock, Connecticut, on 9 October 1875, he earned his B.S. degree from the Worcester Polytechnic Institute in 1897 and his M.S. degree the following year. He then accepted a position with the testing department of General Electric in Schenectady, New York. In 1899, he went to work for Lehigh Valley Coal Co. Interested in teaching, he became Dean of Technology at Stetson University in 1902, and then moved to North Carolina to serve as head of the Department of Physics and Electrical Engineering at North Carolina College of Agriculture and Mechanic Arts. In 1904, he earned a degree in electrical engineering. In 1907, he began teaching at the University of Illinois and in 1913 became head of the engineering department. Paine taught at Illinois until his retirement in 1944.

Paine's research at the University of Illinois greatly contributed to sound and film technology. While working on his graduate degree, he designed and built a transformer that produced higher voltages than had been previously produced by any single transformer. While head of the engineering department, he recruited Joseph Tykociner, a distinguished radio engineer from Russia. Tykociner fled the Russian Revolution in 1917, and with Paine's encouragement, worked on the problem of recording sound directly on film. By 1921, Tykociner had resolved the problem. He and Paine set up a demonstration in which Paine, reciting the Gettysburg Address, became the first person to have his voice recorded on film. Because Paine was unable to interest

any commercial firms in motion picture with sound, Tykociner did not patent the method. Three years later, Thomas Edison introduced motion pictures and, separately, the phonograph. The development of equipment to synchronize sound and picture ran into serious problems because the film often broke and had to be spliced. To prevent the disruption of the synchronization, the industry then adopted the Tykociner method of sound and picture together on film. Today, an exhibit at the University of Illinois Engineering Library states, "Tykociner made motion pictures talk, but nobody would listen."

Upon his retirement in 1944, Paine was named Professor Emeritus and remained active in departmental affairs. He was a member of the American Society of Engineers, the American Society for Engineering Education, and the Western Society of Engineers. Eta Kappa Nu named him an Eminent Member in 1954. Ellery Paine died on 28 February 1976 at the age of 100. He was married and had one daughter, three grandchildren and four great grandchildren. ✦

Power Engineer and Educator

Andrey Abraham Potter

1954

Eta Kappa Nu Eminent Member

ANDREY POTTER'S role in education contributed greatly to enhancing the understanding of gas and oil production, combustion engine design, and electric power generation. Born in Vilna, Russia on 5 August 1882, Potter immigrated to the United States at age fifteen. In 1903, he earned his B.S. degree from MIT. Three years later, Potter became an American citizen and pursued a career in engineering and education. Following graduation from MIT, he went to work for General Electric Company (GE) in Schenectady, New York. During his tenure with GE he worked on steam turbine construction and consulted on many projects, including power plant economics, and municipal and private steam-electric and gas-electric power plants. In 1905, he accepted a position as an assistant professor of mechanical engineering at Kansas State University, and in 1913 he was named Dean of Engineering and Director of the University's Engineering Experiment Station. In 1920, he joined Purdue University as Dean of Engineering. Between 1945 and 1946, he was Acting Director and President of the Purdue Research Foundation, and in 1953 he became Dean Emeritus of Engineering.

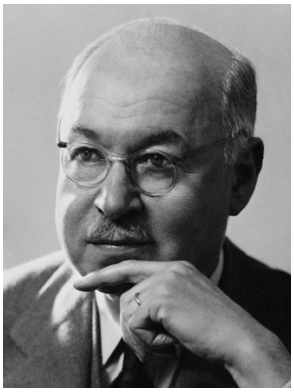
Potter greatly contributed to the engineering field through his exhaustive research and teaching skills. In 1913, he authored a book, *Farm Motors,* that explored heat and the combustion engine process in agricultural engineering. In 1920, he co-authored two influential texts, *Steam and Gas Power Engineering* and *Elements of Engineering and Thermodynamics*. This scholarship made important advances to power engineering. During his tenure as professor, he

authored more than seventy articles that furthered the understanding of various fuels in the generation of electric power. Under his leadership at Kansas and Purdue, both engineering programs flourished. His contribution to knowledge in the field was also realized in twelve published bulletins. The U.S. government frequently availed itself his expertise, appointing him over time to eighteen government positions.

Following his retirement from Purdue in 1953, Potter remained active as a consultant. He maintained his position as President of the Bituminous Coal Research Institute until 1960. He earned many awards and honors during his career, including the McCormick Medal for his contributions to agricultural engineering, the Western Society of Engineers Washington Award for his patriotic service in mobilizing technical contributors to the war effort in 1943, the 75th Anniversary Medal of the American Society of Mechanical Engineers, and the Americanism Award in 1950. He was named an Eminent Member of Eta Kappa Nu in 1954. Potter died 5 November 1979. He was married to Eva Burtner and they had two children. ✦

Inventor and Educator

Reinhold Rudenberg



1954

Eta Kappa Nu Eminent Member

REINHOLD RUDENBERG was one of the first individuals to develop an electron microscope. Born 4 February 1883 in Hanover, Germany, he first became interested in electrical devises as a high school junior in 1899 when he constructed a Ruhmkorff induction coil. While attending school in Hanover, Rudenberg applied for his first patent on a radio oscillator. He attended the Hanover Institute of Technology and graduated in 1906 with a Ph.D. in engineering. He then accepted a position as an instructor in mechanical engineering at George August University. In 1908, he left teaching and joined the Siemens-Schuckert Company in Berlin as an electrical engineer. In 1923, he became the chief electrical engineer of the company and performed extensive investigations on problem of long distance power transmission. He also served as Privatdozent at the Charlottenburg Institute of Technology between 1913 and 1919. He held the title of honorary professor from 1927 to 1936 and also served as visiting professor to MIT in 1929. In 1936, Rudenberg and his family escaped Nazi persecution, and they moved to the United States in 1938. The following year he joined the faculty at Harvard University and changed his name to Gordon McKay. He taught electrical engineering until 1952 when he retired with emeritus rank.

While Rudenberg conducted extensive experiments in electrical power engineering, his most notable contribution was the development of the electron microscope. Building on the work of French physicist Louis de Broglie, Rudenberg investigated the possibilities of using electron beams to produce enormously

magnified images of minuscule objects, most notably viruses. His son's contraction of polio contributed greatly to his desire to make the virus visible. Rudenberg made several patent applications, and in 1931 he patented the microscope. He also patented the electrostatic electron lens and a color television tube. Following his move to the United States, Rudenberg improved the electron microscope's lens and helped promote an industrial electron microscope. In addition, he extensively researched the origin and behavior of traveling waves on transmission lines and transformer windings. At the end of his career he had attained over 300 patents, and researchers considered his book *Transient Performance of Electrical Power Systems* an important text in the field.

Following his retirement in 1952, Rudenberg continued writing and researching. He traveled and lectured at several universities in the United States and South America on electrical engineering and the history of the electron microscope. Rudenberg earned numerous honors and awards during his career including the Honor Award Medallion of the Stevens Institute of Technology in 1946, the Cedergran Medal and Scroll of the Royal Technical Universities of Sweden in 1949, and Elliot Cresson Medal of the Franklin Institute in 1961. He was named an American Institute of Electrical Engineers Fellow (AIEE) in 1950, and Eta Kappa Nu named him an Eminent Member in 1954. Rudenberg died in Boston, Massachusetts on Christmas day in 1961. He was married for 42 years and had three children. ✦

Power Systems Engineer
and Author

Philip Sporn

1954

Eta Kappa Nu Eminent Member

PHILIP SPORN was preeminent in the development of integrated and interconnected power systems. Born in Folotwin, Austria on 25 November 1896, Sporn, a Jewish immigrant, came to the United States in 1907 and settled in New York City. His early childhood memory of Ellis Island was that the nearby Statue of Liberty had poor lighting. Is it just a coincidence that he dedicated the rest of his life to electrical engineering? Sporn attended public schools in his youth and earned his B.S. degree in electrical engineering from Columbia University in 1918. He began his career with the Crocker-Wheeler Manufacturing Company in 1917 and eventually worked as a utility engineer. In 1920, he became a protection engineer with American Electric Power Company (AEP). By 1927 he was the chief electrical engineer, and from 1933 to 1947 he was Chief Engineer of the company and its subsidiaries. During this time Sporn constructed an engineering organization that was paramount in the electric and utility field. In 1945, he became Executive Vice-President, and in 1947 he succeeded George Tidd as President and CEO.

While Sporn was the chief electrical engineer, AEP made numerous technological advances, including the development of large power generating units, and high-voltage transmission and lighting protection. Between 1947 and 1961 AEP increased its miles of power lines from 47,707 to 77,974. Sporn effectively exploited technological advances to make electrical supply more efficient and available. In 1952 he helped found the Ohio Valley Electric Corporation and served as its president and director until 1967. Ohio

Valley Electric provided energy to the uranium-diffusion operation of the U.S. Department of Energy. Throughout his life Sporn authored ten books. *The Integrated Power System* (1950) was regarded as an authoritative work in the field. He was also very active in nuclear research and in the development of electric space heating. In the 1930s he introduced the heat pump to the AEP System office building. Sporn also played a large role in persuading the aluminum industry to move to the Ohio Valley for its energy requirements.

Sporn stepped down from his presidential post in 1961, but remained Director of AEP until 1968. In reality, he never retired. During his later years Sporn worked as an advisor to utility and industrial clients and to the Israeli Government, published books and articles, and helped organize the Israel Institute of Technology. He was also a prolific writer. He wrote some 200 papers and articles published in scientific and technical journals. His books included *Foundations of Energy* (1964); *Fresh Water from Saline Waters* (1966); *Technology, Engineering and Economics* (1969); *The Social Organization of Electric Power Supply in Modern Societies* (1971); and *Energy in an Age of Limited Availability and Delimited Applicability* (1976). Sporn's leadership and devotion to engineering research earned him many awards including the American Institute of Electrical Engineers (AIEE) Edison Medal in 1945, Columbia University's Medal of Excellence in 1948, and the John Fritz Medal in 1956. He was also Fellow of the AIEE. Eta Kappa Nu named him an Eminent Member in 1954. Sporn worked diligently until his death on 23 January 1978. He was married to Sadie Posner, and they had two sons and a daughter. ✦

Antenna Engineer
and Research Director

Harold Henry Beverage

1955

Eta Kappa Nu Eminent Member

HAROLD HENRY BEVERAGE was one of the first engineers to specialize in antenna design and whose name lives on because of an antenna known to all amateur radio operators. Born 14 October 1893 in North Haven, Maine, he took up radio as a hobby at an early age. In April 1912 with his homemade set he picked up signals from both the *Titanic*, after it struck the iceberg, and the *Carpathia*, which rushed to the scene. Upon completion of a B.S. degree in electrical engineering at the University of Maine in 1915, he took a job with General Electric (GE). There he soon became laboratory assistant to the prominent engineer E.F.W. Alexanderson and worked to improve long-distance radio communications. In 1920 Beverage left GE to become one of the first employees of the Radio Corporation of America (RCA). When RCA Communications was formed in 1929, Beverage was named chief research engineer, and in 1940 he became vice president in charge of research and development. In 1937 he served as president of the Institute of Radio Engineers.

In 1919 Beverage, in trying to improve radio communications with South America, developed an improved, highly directional antenna, and in 1921 he received a patent on this "wave antenna" or "Beverage antenna". He worked with Chester Rice and Edward W. Kellogg on a mathematical analysis of the new antenna, and they published their work in 1923. As a highly directional and broadband antenna (receiving a wide range of frequencies well), the Beverage antenna continues to find widespread use today, particularly by amateur radio operators. Beverage made many other improvements in antennas,

such as his development, with H.O. Peterson, of the RCA diversity receiving system (which used multiple antennas to reduce fading). During World War II, as consultant to the War Department, he played a large part in establishing the Army's radio teletype network. He helped design the communication systems used in the D-day invasion in 1944 The work that he directed at RCA, carried out by some of the most talented electronics engineers of the time, involved antennas (for television as well as radio), transmitting and receiving equipment (such as automatic printers), multiplexing and radio relaying, and many other technologies.

After retirement from RCA in 1958, Beverage continued to work as a consultant and to contribute to the activities of URSI, the International Union of Radio Science. His contributions to radio communications technology led to many awards, including the Armstrong Medal of the Radio Club of America in 1938, the Medal of Honor of the Institute of Radio Engineers in 1945, a Presidential Certificate of Merit in 1948, the Lamme Medal of the American Institute of Electrical Engineers in 1957, and the Marconi Gold Medal of the Veteran Wireless Operators Association in1974. He was a Fellow of the IRE, the AIEE, and the IEEE. Eta Kappa Nu named him an Eminent Member in 1955. A well-illustrated biography of Beverage, "Genius at Riverhead", by A. I. Wallen, was published by the North Haven (Maine) Historical Society in 1988. He died at the age of 99 on 27 January 1993 in Stony Brook, NY.✦

Inventor and Research Director

William D. Coolidge

1955

Eta Kappa Nu Eminent Member

WILLIAM D. COOLIDGE'S production of ductile tungsten and his discovery of a vacuum tube for generating x-rays profoundly changed everyday life for many people. Born in Hudson, Massachusetts 23 October 1873, Coolidge was the son of a farmer and a distant cousin of President Calvin Coolidge. He excelled in the remote one-room school near his home and enjoyed hobbies that included mechanics and electricity. In 1896, he received his B.S. degree from MIT. He then relocated to Germany where he earned a Ph.D. in physics from the University of Leipzig. He returned to the United States and joined the faculty at MIT. In 1905, Coolidge joined the General Electric (GE) Research Laboratory and in 1908 was made Assistant Director, a position that he held until 1928 when he was promoted to Associate Director. In 1932, he became Director of GE's Research Laboratory and faced the tall order of saving the research lab from severe financial problems brought on by the Depression. Despite almost insurmountable odds, Coolidge managed to avoid wholesale layoffs through reorganization.

Coolidge worked as both an inventor and a research leader. He organized the first laboratory in the United States that employed scientists as industrial researchers rather than inventors. This philosophy paid off. General Electric not only survived but also became quite profitable, in part because of its R&D. His work as an inventor also contributed greatly to GE's success. His first major discovery came in 1909, when he developed a way to make tungsten ductile, so that it could be drawn into filaments for light bulbs. This

gave light bulbs a greater lifespan. In 1910, GE sold the new lamp under the name "Mazda." In 1913, Coolidge invented what many considered to be his crowning achievement. The vacuum tube known as the Coolidge tube, for generating x-rays, made x-ray use both safe and convenient for medical use. During World War I, Coolidge invented a portable version. The basic design has never been changed. Coolidge also made other valuable contributions, including the "C-Tube" used for submarine detection and underwater listening, as well as his modification of the Lenard cathode-ray tube, which greatly increased its power.

Following his retirement from GE in 1945, Coolidge remained active, spending time consulting, writing, and researching. He also spent much time traveling abroad with his wife. Coolidge earned many awards and honors, including the Rumford Medal for his invention of ductile tungsten, the Gold Medal of the American College of Radiology, the Hughes Medal from the London Royal Society, and the Edison Medal from the American Institute of Electrical Engineers in 1926 for his contributions to the incandescent electric lighting and the x-ray arts in 1927. In addition, Coolidge was granted eighty-three patents during his life. He was named a Fellow of the American Institute of Electrical Engineers (AIEE) in 1955, and Eta Kappa Nu named him an Eminent Member that same year. He died 4 February 1975 at the age of 101. He was married to Dorothy MacHaffie and they had two children.✦

Electric Power Engineer

Leslie N. McClellan

1955

Eta Kappa Nu Eminent Member

LESLIE MCCLELLAN'S leadership advanced technology in the construction and operation of hydroelectric power stations across the Western United States. He was born 27 March 1888 in Middleton, Ohio. He received a B.S. degree in electrical engineering from the University of Southern California in 1911. The same year he joined the Bureau of Reclamation on the Salt River Project in Arizona as a Junior Engineer. McClellan later became Assistant Engineer, designing construction and operation of power systems. His career was briefly interrupted during World War I, where he served as a first lieutenant in the Corps of Engineers and the Tank Corps of the U.S. Army. Following the war, McClellan remained active with the U.S. Army serving as Captain of the Officer Reserve Corp from 1918 to 1928. His service in the army did not infringe upon his work as an electrical engineer. In 1919, he worked as an Electrical Engineer for Southern California Edison Company. Five years later, McClellan accepted a position at the Bureau of Reclamation as a Chief Electrical Engineer in charge of design, construction and operation of hydroelectric power stations, pumping plants, transmission lines and substations. He held this position until 1945 when he became Assistant Commissioner and Chief Engineer. From 1945 until his retirement in 1958, he was responsible for all technical phases of design, planning, construction and operation of the Bureau of Reclamation in seventeen Western states.

Following his retirement, McClellan acted as a consulting engineer for multiple projects including the Tennessee Valley Authority, the

government of India, and the Power Authority, New York. McClellan's contributions also include his service to the American Institute of Electrical Engineers (AIEE). He was named an AIEE Fellow in 1938 and served as the organization's Vice-President. McClellan earned many awards and honors including an honorary doctorate form the University of Colorado in 1949, the Colorado Engineering Council's Gold Medal in 1951, the U.S. Department of Interior's Gold Medal in 1952, and the Distinguished Alumnus Award from the School of Engineering, University of Southern California in 1967. Eta Kappa Nu named him an Eminent Member in 1955. McClellan was married to Mary Jane Lair, and they had one daughter. ✦

Engineer and Civic Leader

Harold S. Osborne

1955

Eta Kappa Nu Eminent Member

HAROLD OSBORNE'S diverse and noted career influenced the development of new forms of telephone communication. Osborne was born 1 August 1887 in Fayetteville, New York. He earned his B.S. degree and Eng.D. from MIT in 1908 and 1910, respectively. Between 1905 and 1910, Osborne worked for the Edison Electric Illuminating Company of Boston, and the Turners Falls Power Company. In 1910, he began his long career with AT&T, first as an assistant transmission and project engineer. In 1914, he became an assistant to the transmission and protection engineer, and in 1920 the transmission engineer. In 1939, Osborne became operating results engineer and, one-year later, plant engineer. By 1943, Osborne had become Chief Engineer. Following his retirement from AT&T in 1952, he worked as a consultant to Brazilian Traction Light and Power and the International Bank for Reconstruction and Development. Osborne was also very active in community affairs. Between 1952 and 1956, he was the Commissioner of Public Works in Montclair New Jersey. In 1961, he was elected Mayor of Montclair.

Osborne is well known for his work on wireless telephony. When the Bell System announced the development of the transistor on 1 July1948, many inventors were reluctant to predict the long-term implications of such technology. Osborne responded in a famous quote: "Let us say in the ultimate, whenever a baby is born anywhere in the world, he is given at birth a number which will be his telephone number for life. As soon as he can talk, he is given a

watch-like device with ten little buttons on one side and a screen on the other. Thus equipped, at any time when he wishes to talk with anyone in the world, he will pull out the device and punch on the keys the number of his friend. Then turning the device over, he will hear the voice of his friend and see his face on the screen, in color and in three dimensions. If he does not see and hear him he will know that the friend is dead." No one else seemed ready to make an overt prediction like that.

Osborne earned many awards and honors, including the Howard Coonley Medal from the American Standards Association in 1956 and the American Institute of Electrical Engineers (AIEE) Edison Medal in 1960. He was a Fellow of the Institute of Radio Engineers, a Fellow of the American Institute of Electrical Engineers, and a Fellow of the Institute of Electrical and Electronics Engineers. He served as AIEE's President from 1942 to 1943. He was a director of the American Standards Association from 1943 to 1952, and the President of the International Electro-technical Commission from 1952 to 1955. He was also a Fellow of the American Physical Society, the Acoustical Society of America, and the American Society for Engineering Education. Osborne authored numerous technical articles in magazines and journals. His civic activities were recognized through awards from the American Society of Planning Officials (Silver Medal) and the Regional Plan Association of New York, among others. Eta Kappa Nu named Osborne an Eminent Member in 1955. He was married to Dorothy Brockway and they had two daughters. ✦

Electric Power Engineer
and Corporate Leader

Harry A. Winne

1955

Eta Kappa Nu Eminent Member

HARRY A. WINNE is widely recognized for his leadership with General Electric and his work on atomic energy regulation. Born 27 October 1888 in Cherry Valley, New York, he earned his electrical engineering degree from Syracuse University in 1910. That same year he began a long and productive career with General Electric, where he worked in various engineering positions. By 1941 he had become Vice President of Apparatus Design Engineering. Between 1945 and 1951 he served as Vice President in Charge of Engineering Policy. In 1951 Winne left GE and accepted the position of Director of American Gas and Electric. Winne also served as chairman of the Defense Department's panel on atomic energy.

Winne's visionary contributions to the Acheson-Lilienthal Report on the International Control of Atomic Energy, along with other noted scientists such as Chester Barnard. J.R. Oppenheimer, Charles Thomas, and Chairman David Lilienthal, has been widely recognized. The report published 16 March 1946 was America's first effort to define a policy on the control of atomic energy. Many government officials viewed Winne's proposal for the regulation of atomic energy radical. Richard Rhodes, in his book *Dark Sun: The Making of the Hydrogen Bomb*, demonstrates that Winne strongly opposed outlawing atomic bomb production and using international inspections to enforce the legal code. Instead, Winne claimed that rivalry between nations must be removed and that the "dangerous phases of the development of atomic energy" should be overseen by an international organization that was responsible to all people.

Winne's approach was viewed as radical by some and as enlightened by others. Many in the scientific community believed that this approach would promote and reinforce energetic research and development in a constructive form. The first US proposal to the United Nations on international controls on nuclear material, named the Baruch Plan for its author Bernard Baruch, drew heavily on the information in the Acheson-Lilienthal Report.

Winne's contributions to atomic energy research earned him the John Fritz Medal in 1955. This medal is highest award in the engineering profession and is presented for scientific or industrial achievement in any field of pure or applied science. He was named a Fellow of the American Institute of Electrical Engineers in 1945, and Eta Kappa Nu named him an Eminent Member in 1955. Winne died in 1968. He was married to Dorothy Louise Hodges, and they had two children. ✦

Professor and Electrical Engineer

John B. Whitehead

1955

Eta Kappa Nu Eminent Member

JOHN WHITEHEAD organized the School of Engineering at Johns Hopkins University. Born in Norfolk, Virginia on 18 August 1872, he received his preparatory education at Norfolk Academy. In 1893, he earned his B.S. degree in electrical engineering and in 1902, his Ph.D. both from Johns Hopkins University. While in school he worked as an electrical engineer for the Westinghouse Electric and Manufacturing Company in Pittsburgh, Pennsylvania. He then joined the Niagara Falls Power Company in New York where he worked until 1897. The following year Whitehead became a faculty member at Johns Hopkins University. In 1910 he became a full professor in electrical engineering. With the support of those around him, Whitehead organized the first school of Electrical Engineering in 1912, and in 1920 he was named Dean. Whitehead served as the Johns Hopkins exchange professor in France in 1927. By 1938, Whitehead had become the director of the school. While Whitehead is widely recognized for his educational contributions, he was also was a diligent researcher.

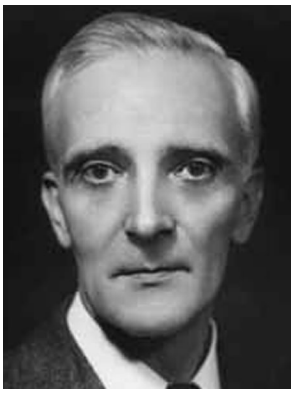
While working for the University in 1902, Whitehead was a laboratory assistant for the U.S. Bureau of Standards and a research assistant at the Carnegie Institute in Washington D.C. In 1917, he was commissioned a major in the Army Corps of Engineers and provided essential research for the Naval Consulting Board on techniques for detecting enemy submarines. During World War II, he served as naval adviser working to develop a system to protect U.S. ships from magnetic mines. He also conducted electronics research

for the Air Force. When not involved with national security issues, Whitehead consulted on the electrification of several railroad lines and did extensive research on high-voltage insulation. He authored four books between 1909 and 1939 concerning high-voltage insulation, the physics of electricity and magnetism, and railroad steam power. He retired from Johns Hopkins as Professor Emeritus in 1942.

Following Whitehead's retirement he continued researching for the Air Force using his laboratory at Johns Hopkins. Whitehead's contributions led to many awards and honors, including the triennial prize of the Montefiore Electrotechnic Institute of Liege, Belgium in 1922, the Franklin Institute's Elliot Cresson Gold Medal in 1932, and the American Institute of Electrical Engineers (AIEE) Edison Medal in 1941 "For his contributions to the field of electrical engineering, his pioneering and development in the field of dialectic research, and his achievements in the advancement of engineering education." Eta Kappa Nu named him an Eminent Member in 1955. John Whitehead died 16 November 1954 in Baltimore, Maryland. He was married to Mary Ellen Colston, and they had three daughters.✦

Solid State Physicist and Educator

Leon N. Brillouin



1956

Eta Kappa Nu Eminent Member

LEON N. BRILLOUIN enhanced the understanding of solid-state physical behavior and made several contributions to radio engineering, antennas and electric wave transmission. Born 7 August 1889 in Paris, France, he was heavily influenced by his father, physicist Marcel Brillouin, who held the chair of general physics and mathematics at the College de France. Between 1908 and 1912, he attended the prestigious École Normale Supérieure, which offered the best training in physics and mathematics then available in France. In 1912, he attended school in Munich, working under Arnold Summerfield. His x-ray studies accounted for his first article in 1914. World War I interrupted his dissertation work on quantum theory. During the war he worked on radio transmission in the laboratory of General Gustave-Auguste Ferrié. Following the war he completed his dissertation and published the first textbook on quantum theory to be written by a French scholar. In 1928, he was offered the Theoretical Physics Chair at the Sorbonne. In 1932, he accepted a position as a full professor with the College de France and remained there until 1949. Between 1939 and 1941, Brillouin also worked as Director General of the French National Broadcasting System. During World War II, he embarked on a lecture tour in the United States and decided to emigrate in 1941 to study at the University of Wisconsin, where he later became a full professor. In 1943, he became a research lecturer at the Craft Laboratory at Harvard, and between 1947 and 1949 he was Gordon McKay Professor of Applied Mathematics. In 1948, Brillouin accepted a position as Director of Electronic Education at International Business Machines (IBM), and the

following year became a citizen of the United States.

During his distinguished career Brillouin advanced the understanding of quantum mechanics. During World War I, he led the development of the "resistance amplifier" and a remote-control system for ships and airplanes, which won him the Legion of Honor. In 1926, he published a method to obtain approximate energies of bound states and approximate transmission coefficients for tunneling problems. Gregory Wentzel reinvented this method later that year and Harold Kramers perfected it. The method is now called the BWK method and was widely used in quantum mechanical problems. Brillouin also discovered what are now known as the Brillouin Zones, that provide a way to understand the complex characteristics of crystal lattice structures. In addition to his research on solid-state theory, he also contributed greatly to the understanding of electrical wave transmission in cables and the motion of electron beams in magnetrons and in traveling-wave tubes. During World War II, he performed defense related research while a member of the Applied Mathematics Group at Columbia University. Following his retirement from IBM in 1953, he lectured part-time at Columbia.

In addition to research and teaching, Brillouin published some two hundred papers, several pamphlets and fifteen books in English, French and German on theoretical physics, radio waves, wave propagation and solid-state physics. While teaching part-time at Columbia University, he continued as an engineering consultant in radio to several companies in the United States, France, and Holland. He also took part in many technical missions to England, Belgium, Holland, Sweden, Norway, Canada, Russia, Czechoslovakia, Italy, Spain, and Mexico. Brillouin was named an Institute of Radio Engineers (IRE) Fellow in 1952 "for his many teaching accomplishments and his contributions to the literature of physics and audio", and was elected to the National Academy of Sciences in 1953. Eta Kappa Nu named Brillouin an Eminent Member in 1956. He died in New York City on 4 October 1969. ✦

Physicist and Radio Engineer

John Howard Dellinger

1956

Eta Kappa Nu Eminent Member

JOHN HOWARD DELLINGER'S contributions to the development of radio measurements and standards greatly advanced telecommunications. Born 3 July 1886 in Cleveland, Ohio, Dellinger began his 41-year career with the National Bureau of Standards in 1907. He received his A.B. degree from George Washington University in 1908, and in 1913 he earned a Ph.D. in physics from Princeton University. Between 1907 and 1928, he held many positions, including physicist, radio section chief, and chief of the Central Radio Propagation Laboratory. From 1922 to 1948, he served as a representative of the United States Department of Commerce on the Interdepartmental Radio Advisory Committee. In 1928, Dellinger was promoted to Chief Engineer of the Federal Radio Commission, and six years later he became Vice-President of the International Scientific Radio Union. In 1941, Dellinger was made Chairman of the Radio Technical Commission for Aeronautics.

Throughout the 1920s, Dellinger developed his theory of radio wave transmission, which explained how upper air transmission led to radio fading. He developed methods and instruments for improving the accuracy of frequency measurement. These advances helped reduce station interference. He also supervised the development of the aeronautic radio beacon and other aids that allowed for the blind landing of aircraft. He discovered the effects of solar eruptions on radio transition. Overall, Dellinger's research greatly advanced understanding of radio wave propagation. His leadership at international conferences also contributed to worldwide cooperation

in telecommunications.

Following his retirement from the National Bureau of Standards, Dellinger remained active. He held the position of Chairman of the Radio Technical Commission for Aeronautics until 1957. During his career, Dellinger authored 136 articles, several books, and various treaties. He earned many awards and honors, including the Institute of Radio Engineers (IRE) Medal of Honor in 1938 "For his contributions to the development of radio measurements and standards, his researches and discoveries of the relation between radio wave propagation and other natural phenomena, and his leadership in international conferences contributing to the world wide cooperation in telecommunications", the Collier Award for Highest Achievement in Aviation in 1948, and the U.S. Department of Commerce's Medal for Exceptional Service in 1949. He was an IRE Fellow and was the organization's President in 1925, Director from 1924-1927, and was Chairman of the IRE Washington Section during 1932-1933. Eta Kappa Nu named him an Eminent Member in 1956. Dellinger died 28 December 1962.✦

Electrical Engineer, Inventor,
and Educator

William B. Kouwenhoven

1956

Eta Kappa Nu Eminent Member

WILLIAM B. KOUWENHOVEN was the first to develop the electric heart defibrillator. Born 13 January 1886 in Brooklyn, New York, he received a B.E. degree from the Brooklyn Polytechnic Institute. He then relocated to Baden, Germany, where he earned a Ph.D. from the Karlsruhe Technisch Hochschule in 1913. Later that year he accepted a position as an instructor at the University of Washington. One year later he became an instructor in Electrical Engineering at Johns Hopkins University. During his 41 year career with John Hopkins, Kouwenhoven made many vital contributions in cardio-physiology. In 1925, the power company, Consolidated Edison of New York, selected Johns Hopkins to study the effects of electric shock. This later prompted Kouwenhoven to begin researching non-surgical methods to stimulate a heart that has stopped beating. While continuing his research, he became an effective administrator and was appointed Associate Dean of the School of Engineering in 1930. In 1938 he was named Dean, a position he held until retirement in 1954.

Kowenhoven's interest in cardiovascular physiology began in 1928 with his experiments on the effects of electrical current on the heart. Ironically, he had no medical background. This, however, did not impede his pioneering research. In 1933 he and his colleagues confirmed that an electrical shock could restore a fibrillating heart. While researching, Kouwenhoven was known to climb electrical poles so that he could feel the effects of electricity on his own body. The next step, the development of a machine that could administer

the shock, would take several years. In 1950, Kouwenhoven and cardiovascular physiologist William Minor began working on a closed chest defibrillator. By the mid-1950s, they had developed a 200-pound contraption mounted on a wheel cart. While placing the electrodes on a dog, Guy Knickerbocker, a young engineering associate, and Kouwenhoven noticed that the pressure administered raised the dog's blood pressure. Kouwenhoven and Knickerbocker had made another major discovery, cardiac massage. This technique would become the key to cardiopulmonary resuscitation. Finally in 1957, three years after Kouwenhoven's retirement, a defibrillator saved the first human life.

Kouwenhoven retired as Professor Emeritus from Johns Hopkins in 1954. Interestingly, the fruits of his many years of research did not materialize until after his retirement. Kouwenhoven received many honors and awards. In 1969, he became one of only two individuals to be awarded an honorary MD from Johns Hopkins. He also received the Scientific Achievement Award from the American Medical Association and an Albert Lasker Clinical Research Award in 1973. He was named a Fellow of the American Institute of Electrical Engineers (AIEE) in 1934, and Eta Kappa Nu named him an Eminent Member in 1956. Kouwenhoven died 12 November 1975. He was married to Abigail Baxter Remsen. They had one son and two grandchildren. ✦

Communications Engineer

Harry Nyquist

1956

Eta Kappa Nu Eminent Member

HARRY NYQUIST'S research profoundly contributed to modern communications and control engineering. Born on 7 February 1889 in Nilsby, Sweden, he immigrated to the United States in 1907 to pursue training in electrical engineering and communications. Between 1912 and 1915, he attended the University of North Dakota, earning both his B.S. and M.S. degrees in electrical engineering. In 1917, Nyquist earned a Ph.D. in physics from Yale and joined American Telephone and Telegraph (AT&T) in the Department of Development and Research Transmission. Between 1917 and 1934, Nyquist researched telegraph, picture, and voice transmission, increasingly focusing on television research. From 1934 to 1954, he was employed at Bell Labs, where he reached the position of Assistant Director of Systems Studies two years before his retirement in 1954. During this time he worked mainly on transmission and systems engineering.

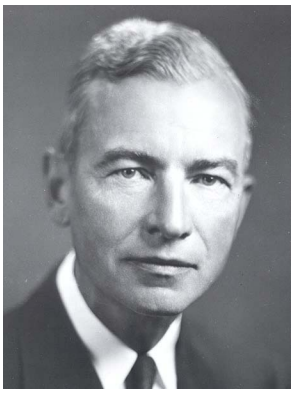
Nyquist's proposal for bandwidth-efficient data communication helped produce a communications revolution. In 1923, he developed a metallic telegraph system and devised a way to increase message-handling capability of narrow-band telegraph channels. In 1928, his mathematical analysis of the pulse capacity of fixed bandwidths led to his discovery of what is now called the "Nyquist rate." This stimulated digital processing techniques that underlie almost all modern communication technologies. In 1932, Nyquist's research significantly contributed to the first analysis of stability in feedback amplifiers. His discovery of the conditions necessary to keep feedback circuits stable, the "Nyquist criterion," earned widespread

acclaim. He also invented the “Nyquist diagram,” which simplified circuit design by allowing AT&T engineers to enhance long distance telephone service through feedback amplifiers. His contributions to television research included helping to solve the problem of delay distortion and new methods of signal transmission. Nyquist’s discoveries are part of many the electronic technologies we use today.

Following his retirement in 1954, he worked as a consultant to several companies and the United States government. Nyquist earned many honors and awards including the Stuart Ballantine Medal of the Franklin Institute in 1960, the IRE Medal of Honor “For fundamental contributions to a quantitative understanding of thermal noise, data transmission and negative feedback" in 1960, the Mervin J. Kelley Award in 1961, and National Academy of Engineers Founders Medal in 1969. In addition, Nyquist was named AIEE Fellow in 1951 and an IRE Fellow in 1952 in recognition of his fundamental contributions to physical and mathematical science in the field of communications. Eta Kappa Nu named him an Eminent Member in 1956. Nyquist died 4 April 1976 in Harlington, Texas.✦

Engineer, Air Force Secretary,
and Research Director

Donald A. Quarles



1956

Eta Kappa Nu Eminent Member

DONALD QUARLES' military research and corporate leadership produced advancements in communication systems and radar. Quarles was born in Van Buren, Arkansas on 30 July 1894. In 1910, he enrolled in the University of Missouri summer school at Columbia and taught mathematics at Van Buren High School during the intervening academic years between 1910 and 1912. He then studied at Yale, earning a B.A. degree in 1916. The following year, he enlisted in the army and served for two years in France and Germany during World War I. Quarles was honorably discharged with the rank of Captain in Field Artillery in 1919. He then joined Western Electric Company as an engineer specializing in transmission research. While with Western Electric, he studied theoretical physics part-time at Columbia University. In late 1924, his research department at Western Electric became part of the newly established Bell Laboratories. Quarles took over apparatus inspection engineering. By 1929, he had become head of the Outside Plant Development Department. Between 1940 and 1944, he directed the Bell Laboratories' transmission department, where he was deeply involved in radar research and development. Between 1944 and 1948, he oversaw telephone apparatus development for military and commercial purposes. In 1948, Quarles was elected Vice-President of Bell Telephone Labs, and he held that position until 1952. He was then made Vice-President of the Western Electric Company and President of the Sandia Corporation, a subsidiary of Western Electric. In 1954, Dwight Eisenhower appointed Quarles to the National Advisory Committee for Aeronautics. One year later he succeeded

Harold Talbott as Secretary of the Air Force. In 1957, Quarles was promoted to Deputy Secretary of Defense, a post he held until his death in 1959.

Quarles' leadership as Director of the Transmission Development Department of Bell Telephone advanced military electronics systems, especially radar systems. His appointment into government service carried profound responsibilities. During his tenure as Assistant Secretary of Defense for Research and Development, he oversaw the satellite technology and missile production. After his appointment to Secretary of the Air Force, Quarles made national news when he dismissed security charges levied against Stephan Branzovich, an airman, which were based on allegations that his father was a communist. Quarles' unprecedented decision to remove the case from the hearing board set a precedent in Air Force security cases. As secretary of the Air Force Quarles was also responsible for an $18 billion annual budget. He made decisions regarding some of the most advanced weapons of the time. Quarles was scheduled to become Secretary of Defense, but died suddenly of a heart attack.

Quarles was a prolific writer and an active member of the community. Between 1936 and 1946, he published several papers on telephone wiring and radar systems. He was also involved in local government, serving as mayor of Englewood, New Jersey from 1946 to 1948 and Chairman of the Bergen County Sewer Authority from 1948 to 1950. Quarles earned many awards during his career including the Air Force's Exceptional Service Award in 1957, the American Institute of Consulting Engineers' Award of Merit, and the Presidential Medal of Freedom in 1957. Eta Kappa Nu named him an Eminent Member in 1956. Quarles was married twice. He and his first wife, Carolyn Whittemore, had three children, Carolyn, Elizabeth and Donald. Quarles married Rosina Cotton in 1938. He died in Washington DC on 8 May 1959. ✦

Industry Leader
And Humanitarian

Clifford Hood

1958

Eta Kappa Nu Eminent Member

CLIFFORD HOOD was a profoundly successful industrial leader. Born on a farm near Monmouth, Illinois on 8 February 1894, Hood received his B.S. degree from the University of Illinois in 1915. Following his graduation he became a technical apprentice with Packard Electric Company and was later promoted to sales engineer in 1917. That same year Hood joined American Steel and Wire, a subsidiary of United States Steel Corporation. World War I, however, temporarily interrupted his employment, and he served as an officer in the U.S. Coast Artillery. Following the war Hood returned to American Steel and Wire Company in 1919 and six months later became a foreman. Hood's career with US Steel progressed rapidly. In 1925, he was named Assistant Superintendent of American's South Works in Worcester. In 1932, he was elevated to assistant manager of the entire Worcester district operations and in 1933 manager. Hood was transferred to the company's headquarters in Cleveland in 1935 and was made Vice-President of operations. He was named Executive Vice-President in 1937 and President in 1938, a position he held until 1950. In 1950, Hood transferred to Carnegie Illinois Steel Corporation as President until 1951. Hood was elected President of United States Steel in 1953 when American Steel and Wire and Carnegie Illinois Steel Company were merged into the parent company. He held this office until his retirement in 1959.

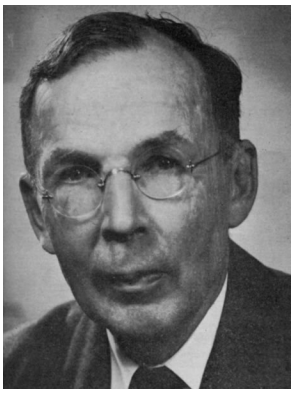
Hood's leadership at US Steel left an indelible legacy. US Steel's sales of 3.1 billion dollars and net income of 144 million dollars in 1952 grew to 3.6 billion dollars and 254.5 million dollars respectively

by 1959. During his tenure a new research center was constructed in Monroeville, PA. This center coordinated the corporation's research and development activities. In addition, Hood's project, Search For a Better Way, sought to improve human relations within the corporation. This program was believed by many to have created greater enthusiasm and incentive in the workplace. Hood's leadership and devotion to bettering human relations spilled over into community activities. Hood was a member of the National Council on Alcoholism, and in 1960 he initiated the creation of an advisory committee of which he served as chairman for eight years. During this time Hood was one of those responsible for developing the Council's Labor Management Services Department. This council initiated effective methods used in employee alcoholism programs. In 1978, Hood and his wife established the Clifford F. and Mary Tolerton Hood Foundation at Palm Beach Atlantic College. The foundation promoted the study of photography and the free enterprise system.

Hood's corporate leadership and humanitarian efforts have led to many awards including the Horatio Alger Award in 1954, the University of Illinois' Illini Achievement Award in 1957, and the first Industry Leadership Award of the National Council on Alcoholism in 1969. Eta Kappa Nu named him an Eminent Member in 1958. He and his first wife, Emily Tener, had two adopted sons, Randall and Richard. Emily passed away in 1941. Hood married Mary Tolerton in 1953. Hood died in Palm Beach, Florida on 9 November 1978.✦

Engineer and Educator

Philip L. Alger



1960

Eta Kappa Nu Eminent Member

PHILIP ALGER'S research and scholarship greatly contributed to the development of new technologies in rotating electric machines. Born in Washington D.C. on 27 January 1894, he earned his B.S. degree from St. Johns College in Annapolis, Maryland in 1912 and a second B.S. in electrical engineering from MIT In 1915. In 1920, Alger completed his M.S. degree in electrical engineering at Union College in Schenectady, New York. Early in his career, he worked as an associate professor at MIT. In 1917, he joined the army and served as a Lieutenant with the Ordinance Department in the United States Army. In 1919, Alger began his long and notable career with General Electric. Throughout his many years with GE, Alger worked in the Induction Motor Engineering Department and the Alternating Engineering Department, and he finally rose to manager of the Engineering Apparatus Department. In 1958, he joined the faculty at Rensselaer Polytechnic Institute in Troy, New York. He then went on to earn his Ph.D. in engineering from the University of Colorado in 1968.

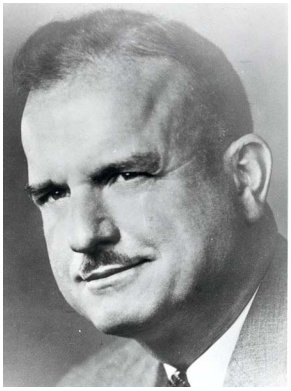
Alger is best known for his research on induction motor engineering and alternating current engineering. Alger's research at GE and Rensselaer led him to author and co-author several books including *The Nature of Polyphase Induction Machines* in 1951, *Mathematics of Science and Engineering* in 1957, and *The Nature of Induction Machines* in 1965. *Induction Machines: Their Behavior and Uses,* first published in 1970, was released in its second edition in 1995. This book served as an essential reference for the understanding and

development of rotating electric machines, offering a comprehensive study of the fundamentals of induction machine design and application.

Alger's research and devotion to education earned him AIEE's Lamme Medal, shared with Sterling Bequist in 1958, in recognition of Alger's "contribution to the art and science of design and application of rotating electric machines." Several awards were also named for Alger's contributions, including the Philip Alger Award for excellence in rotating machinery design, established by General Electric, and the Philip Alger Fund in engineering ethics, established by Rensselaer. Eta Kappa Nu named him an Eminent Member in 1960. Alger's first wife Catherine Jackson, with whom he had four children, died in 1945. His second wife, Helen Hubbell died in 1974. Philip Alger died on 24 September 1979 in Schenectady, New York at the age of 85.✦

Physicist and Nuclear Engineer

Chauncey Starr



1960

Eta Kappa Nu Eminent Member

CHAUNCEY STARR was the founding president and later Vice Chairman of the Electric Power Research Institute (EPRI). Born in Newark, New Jersey on 14 April 1912, he attended Rensselaer Polytechnic Institute in Troy, New York, where he earned his B.S. degree in electrical engineering in 1932 and a Ph.D. in physics in 1935. He then became a research fellow in physics at Harvard. There he worked with Nobel Prize winner P.W. Bridgman in the field of high-pressure physics. Between 1938 and 1941, Starr was a research associate in cryogenics at the Bitter Magnet Laboratory at MIT. Following the outbreak of World War II, Starr served with the Bureau of Ships and worked with the Manhattan District at the Radiation Laboratory of the University of California Berkeley and later at Oak Ridge. In 1946, he accepted a position with Rockwell International and by 1949 was appointed Director of the Atomic Energy Research Department, where he pioneered research in atomic power electricity plants. In 1960, he became Vice President of Rockwell International and President of its Atomic International Division. In 1967, Starr left Rockwell and served as Dean of the UCLA School of Engineering and Applied Science. In 1973, he became the founder and President of EPRI and later became Vice Chairman.

While with Rockwell, Starr led the way in the development of nuclear propulsion for rockets and ramjets and in miniaturizing nuclear reactors for space. He is noted for the high standards he set for the nuclear power industry and for his pioneering work on risk

analysis. Starr's foundation of EPRI resulted from senate hearings in the early 1970s concerning the lack of research and development in the power industry. EPRI was one of the first industry wide collaborative programs in the world. Starr formally established EPRI in 1973 with the financial support of the electricity industry. Upon receipt for the George E. Pake Prize in Palo Alto, California in March 2000, he was praised for his "visionary leadership in physics contributing to the establishment of a worldwide nuclear power industry for peaceful purposes."

Today Starr is President Emeritus of EPRI and remains active in the organization. He has earned many awards and honors including the Atomic Energy Commission Award in 1974, the Henry D. Smyth Award in 1983, the National Medal of Technology from President Bush in 1990, and the George E. Lake Prize of the American Physical Society in 1999. He holds honorary doctorates from Rensselaer Polytechnic Institute, the Swiss Federal Institute of Technology and Tulane University. Eta Kappa Nu named him an Eminent Member in 1960. He and his wife Doris reside in California and have two children, Ross and Ariel. ✦

Electrical Engineer
and Corporate President

John L. Burns

1961

Eta Kappa Nu Eminent Member

JOHN L. BURNS' corporate leadership and community involvement made profound contributions to professional and community life. Born in Watertown, Massachusetts on 16 November 1908, he attended Northeastern University where he received a B.S. degree in electrical engineering. He earned his M.S. and Sc.D. from Harvard University in 1931 and 1934 respectively. While working on his doctorate he was made an assistant in charge of Metallurgical Laboratories at Harvard. Following Burns' completion of his Sc.D. he briefly accepted a position as an assistant professor of metallurgy at Lehigh University. In 1935, he became Director of Metallurgical Laboratories at Republic Steel Corporation. Working with Tom Girdler, Burns augmented Republic Steel's success during very difficult economic conditions. By 1936 Republic Steel had become the nation's third largest producer of steel. In 1941, he accepted a position with Booz, Allen and Hamilton Management Consultants and served as their Chairman of the Executive Committee from 1941 to 1956. Between 1957 and 1961 Burns served as President of RCA and presided over a huge growth in color television production. By 1960, there were more than a half-million color televisions in use in the United States. Burns was also active in the social sphere, serving as Chairman of the Association of Consulting Management Engineers and President of the Greenwich Community Chest. He was also and active member of the executive committee and on the board of the Boys Clubs. Eta Kappa Nu named him an Eminent Member in 1961. ✦

Electronics Researcher
and Manager of Research

James Hillier

1961

Eta Kappa Nu Eminent Member

JAMES HILLIER and Albert Prebus built and designed the first successful high-resolution electron microscope in the western hemisphere. Born 22 August 1915 in Brantford, Ontario, Canada, Hillier was the oldest of four children. He credits his interest in physics and engineering to family lineage. His father and great-grandfather were both engineers. Hillier attended the University of Toronto, earning a B.A. degree in physics and math in 1937, an M.A. degree in physics in 1938, and a Ph.D. in physics in 1941. In 1940, Hillier joined the Radio Corporation of America (RCA) in Camden, New Jersey. RCA was the only company in the United States and Canada that recognized the large potential market for the technologies Hillier was developing. In 1942, he was transferred to the David Sarnoff Research Center in Princeton, New Jersey where he became research physicist in charge of electron microscope research. In 1954, he was named Administrative Engineer for Research and Engineering, and in 1957 he became General Manager of the Sarnoff Research Center, where he actively managed 500 professional inventors. In 1968, he was appointed Executive Vice President for Research and Engineering. He was responsible for directing research programs and the administration of RCA's central research facility, which made an astounding 1,000 patent applications a year. Hillier retired as Executive V.P. and Senior Scientist in 1977.

While enrolled in the University of Toronto's graduate program in 1937, Hillier and Albert Prebus designed the electron microscope. Their invention had a magnification of 7,000 times, exceeding optical

microscopes, which, with U.V. light, had a magnification of 2,000 times. Hillier took the design to RCA and developed it into a prototype for production. Within one year the magnification grew to 60,000. By 1953, Hillier had raised the useful magnification to over 400,000 diameters, 400 times the 1,000 limit of the light microscope using visible light. He also discovered the principle of the stigmator, which corrected the electron microscope's objective lenses astigmatism and invented the micro-analyzer. Hillier became the first to show tobacco mosaic viruses. Because of his work in various scientific disciplines, he developed many useful applications of the electron microscope, including improvements in electron diffraction and microanalysis, as well as viral and bacteriological techniques. Hillier was also a prolific writer, coauthoring *Electron Optics and the Electron Microscope* and publishing 150 technical articles.

Hillier remained active following his retirement from RCA in 1977. He consulted and advised on the use of advanced technology to improve the economies of the third world, most notably Egypt. He also lectured and campaigned to interest more students in technical careers. Because Hillier relied heavily on outside funding for his own education, he worked closely with his home town of Brantford by supporting a scholarship fund in his name for Brant County science students. Hillier has received many honors and awards over his distinguished career. Most recently he received an honorary degree from the new branch of Laurier University in Brantford. Other awards include the Albert Lasker Award sponsored by the U.S. Public Health Department in 1960, the Institute of Electrical and Electronics Engineers (IEEE) David Sarnoff Award in 1967, and the IEEE Founders Medal in 1981. The Inventors Hall of Fame inducted him in 1980, and he also earned the Canadian Government's top world achievement award, Honorary Officer, Order of Canada in 1997. He was named an IRE Fellow in 1957, and Eta Kappa Nu named him an Eminent Member in 1961. Hillier married Florence Marjory in 1936. She passed away in 1992. Hiller has two sons, J. Robert and William.✦

Engineer, Inventor,
and Educator

Arthur Dearth Moore

1961

Eta Kappa Nu Eminent Member

ARTHUR D. MOORE'S research was fundamental to the development of electrical engineering instrumentation. Born on a farm outside the town of Fairchance, Pennsylvania, on 7 January 1895, he decided to become an electrical engineer and teacher at age six! When he turned 16, Moore entered Carnegie Technical College, graduating in 1915 with a B.S. degree in electrical engineering. He then worked one year with Westinghouse Electric's Graduate Training Program. A year later, Moore began a forty-year career with the University of Michigan when he joined the faculty as an instructor in electrical engineering. In 1920, he became an assistant professor and in 1923, he earned his M.S. in electrical engineering. In 1931, he was named full professor. Moore was also involved in local government. From 1940 to 1957 he served as a member of the Ann Arbor, Michigan, city council, and as its president in 1955. Because Moore had many connections with other scientists, he was asked to become a personnel recruiter for the Naval Ordinance Laboratory in 1941. During the early war years he recruited and hired over 150 men.

Much of Moore's research was devoted to electrostatics. Throughout the 1940s and 1950s, he gained a reputation as an eminent inventor in the field of electrostatics. His more noteworthy inventions include the hydrocal, a hydraulic analog used to simulate and measure heat transients, the dirod, a reliable and useful generator, and fluid mapping devices of various kinds. These fluid mappers visually demonstrated fluid flow of potential fields and were used to solve engineering problems in areas such as underground gas recovery and

storage and canal seepage. Moore's knowledge was also put to use in his community. While serving on Ann Arbor's city council, he pushed for citywide waste collection and for the establishment of a sanitary landfill. Previous practices involving the feeding of garbage to hogs led to the outbreak of diseases such as trichinosis. In response to this, Moore organized and served as Vice-President of the First and Second National Conference on Trichinosis in 1952 and 1954. .

Moore received emeritus status from the University of Michigan in 1963. Meanwhile his career in electrostatics progressed. In 1964, with a grant from Lapp Insulator and Union Carbide, he traveled throughout the Western United States demonstrating his electrostatics equipment to engineers and students. He also gave demonstrations in England, Scotland, Sweden and Denmark. In 1970, he founded the Electrostatics Society of America. In 1974 he served on the National Academy of Sciences committee on hazards and electrostatics. Moore was a Fellow of the American Institute of Electrical Engineers (AIEE) and the Institute of Electrical and Electronics Engineers (IEEE). In 1969 he was awarded the Instrument Society of America's Donald P. Eckman award for a distinguished career in education. In addition, he authored three texts and edited one; *Fundamentals of Electric Design; Electrostatics; Invention Discovery* and *Creativity; and Electrostatics and its Applications* (Ed.). Eta Kappa Nu named him an Eminent Member in 1961. Moore maintained his office and laboratory at the University of Michigan until the mid-1980s. He married Josephine Shaffer in 1920. They had three children, Jeanne Ellen, Arthur Dearth, Jr., and Jo Carroll.✦

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Power Systems Engineer

Charles F. Wagner

1961

Eta Kappa Nu Eminent Member

CHARLES WAGNER is widely recognized for his contributions to the field of power system integration. Born 20 March 1895 in Pittsburgh, Pennsylvania, he received his B.S. degree from the Carnegie Institute of Technology in 1917. Following one year of graduate study at the University of Chicago, Wagner accepted an offer to join Westinghouse Electrical Corporation in 1918. While with Westinghouse he was very active on national and international technical and standardizing committees including the American Institute of Electrical Engineers, the National Electrical Manufacturers Association, the American Standards Association, the International Electro-technical Commission, and the International Conference on Large Electrical High-Tension Systems. Wagner was also known for his extensive research on lighting strikes. In 1945 the Wagner argued in journal *East, West* that lightning travels faster moving away from the earth than toward it. The most brilliant part of a lightning strike moves upward from the earth to the cloud at a speed of 20,000 miles a second which is fast enough to make a round-the-world trip before you can draw a deep breath. The downward dive travels at the rate of only 100 miles a second. "This luminous upward stroke moves along a highway of ionized air established by an earlier stroke from the cloud to the ground…Only a few ten-thousandths of a second separate the two, so the human eye sees them as one." Wagner maintained, contrary to popular opinion, that it is not the impact of the stroke that pulls a tree from its roots, but rather the heat of the lightning which converts wood moisture into steam and literally "blows up" the tree.

Wagner's contributions to engineering and devotion to research on lighting led to numerous honors and awards including the George Montefiore Prize of Belgium in 1929, won with his collaborator R. D. Evans, for outstanding achievements in research and development in the fields of electrical science and engineering, AIEE's Edison Medal for his distinguished contributions in the field of power system engineering in 1951 and Westinghouse's Order of Merit Award. Wagner also received an honorary Doctor of Engineering degree from the Illinois Institute of Technology. He was a Professional Engineer in the State of Pennsylvania and a member of Tau Beta Pi and Sigma XI. Wagner became an AIEE Fellow in 1940 and was named Eta Kappa Nu Eminent Member in 1961. Charles Wagner was married twice and had two children, Charles and Leonard.✦

Inventor, Educator,
and Nobel Laureate

John Bardeen

1962

Eta Kappa Nu Eminent Member

JOHN BARDEEN'S co-invention of the transistor led to an electronics revolution. He was born in Madison, Wisconsin on 23 May 1908. His father, Charles Bardeen, was the first graduate of the Johns Hopkins Medical School and also founded the Medical School at the University of Wisconsin. One of five children, John Bardeen studied electrical engineering at the University of Wisconsin where he received a B.S. degree in 1928 and an M.S. degree the following year. Between 1930 and 1933, he performed research in geophysics for Gulf Research Laboratories in Pittsburgh, Pennsylvania. In 1933, he left to pursue his Ph.D. in mathematics at Princeton University. While working closely with professor E.P. Wigner, he was exposed to solid-state theory. He received his doctorate 1936, and spent the next three years as a Junior Fellow at Harvard University. In 1938, he accepted a position as an assistant professor with the University of Minnesota. During World War II he worked for the Naval Ordnance Laboratory in Washington, D.C. In 1945, Bardeen joined a newly formed research group at Bell Telephone Laboratories in Murray Hill, New Jersey. There he developed an interest in semiconductors. In 1947, while working with Walter Brattain, he discovered the transistor effect. In 1951, he accepted a position as professor of electrical engineering and of physics at the University of Illinois, Urbana.

Bardeen produced one of his greatest contributions while working with two other Bell Lab researchers, Walter Brattain and William P. Shockley. Shockley asked Bardeen why an amplifier he developed

did not work. Brattain and Bardeen discovered that electrons behaved differently at he surface of germanium than first believed. The trio devised a way to control the electrons, which led to the first point-contact transistor. This discovery earned them a Nobel Prize in Physics in 1956. Their disclosure of the semiconductor transistor, in 1948, led to its use in telephone switching equipment four years later.

Bardeen's research in superconductivity theory flourished while teaching at the University of Illinois. With two graduate students, Leon Copper and Bob Schrieffer, Bardeen developed a theory of low-temperature superconductivity in which current flows with little or no resistance. This was the first theory on how cold metals conduct electricity so efficiently. It is known as the BCS theory, named after its inventors. This work resulted in Bardeen's receiving his second Nobel Prize in physics in 1972. Copper and Schrieffer were co-recipients.

Following his retirement from the University of Illinois in 1975, Bardeen continued his research and teaching. Over the course of his career, he was involved in many government activities, including serving on the President's Science Advisory Committee from 1959 to 1962 and on the White House Science Council in the early 1980s. He earned many awards and honors, including the U.S. National Medal of Science in 1965, IEEE's Medal of Honor in 1971, the Presidential Medal of Freedom in 1976 and the Lomonosov Prize from the Soviet Academy of Sciences in 1988. He received sixteen honorary degrees and was elected to the National Academy of Sciences, the National Academy of Engineering, and the American Philosophical Society. Eta Kappa Nu named Bardeen an Eminent Member in 1962. He died 30 January 1991 in Boston, Massachusetts. He was married to Jane Maxwell and they had two sons and a daughter.✦

Electrical Engineer
and Scientific Entrepreneur

Lloyd V. Berkner

1962

Eta Kappa Nu Eminent Member

LLOYD BERKNER was a key figure in the exchange of scientific information during the International Geophysical Year in 1957-1958, and helped shape space policy following the Russian success with Sputnik. Born in Milwaukee, Wisconsin, on 1 February 1905, Berkner grew up in Sleepy Eye, Minnesota. By the age of fourteen, he had already become an amateur radio enthusiast, setting records for radio communication between Connecticut and Hawaii. In 1927, he received a bachelor's degree from the University of Minnesota in Electrical Engineering and began working on radio and navigation systems for the Airways Division of the U.S. Bureau of Lighthouses. The following year, he flew on a reconnaissance mission to Antarctica to set up radio communication equipment. In 1930, he returned to the Bureau and in 1933 went to work for the Department of Terrestrial Magnetism (DTM), where he worked on the ionosphere-sounding program. In 1941, Vannevar Bush appointed Berkner his assistant at the Office of Scientific Research and Development. However, shortly thereafter the Navy tapped Berkner to organize a radar section in the Bureau of Aeronautics. Following World War II, he returned to the DTM as chairman of the Section of Exploratory Geography. Between 1951 and 1960, he served as head of Associated Universities, Inc. In 1961, he was appointed president of the Graduate Research Center of the Southwest and four years later was named director.

While working at the DTM in 1950, Berkner made his greatest contribution to international science. He argued that a third

International Polar Year should be set up twenty-five instead of fifty years after the second, noting that technologies developed during World War II would allow a more effective analysis of Antarctica. In addition, these technologies allowed scientists to conclude that the years1957 through 1959 would be years of maximum sun spot activity. Berkner's vision of a global program that would not be limited to the polar regions was called the International Geophysical Year (IGY). As a result of IGY, resolutions were passed at the International Union of Radio Science (URSI) and the International Union of Geology and Geodesy (IUGG) General Assemblies in 1954, the same year that satellite programs in the United States and the USSR began. Berkner was also highly influential in the 1959 signing of the Artic Treaty, which reserved scientific research on the continent for peaceful purposes. By the end of the IGY, satellite programs had also contributed to the understanding of the upper atmosphere. Because of Berkner's contributions, he was asked to serve on President Eisenhower's Science Advisory Committee from 1956 to 1959.

During the final years of his life he was dedicated to the promotion of research. In 1961, with the support of the community in Dallas Texas, he founded the Southwest Center for Advanced Studies. He had envisioned a community of scholars dedicated to post-graduate education and research that would be fully self-supporting by 1967. However, before this could happen, Berkner suffered a major heart attack in 1964 and was forced to curtail his activities. In 1969, two years following his death, the Center became the University of Dallas. Berkner earned many honors and awards, including the Fleming and Bowie Medal of the American Geophysical Union and the NASA Distinguished Public Service Medal in 1966. He was a Fellow of the American Institute of Electrical Engineers (AIEE), the Institute of Radio Engineers (IRE), and the Institute of Electrical and Electronics Engineers. He served as president of the IRE in 1961. Eta Kappa Nu named him an Eminent Member in 1962. Berkner died 4 June 1967. He was married and had one daughter.✦

Physicist and Nobel Laureate

Edward M. Purcell

1962

Eta Kappa Nu Eminent Member

EDWARD PURCELL is widely known for discovering a way to detect the extremely weak magnetism of the atomic nucleus. Born 30 August 1912 in Taylorville, Illinois, he was educated in public schools. In 1933, he graduated from Purdue University with a B.S. degree in electrical engineering. Before he graduated his interests had turned to physics as he conducted research in electron diffraction under the watchful eye of Professor K. Lark-Horovitz. Purcell then studied in Germany for one year as an exchange student at the Technisch Hochschule. He returned to the United States in 1934 and attended Harvard University. After receiving his Ph.D. in 1938, he taught physics for two years at Harvard. In 1940, Purcell took a leave of absence from Harvard and accepted a position at MIT in the Radiation Laboratory, where, during World War II, he worked on the research and development of microwave radar. He also directed the Fundamental Developments Group in the Radiation Laboratory, which explored new frequency bands and microwave techniques. In 1946, he returned to Harvard as an associate professor of physics and three years later became a full professor. He remained at Harvard until his retirement in 1977.

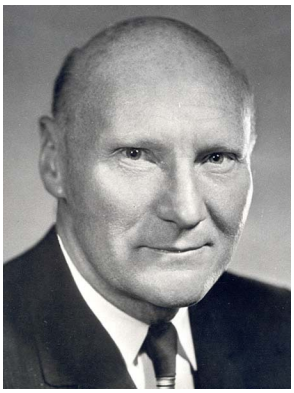
Purcell's research at MIT led to a remarkable discovery. Specific atomic nuclei, including those of hydrogen, spin and generate a magnetic field, but they do so weakly, making detection quite difficult. Purcell deduced that with a strong magnetic field he could bring the spinning nuclear particles into alignment. Then he could use microwaves to find their resonant frequency and strength. For this

contribution, Purcell shared the 1952 Nobel Prize in Physics with Felix Block of Stanford University, who devised a similar method. The previous year, Purcell and a graduate student, Harold I. Ewen, built an antenna and placed in on a Harvard roof for the first detection of radio emissions from clouds of hydrogen in space. This became a prime astronomical tool. In addition to his research and pioneering discoveries, Purcell also served as Science Advisor to Presidents Dwight Eisenhower, John Kennedy, and Lyndon Johnson.

Purcell remained active following his retirement from Harvard in 1977. In 1985, he allied himself with those scientists who opposed the development of the U.S. Strategic Defense Initiative, a space-based missile defense system, arguing that it would not work and could escalate the arms race. Purcell received many honors and awards, including the Oersted Medal of the American Association of Physics Teachers in 1967 and the National Medal of Science in 1979. Eta Kappa Nu named him an Eminent Member in 1962. Purcell died 7 March 1997 in Cambridge, Massachusetts, at the age of 84. He was married to Beth C. Busser and they had two sons.✦

Engineer, Mathematician,
and Educator

Ernst Weber



1962

Eta Kappa Nu Eminent Member

ERNST WEBER was the first president of the Institute of Electrical and Electronics Engineers (IEEE) and one of the founders of the U.S. National Academy of Engineering. Weber was born in Vienna, Austria on 6 September 1901. Growing up in war torn Vienna did not stifle Weber's interests in electrical engineering. He earned a B.S. degree in 1924 from the Technical University of Vienna and two Ph.D.'s, one from the University of Vienna in 1926 and another in engineering from the Technical University of Vienna in 1927. Doing research based on his mastery of mathematics and physics, he went to work for Siemens-Schukert in 1924. In the fall of 1930, he was invited to be Visiting Professor at the Polytechnic Institute of Brooklyn. A year later he was named a Research Professor of Electrical Engineering in charge of graduate study. From 1942 to 1945, he was Professor of Graduate Electrical Engineering and head of graduate study and research in that field. During World War II, he worked on radar and other military projects and also helped establish a company, Polytechnic R&D, which developed and manufactured microwave devices. In 1945, he was appointed Chairman of the Electrical Engineering Department and Director of the Microwave Research Institute at Polytechnic. In 1957, Weber became the president of the Polytechnic University and held this position until his retirement in 1969.

Weber is widely recognized for organizing a research group devoted to microwave research. Under his guidance, they developed the precision microwave attenuator, which was desperately needed for

the accurate calibration of radar. Weber's research organization founded in 1944, Polytechnic R&D, was granted over 30 patents. Weber also worked in the Institute of Radio Engineers (IRE) setting standards for radio equipment. Weber also played a large role in the merger of the IRE and the American Institute of Electrical Engineers (AIEE). Weber was a Fellow of both organizations and his leadership emphasized diversity and mutual support. Weber demonstrated that diversity was a source of strength and that having separate almost autonomous research groups was the secret of the organization's strength. Weber's administration of the merger earned him praise. He also allowed researchers to participate in the changes and committee formations. Weber's leadership laid the foundation for the IEEE's present structure of many technical societies within a profession society.

Following his retirement in 1969 from the Polytechnic Institute Weber, who was named President Emeritus of Polytechnic, worked for the U.S. National Research Council for nine years. He published over fifty papers and two textbooks on electromagnetic field, linear and non-linear circuits, and microwave measurements. He also earned six honorary doctorates. Weber also served as President of the Institute of Radio Engineers (IRE) in 1959. In 1963, he became the first President of the IEEE when the AIEE merged with the IRE. Weber was presented with many awards during his life, including the U.S. Presidential Certificate of Honor in 1948, the Institute of Electrical and Electronics Engineers (IEEE) Founders Award in 1971 "for leadership in the advancement of the electrical and electronics engineering profession in the fields of education, engineering societies, industry and government," and the U.S. National Medal of Science in 1987. Eta Kappa Nu named him an Eminent Member in 1962. Weber died 16 February 1996 in Columbus, North Carolina. He had two stepdaughters and was married to Sonya Weber.✦

Research Engineer
and University President

Jerome B. Wiesner

1962

Eta Kappa Nu Eminent Member

JEROME B. WIESNER'S work was important in development of radar and also heavily influenced the creation of the Nuclear Test Ban Treaty signed by the United States, Soviet Union and England in 1963. Born 30 May 1915 in Dearborn Michigan, Wiesner earned his B.S. in electrical engineering and mathematics in 1937, his M.S. degree in 1938, and a Ph.D. in electrical engineering in 1940, all from the University of Michigan at Ann Arbor. Wiesner then embarked on a diverse and creative career. While working for the Library of Congress as Chief Engineer for the Acoustical and Record Library in 1940, he helped develop recording facilities and equipment. This led to a meeting with folklorist Alan Lomax in 1942, whom he accompanied on a tour through the South and Southwest recording African American musicians. Upon his return, he joined the staff at MIT's Radiation Laboratory. In 1945, he spent one year at the Los Alamos Laboratory at the University of California. There he helped develop electrical components used at the Bikini Atomic bomb tests. In 1946, he returned to MIT as an assistant professor in the Department of Electrical Engineering. In 1950, he was promoted to full professor. Between 1952 and 1961, Wiesner served as Director of the Research Laboratory of Electronics (RLE) and helped broaden its emphasis on the underlying physics and on communications. In 1961 Wiesner took a leave of absence to direct the President's Science Advisory Committee under President Kennedy and, for a short time, under President Johnson . He returned to MIT in 1964 as the Dean of the School of Sciences. In 1966 he was appointed MIT Provost, and in 1971 he became MIT's thirteenth university president. In addition

he was named to the Technology Assessment Advisory Council of the Office of Technology Assessment of the U.S. Congress in 1974, and he was elected chairman in 1976.

While at MIT he was a leader in radar development at the Radiation Laboratory and also worked with Norbert Wiener on information systems. Wiesner was also considered to be an expert on microwave theory, communications science and engineering, signal processing, and radar. In 1942, he headed Project Cadillac. This was an airborne radar system that was a precursor to the Airborne Warning and Control System (AWACS). He later contributed to the conception of radio transmission by scatter techniques from the earth's ionosphere. Wiesner is also well known for his work on nuclear disarmament. He was an outspoken critic of nuclear arms proliferation and worked on the treaty banning all underground nuclear tests in 1963. In addition, he founded the International Foundation for the Survival and Development of Humanity, which was an organization comprised of scientists from the United States and the Soviet Union. Wiesner was a frequent advisor to government officials and served under Dwight Eisenhower as the director of the U.S. delegation to the Geneva Conference in 1958. In 1965, he authored *Where Science and Politics Meet*, which argued for effective disarmament measures.

Following his retirement in 1980, Wiesner continued his efforts to join humanism, science, and technology. He promoted the use of advanced technology and fostered the development of research in the cognitive sciences. He continued to speak out against the nuclear arms race and in 1993, and along with MIT scientists Philip Morris and Kosta Tsipis, proposed deep cuts in the U.S. military budget. Wiesner was presented with many awards including the President’s Certificate of Merit in 1948, Institute of Electrical and Electronics Engineers (IEEE) Founders Medal in 1977, and the National Academy of Sciences’ Public Welfare Medal in 1993. He was a Fellow of the Institute of Radio Engineers (IRE), and the American Academy of Arts and Sciences. Eta Kappa Nu named him an Eminent Member in 1962. Wiesner also received several honorary doctorates and is the subject of a new book, *Jerry Wiesner, Scientist, Statesman, Humanist: Memories and Memoirs*, edited by Walter Rosenblith, 2003. Wiesner died 21 October 1994 at his home in

Watertown, Massachusetts. He was married to Laya Wainger, and they had three sons and a daughter.✦

MIT Professor
and Computer Researcher

Gordon S. Brown

1963

Eta Kappa Nu Eminent Member

MASSACHUSETTS INSTITUTE OF TECHNOLOGY professor Gordon Brown was a pioneer in computer and engineering education and was internationally known for his work on automatic feedback-control systems. Born on 30 August 1907 in Drummoyne, Australia, he graduated in 1925 from Workingman's College, now the Royal Melbourne Technical College, with three diplomas in mechanical, electrical, and civil engineering. In 1929, he immigrated to the United States and was accepted to MIT where he earned his B.S. degree in electrical engineering in 1931, an M.S. degree in 1934, and a Ph.D. in 1938. In 1939, Brown became an assistant professor at MIT and a naturalized U.S. citizen. By 1952, Brown was serving as head of the Department of Engineering and had launched a major reconstruction of the electrical engineering curriculum. His emphasis on teaching fundamental sciences such as physics and mathematics modified the department's approach to education. In 1959, Brown became Dean of Engineering. His willingness to share technology with universities in India, Singapore, and Germany fostered an atmosphere of international cooperation. In 1973, he was named Institute Professor, an appointment reserved for MIT's most distinguished professors.

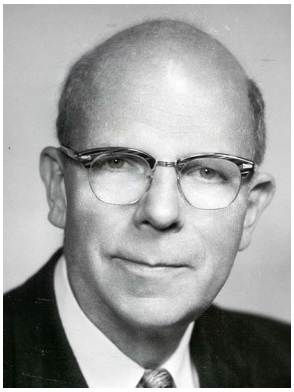
His doctoral dissertation on the Cinema Integraph, an early analog computer, demonstrated Brown's understanding of the future importance of computer automation. In 1940, he founded the MIT Servomechanism Laboratory. There he helped develop the path-breaking digital computer, Whirlwind. During World War II, he and his colleagues developed automatic fire control systems for the U.S.

military on land, at sea, and in the air. His book *Principles of Servomechanisms,* co-authored with Donald P. Campbell and published in 1948, examined linear feedback control and was a widely used textbook for several years. Following World War II, the Whirlwind computer became part of MIT's Lincoln Laboratory. Whirlwind helped advance groundbreaking technologies in air defense such as the Semi-Automatic Ground Environment (SAGE) project. Brown's research also contributed to the numerically controlled machine-tool project, a revolutionary technology that merged computers and servomechanisms with machine tools and redirected the future of the machine-tool industry. While Brown's work traversed many frontiers, the classroom was his true passion. He believed that undergraduate engineering education should emphasize engineering principles and should be based on a solid foundation of science and mathematics.

Following his retirement from MIT in 1974, Brown continued to strive for engineering modernization in public education. In Tucson, Arizona, where Brown lived during his retirement, he initiated a movement to utilize computers in education. He negotiated a donation of $100,000 worth of computers from Apple Computers, Inc. to be placed in an eighth-grade classroom. He was also a frequent consultant to industry and government. Brown received many awards and honors, including the President's Certificate of Merit in 1948, the George Westinghouse Award in 1952, the Lamme Medal of the American Society for Engineering Education in 1959, and the Institute of Electrical and Electronics Engineers (IEEE) Centennial Medal in 1984. Brown was a Fellow of the American Institute of Electrical Engineers (AIEE) and the Institute of Radio Engineers (IRE). Eta Kappa Nu named him an Eminent Member in 1963. Brown died 23 August 1996, at the age of eighty-eight in Tucson, Arizona. He was married to Jean Brown for sixty-one years. They had a daughter, Sydney, and a son, Stanley.✦

Electrical Engineer,
Inventor, and Educator

William L. Everitt



1963

Eta Kappa Nu Eminent Member

WILLIAM EVERITT was a pioneer in the field of radar, a recognized authority on electronics and a respected university dean. The son of a preacher, Everitt was born 14 April 1900 in Baltimore, Maryland. Between 1918 and 1919, he served in the U.S. Marine Corps during World War I. Following the war, Everitt attended Cornell University and earned his B.S. degree in electrical engineering in 1922. That same year he joined North Electric Manufacturing Company in Galion, Ohio where he designed automatic relay switchboard exchanges. In 1924, he left to teach engineering at the University of Michigan. While there he earned his M.A. degree in electrical engineering. During the summers between 1925 and 1930, he worked with American Telephone and Telegraph Company (AT&T) in development and research. In 1933, he received his Ph.D. from Ohio State University and was promoted to full professor. In 1940, Everitt became a member of the Communications Section of the National Defense Research Committee. Two years later he took a leave of absence from the university to serve as Director of Operational Research with the U.S. Army Signal Corps. In 1943, he was appointed the head of the electrical engineering department at the University of Illinois. In 1945, he served as President of Institute of Radio Engineers (IRE), and between 1949 and 1968 Everett was Dean of the University of Illinois' Engineering College.

Everitt promoted new ideas in teaching at the University of Illinois and is credited with guiding the engineering program to national prominence. He encouraged graduate study and interdisciplinary

research, and advocated cooperation between the sciences and humanities. He believed that students should incorporate studies in agriculture, commerce, and the liberal arts. Known for his accessibility, students at Ohio State often followed him around the golf course or sat in his kitchen on Sunday afternoons discussing their problems. Undergraduate students at the University of Illinois established the annual William Everitt Awards for Excellence in Teaching and made him the first recipient. A founding member of the National Academy of Engineering, Everitt was responsible for several inventions including automatic telephone equipment, a frequency modulation radio altimeter, and several antenna matching and feeding systems. In addition, he developed the principles of high-power radio amplification and co-invented the automatic time compressor. He authored two textbooks, *Communications Engineering* and *Fundamentals of Radio,* and edited more than 100 textbooks published by Prentice Hall.

Everitt received many awards and honors during his career. He was named to the American Society of Engineering Education's Hall of Fame and the Institute of Electrical and Electronics Engineers (IEEE) honored him as one of the top ten electrical engineers of all time. In addition to these honors, he was awarded the IRE Medal of Honor in 1954, the American Institute of Electrical Engineers (AIEE) Medal for Electrical Engineering Education in 1957, and the Mervin J. Kelly Award in 1963. Eta Kappa Nu named him an Eminent Member in 1963. He was married to his wife Dorothy for fifty-five years. They had two daughters and a son, and they also served as guardian sponsors to two sons of a Chinese colleague who asked the Everitt's to raise their children after the Chinese government succumbed to revolution. Two years after his wife's death in 1978, he married Margaret Anderson. Everitt died 6 September 1986.✦

Educator, Physicist,
and Research Leader

Lee A. DuBridge

1964

Eta Kappa Nu Eminent Member

LEE A. DUBRIDGE'S leadership roles as head of MIT's Radiation Laboratory and as President of the California Institute of Technology help pave the way for vast changes in science and the application of new technologies. Born 21 September 1901 in Terre Haute, Indiana, DuBridge's father held many jobs including Director of the YMCA, and his mother wrote poetry for greeting cards. DuBridge earned a scholarship to Cornell College in Iowa and graduated in 1922 with a B.S. degree in physics. In 1926, he earned his Ph.D. in physics from the University of Wisconsin. Two years later, he joined the faculty at the Washington University. In 1934, he accepted a position with the University of Rochester, where he later became Dean of Arts and Sciences. In 1940, he took a leave of absence from his post as the head of the Physics Department at Rochester, to serve as Director of the MIT Radiation Laboratory for the National Defense Research Committee (NDRC). From the Radiation Laboratory's inception in 1940, through its five years of vital wartime research, to its final dissolution in 1945, DuBridge implemented technical policies mandated by the NDRC's Microwave Committee. He also directed vital wartime research on radar technology. He was a member of the Naval Research Advisory Committee and the Air Force Science Advisory Board. Following the disbanding of the Radiation Laboratory, DuBridge was offered the presidency of the California Institute of Technology in 1946. For the next twenty-three years, he presided over tremendous growth at Cal Tech.

During the 1930s, DuBridge taught, researched, and published on

photoelectric phenomena. While with MIT's Radiation Laboratory, he directed the design and construction of numerous radar systems for air interception and detection of ships and submarines for night bombing. In the course of the war, DuBridge supervised the development of over 100 types of microwave radar. By 1945, he presided over the Radiation Laboratory's 4,000 scientists and engineers with an annual budget of fifty million dollars. The end of the war brought new opportunities. While serving as President of the California Institute of Technology, the campus tripled in size and new research fields emerged, including chemical biology, planetary science, and nuclear astrophysics. DuBridge was a firm believer that the government should financially support scientific research. One of his most trying challenges as an administrator came when a university trustee, sympathetic to Senator Joseph McCarthy's "red-baiting" campaign, called for the resignation of Linus Pauling, an esteemed member of the faculty. DuBridge refused to comply, offering his own resignation instead. It was not accepted, Pauling remained at Cal Tech, and was awarded his second Nobel Peace Prize in 1963.

DuBridge was a trustee of several philanthropic organizations, including the Rockefeller Foundation and the Carnegie Endowment for International Peace. He also served on the President's Communications Policy Board and the President's Air Quality Advisory Board.

Following his retirement in 1969, DuBridge served as a science advisor to President Richard Nixon. He was a Fellow of the Institute of Radio Engineers and a Fellow and past president of the American Physical Society. He was a member of the National Academy of Sciences and the American Association for the Advancement of Science. DuBridge earned many honors and awards, among them the U.S. Medal for Merit, Great Britain's King's Medal for Service in the Cause of Freedom, and the Gold Medal of the American College of Cardiology. In 1982 he was presented the Vannevar Bush Award of the National Science Foundation. He also earned twenty-eight honorary degrees. Eta Kappa Nu named him an Eminent Member in 1964. DuBridge died 23 January 1994 in Pasadena, California. He was married to Doris Koht and they had two children, Barbara and

Richard. Doris died in 1973. He remarried in 1974, to Arrola Bush Cole, the widow of a college classmate who had been president of Cornell College. Arrola died a few months after DuBridge.✦

Corporate Executive
and NASA Research Director

Winston E. Kock

1964

Eta Kappa Nu Eminent Member

WINSTON KOCK'S research was fundamental in developing the electronic organ and microwave relay systems. Born in Cincinnati Ohio on 5 December 1909, he attended local public schools and was denied admittance to the University of Cincinnati's Engineering College because he was only 16 years old. He was admitted one year later, completing his degree in electrical engineering in 1932. He received his M.S. degree in physics one year later. While in school, Kock studied organ at the College of Music in Cincinnati and was awarded three scholarships. His love of music and his knowledge of electronics led him to design and build an electronic organ while still an undergraduate. In 1933, the Institute of International Education awarded him an Exchange Fellowship, allowing him to earn his Ph.D. in 1934 from the University of Berlin. He returned to the United States and briefly taught in the physics department at the University of Cincinnati before accepting a position at the Institute for Advanced Study at Princeton University. Between 1942 and 1956, Kock worked with Bell Telephone Laboratories on radar antennas. By 1956, Kock had served as Director of Acoustics Research and Director of Audio and Video Systems. In 1956, he joined the Bendix Corporation and became Vice President of Research in 1962. In 1964, Kock was selected to be the first Director of NASA's Electronics Research Center at Cambridge Massachusetts. In 1966, he returned to Bendix, where he served as Vice President and Chief Scientist until 1971.

Kock was involved with several inventions during his career. In

1935, his association with Baldwin Piano Company of Cincinnati as a researcher led to the construction, by him and John Jordan, of the first commercial fully electronic organ. Thirty patents protected their invention in the United States and abroad. While working with Bell Telephone Laboratories, Kock invented the metal plate lens and the artificial dielectric lens, both of which were essential components of the microwave relay system. While Director of Acoustics Research, he developed acoustic lenses and presided over the U.S. Navy's highly classified Jezebel-Caesar projects on underwater sound. In the mid 1950s, he directed much of the early work on a narrow-band television system for the picture phone. His skill as an organizer and leader also led to the development of an automatic digit recognizer, called Audrey. During Kock's tenure with NASA, he initiated satellite and integrated communications projects as well as navigations projects. Under his leadership the staff grew from 70 scientists and engineers to 550.

Following his retirement in 1971, Kock worked as a corporate consultant for Bendix and visiting professor at the University of Cincinnati. He also held the position of Director of the Herman Schneider Laboratory of Basic and Applied Science Research at the University. During Kock's prolific career he earned many accolades. He was the recipient of the Eta Kappa Nu's Outstanding Young Engineer Award in 1938 and Award of Merit in 1959, and the U.S. Navy Distinguished Public Service Medal in 1964. Kock was an Institute of Radio Engineers (IRE) Fellow, and Eta Kappa Nu named him an Eminent Member in 1964. He died in Ann Arbor, Michigan on 26 November 1982. He was married to Kathleen Redmond, and they had three children, Winston, Robert, and Kathleen.✦

Microwave Researcher
and University President

Julius Stratton

1964

Eta Kappa Nu Eminent Member

JULIUS STRATTON was an eminent engineer and educator. Born in Seattle, Washington on 18 May 1901, he developed interests in radio technology at an early age and served as a ship's radio operator during World War I. Following the war, Stratton studied for one year at the University of Washington and then transferred to MIT, earning his B.S. degree in electrical engineering in 1923. The following year, he studied in France at the University of Grenoble and Toulouse. He returned to MIT where he earned his M.A. degree in electrical engineering. Two years later, he earned a Ph.D. in mathematics from the Swiss Federal Institute of Technology in Zurich. In 1928, he returned to MIT as an assistant professor of electrical engineering. In 1930, he transferred to the physics department and in 1935 became an associate professor. By 1941, Stratton had become full professor and had performed extensive research on high-frequency electromagnetic waves. His work led to the publication of *Electromagnetic Theory* in 1941. During World War II, he became an expert consultant to the Secretary of War, Henry L. Stimson. In 1946, Stratton was appointed the first director of the new interdisciplinary Research Laboratory of Electronics at MIT. Three years later he was named MIT's first provost, and in 1956 he became MIT's first chancellor. In 1959, Stratton became MIT's eleventh president.

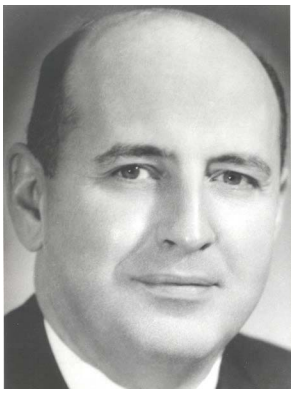
Stratton's research on short-wavelength electromagnetic waves produced a deeper understanding of radio systems at all frequencies. More important, however, was the design of systems based on Maxwell's equations. This understanding aided in the development of

microwave radar during World War II, as well as important advances in microwave radio used in telephone, television and data communication. In 1940, Stratton joined the Radiation Laboratory. He worked on the development of microwave radar and was instrumental in developing the LORAN navigation system. While consulting for Secretary of War Henry Stimson, he worked on radar and guidance systems, which led to his assistance in planning for the invasion of Normandy. His contributions earned him the United States Medal for Merit. During Stratton's tenure at MIT he presided over major building programs and encouraged women's enrollment. He also oversaw the integration of humanities, social sciences and management with science and technology and encouraged research development and interdisciplinary centers. He retired from MIT in 1966. Between 1966 and 1971, Stratton was a trustee of the Ford Foundation and served as its chairman.

In 1971, Stratton returned to Cambridge and devoted much of his time and energy to preparing a history of MIT. Stratton was presented with many awards during his distinguished career including the Institute of Radio Engineers (IRE) Medal of Honor in 1957, the Faraday Medal for Distinguished Achievement in 1966, and the Marine Technology Society Citation in 1969. He held sixteen honorary doctorates and was a member of the National Research Advisory Committee and the National Science Board. He was also an IRE Fellow. Eta Kappa Nu named him an Eminent Member in 1964. Stratton died in Boston on 22 June 1994. He was married to Catherine Coffman and they had three daughters, Catherine, Lew, and Laura.✦

Television Pioneer, Editor,
and IEEE Executive Director

Donald G. Fink



1965

Eta Kappa Nu Eminent Member

DONALD FINK'S research made profound contributions to the development of television. Born 8 November 1911 in Englewood, New Jersey, he earned his B.S. degree in electrical engineering in 1933. The following year he joined the editorial staff of McGraw-Hill's *Electronics* magazine and later became Editor-in-Chief. In 1942, Fink earned his M.S. degree in electrical engineering from Columbia University. During World War II, he took a leave of absence from McGraw-Hill and joined MIT's Radiation Laboratory, directing its Loran Division. Between 1943 and 1946, he was appointed Expert Consultant to the Office of the Secretary of War. Fink was an observer of the atom bomb tests conducted at Bikini Atoll. Following the war, he returned to *Electronics* magazine as Editor-in-Chief and held that position until 1952. In 1950, he was appointed Vice-Chairman of the National Television System Committee (NTSC) where he worked on resolution standards. In 1952, he became the Director of Research for the Philco Corporation. In 1962, he was named director of the Philco-Ford Scientific Laboratories. Fink also was involved with the Institute of Radio Engineers, (IRE). He was a member of the of the IRE Board of Directors from 1949 to 1951 and was elected IRE president in 1958. When IRE and the American Institute of Electrical Engineers (AIEE) merged in 1963 and formed the Institute of Electrical and Electronics Engineers (IEEE), Fink served as the organization's first general manager until his retirement in 1974.

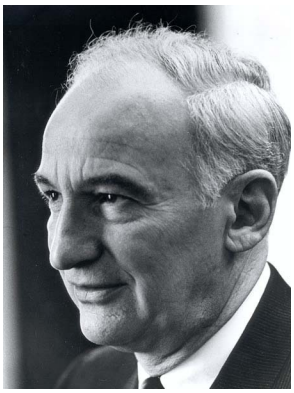
Fink made many contributions to the development of television

technology. In 1940, he wrote *Principles of Television Engineering*, which became the standard text for those working in television development. In 1966, Fink also authored a groundbreaking text used in high-school computer classes, *Computers and the Human Mind, an Introduction to Artificial Intelligence.* While serving as Vice-Chairman of the National Television System Committee (NTSC) in 1950, he proposed the 1941 resolution standard of 525 lines for color television and he played an important part in the NTSC color-television standards adopted in 1953. That same year he joined a Senate Advisory Committee on Color Television, The Condon Committee.

Fink was exceptionally active during his retirement years. He remained self-employed as a registered professional engineer, served as chairman of the Society of Motion Picture and Television Engineers Study Group on High Definition Television, and in 1975 created the Electronics Engineers' Handbook, the most widely used reference book in the field. Fink received numerous awards throughout his career including the Medal of Freedom from the U.S. War Department in 1946, the Presidential Certificate of Merit in 1948, and the Journal Award from the Society of Motion Picture and Television Engineers in 1955. Eta Kappa Nu named him an Eminent Member in 1965. Fink died 3 May 1996 in Mount Kisco, New York. He was married to Alice Berry Fink, and they had two daughters, Kathleen and Susan, and one son, Stephan.✦

Engineer, Corporate Leader, and Author

Simon Ramo



1966

Eta Kappa Nu Eminent Member

SIMON RAMO was the chief engineer overseeing the development of Intercontinental Ballistic Missile Research (ICBM) during the Eisenhower Administration. Born 13 May 1913 in Salt Lake City, Utah, Ramo was awarded a music scholarship at the University of Utah, which he used to earn his B.S. degree in electrical engineering at the age of 20. In 1936, he completed his Ph.D. in electrical engineering and physics at the California Institute of Technology. He was twenty-three years old. Shortly thereafter, he took a job with General Electric working in the new field of microwaves. While with GE, he taught a series of classes on electricity and magnetism theory and completed one of the first books on the characteristics of microwaves. He then co-authored the widely used textbook, *Fields and Waves in Modern Radio,* published in 1944. In 1946, Ramo joined Hughes Aircraft and served as the director of research in the electronics department. He later left Hughes Aircraft and joined Dean Wooldridge to form the Ramo-Wooldridge Corporation in 1953. Ramo-Wooldridge Corporation managed to earn the trust of General Bernard A. Shriver. Shriver was commander of Western Development, which was responsible for ballistic missile development. In 1958, Ramo-Woodbridge merged with Thompson Products and became TRW Incorporated. Ramo became Vice Chairman of TRW's Board of Directors and Chairman of the Executive Committee until his retirement. He also was President of TRW's former affiliate, the Bunker-Ramo Corporation, which developed technologies for the securities industry and designed and implemented the system software for the NASDAQ Stock Exchange.

Ramo recognized his technological abilities early in his career. While working with GE he pioneered microwave technology and developed GE's electron microscope. His crowning achievement involved his work on ICBM technology. The Ramo-Wooldridge Company was responsible for technical direction and systems engineering for the development of the US Intercontinental Ballistic Missile (ICBM). In 1953, the United States Air Force, under pressure from President Eisenhower, practically drafted the Ramo-Woodbridge Company to develop the ICBM before the Soviet Union could complete their project. In 1958, the Air Force successfully tested the Atlas ICBM, which could travel a distance of more than 5,000 miles. The Ramo-Wooldridge Corporation determined how large the missiles should be, what warheads would be carried, how the guidance system should operate, and its overall accuracy. Ramo's contributions allowed the United States to outpace the Soviet Union during the arms race. His work also had resounding effects on the development of the space program. His leadership led to the successful cooperation between the U.S. Air Force and private industry, paving the way for the development of the military space program. Following his years with TRW, Ramo was an influential business leader and author. He has authored or co-authored thirteen books ranging from business management to tennis strategy.

Few individuals have rendered influential advice to the U.S. government on science and technology over so long a period. Ramo has been a member of the National Science Board, the White House Council on Energy R&D, the Advisory Council to the Secretary of Commerce, and the Advisory Council to the Secretary of State for Science and Foreign Affairs, and he served on many special advisory committees to the Defense Department and NASA. Following retirement he served as a key advisor to the government on science and technology. Under Gerald Ford he was made Chairman of the President's Committee on Science and Technology and co-chaired the Transition Task Force on Science and Technology under Ronald Reagan. He was also a visiting professor at Cal Tech and Chairman of the UCLA School of Medicine Planning Committee. Ramo has received numerous awards, including the National Medal of Science in 1979, the Institute of Electrical and Electronics Engineers (IEEE)

Founders Medal in 1980, the Presidential Medal of Freedom in 1983, and the John Fritz Medal in 1986. Eta Kappa Nu named him an Eminent Member in 1966. He is married to Virginia, and they have two sons, James and Alan. Ramo resides in Beverly Hills, California. ✦

Engineer, Inventor,
and Research Director

George H. Brown

1967

Eta Kappa Nu Eminent Member

GEORGE H. BROWN'S research led to pioneering developments in directional antennas and turnstile antennas used for television broadcasting. Born on 14 October 1908, in North Milwaukee, Wisconsin he earned his B.S. degree in electrical engineering in 1930, his M.S. degree in 1931, and his Ph.D. in 1933, all from the University of Wisconsin. He then joined the Radio Corporation of America (RCA) as a research engineer at Camden, NJ. There he researched radio transmission problems and made profound contributions to the development of directional antennas. During World War II, Brown designed and developed radio and radar antennas for military systems and was awarded a Certificate of Appreciation from the War Department. In 1952, he was made Director of the Systems Research Laboratory at RCA Laboratories, and in 1957 he became Chief Engineer of Commercial and Industrial Electronic Products. RCA named him Vice-President of Engineering in 1959, Vice-President of Research and Engineering in 1961, Executive Vice-President of Research and Engineering in 1965, and Executive Vice-President of Patents and Licensing in 1968. He served on the board of directors until his retirement in 1972.

Early in his career, Brown ambitiously researched the challenge of transmission problems facing the radio broadcasting industry. While with RCA he came up with the theory and analytical deductions that led to his development of the directional antenna systems that are now standard in the transmission of AM and FM radio and in television broadcasting. In 1935, he followed this with development

of the "turnstile" antenna. The turnstile was an effective combination of high gain and broad bandwidth with a wave propagation pattern making it possible to broadcast FM radio and television signals over long distances. Brown was also involved in industry and government efforts to formulate and establish standards for radio and television broadcasting. During the 1950s he was responsible for establishing and leading a comprehensive technical and test program that demonstrated for the first time the advantages and the problems of UHF television broadcasting. During this time he also made significant contributions to the formulation of standards for commercial color television service as a participant in the work of the National Television System Committee and as an expert witness before the Federal Communications Commission.

Brown remained active during his retirement years. In 1979, he published his memoirs entitled *And Part of Which I was--- Recollections of a Research Engineer*. He was member of the Institute of Radio Engineers (IRE) and the American Institute of Electrical Engineers (AIEE) and was a Fellow of both organizations. He was a Fellow of the American Association for the Advancement of Science and a member of the National Academy of Engineering. Brown was awarded eighty US patents, and wrote over 100 technical articles. He earned numerous awards including the Modern Pioneer Award from the National Association of Manufacturers in 1940, the Institute of Electrical and Electronics Engineers (IEEE) Edison Medal "For a meritorious career distinguished by significant engineering contributions to antenna development, electromagnetic propagation, the broadcast industry, the art of radio frequency heating, and color television" in 1967, and the De Forest Audion Award in 1968. In addition he received the coveted Silver Beaver Award for his work in scouting in 1962. Brown died on 11 December 1987 at his home in Princeton, New Jersey. He was married to Elizabeth Ward, and they had twin sons, James and George.✦

Electrical Engineer, Professor,
and Corporate Executive

Harold E. Edgerton

1968

Eta Kappa Nu Eminent Member

HAROLD EDGERTON'S research was fundamental in the development of high-speed, stop-motion photography. Edgerton was born 6 April 1903 in Fremont, Nebraska. His uncle encouraged his interest in photography and helped him set up a dark room in their home while he was in high school. In 1920, Edgerton went to work for Nebraska Light and Power and developed an interest in electrical generation. That interest led him to enroll at the University of Nebraska, where he earned his B.S. degree in electrical engineering in 1925. In 1927, he received his M.S. degree in electrical engineering from MIT, and became a faculty member there for fifty-five years. In 1931, he earned his D.Sc. from MIT and began working with the stroboscope. His research paved the way for the modern electronic flash. During World War II, Edgerton was commissioned to develop a high-powered flash for aerial photography. Following the war, Edgerton founded Edgerton, Germeshausen, and Grier, Inc. (EG&G) with two former students. This company grew into a Fortune-500 Company with 30,000 employees. EG&G specialized in the development of electronic technology and made enormous contributions to high-speed photography. In 1954, Edgerton became Chairman of EG&G and held that position until his retirement from both MIT and EG&G in 1966.

While at MIT, Edgerton pioneered the development of the stroboscope and electronic flash. This discovery was used in both ultra-high speed and still photography. His work led to his discovery of high-speed, stop-motion photography that illuminated a world

imperceptible to the human eye. His technique was popularized in the example of the coronet of a milk drop and his famous stop-motion photograph of a .30 caliber bullet penetrating an apple. Following the founding of EG&G, Edgerton's research contributed to the development of the Rapatronic camera capable of photographing nuclear explosions from a distance of seven miles. In 1953, he began associating with French underwater explorer Jacques-Yves Cousteau. While working with Cousteau, Edgerton developed the "pinger" device, which bounced sound waves off the ocean floor to determine how close the camera was to the bottom. This development led to his discovery of the "boomer sonar" device used for seismic profiling at the bottom of the sea. In 1964, while working with colleagues at MIT, he used his stroboscopic lighting and special cameras to take motion pictures of human blood flow.

Following his retirement in 1966, Edgerton remained active pursuing his love of ocean exploration. In 1973, he and his colleagues, using side screen sonar, located the sunken Civil War battleship the USS Monitor. Edgerton received many awards and honors including the Medal of Freedom from the War Department in 1946, the National Medal of Science in 1973, and the National Medal of Technology in 1988. In 1966, he was appointed Institute Professor at MIT, which is awarded to distinguished faculty members. He was named a Fellow of the American Institute of Electronic Engineers (AIEE) in 1946 and the Institute of Radio Engineers (IRE) "For contributions in the application of electronic techniques to high-speed stroboscopic photography" in 1956. Eta Kappa Nu named him an Eminent Member in 1968. Edgerton died 4 January 1990. He was married to Esther May Garrett for 52 years, and they had three children.✦

Physicist, Electrical Engineer,
and Research Director

William H. Pickering

1968

Eta Kappa Nu Eminent Member

WILLIAM PICKERING'S research greatly contributed to the development of missile and spacecraft technology. Born on 24 December 1910 in Wellington, New Zealand, Pickering immigrated to the United States and became a naturalized citizen in 1941. His early education was at the University of New Zealand; however, after one year there he entered the California Institute of Technology and earned his B.S. degree in 1932, his M.S. degree in electrical engineering in 1934, and a Ph.D. in physics in 1936. He then joined the faculty at Caltech, becoming a full professor in 1946. Between 1936 and 1938 he worked with Nobel Laureate Robert Millikan on high-altitude and cosmic-ray research. His experience proved invaluable during World War II as he explored Japanese balloon warfare techniques. Because of Pickering's experience in the design of telemetering devices, he was asked to join Jet Propulsion Laboratory (JPL) in 1944. Between 1954 and 1976, he would direct technological advances in missile development and unmanned lunar projects for NASA.

Pickering's early research at JPL led to the development of a telemetry system for JPL's research vehicles. Eventually the Department of Defense adopted this technique as part of its program for missile development. By 1949 Pickering was heading the project to convert the Corporal experimental research vehicle into a surface-to-surface guided missile system. In 1952 JPL began developing Sergeant, Corporal's successor, which was a solid propellant missile system that was more reliable than and more mobile than Corporal.

In 1954, he was named Director of JPL. Under his leadership JPL expanded its research into the development of satellites and space flight technology. JPL initiated interplanetary space flight in 1962. The Mariner II space flight to Venus provided temperature and atmospheric conditions for the planet. Other Mariner missions revealed vital information about Mars' craters and its varied terrain. In May 1971 Pickering directed the launch of Mariner Nine, which became the first spacecraft to orbit another planet. Mariner Nine detected vital information concerning Mars' water vapor atmospheric content and past surface volcanic activity. Pickering's final project with JPL involved the development and deployment of the Viking Orbiter and Voyager. Voyager continues to send data to Earth.

Following his retirement in 1976, Pickering accepted a position as Director of the Research Institute, University of Petroleum and Minerals, Dhahran, Saudi Arabia. When he returned to California he established the Pickering Research Corporation, which undertook space-related projects. In response to energy shortages, he founded Lignetics Inc. in 1983. Lignetics manufactured wood pellets from sawdust to produce an efficient and non-polluting fuel source. Although quite active in his retirement, Pickering found time for avocations such as trout fishing and stamp collecting. He was also an excellent gardener and amateur horticulturist. Throughout his distinguished career he was honored with many awards including NASA's Distinguished Service Medal, the Army's Distinguished Civilian Service Award, IEEE's Edison Medal in 1972, and the National Medal of Science in 1976. He was a member of the National Academy of Sciences and the National Academy of Engineering. Pickering was named an Eta Kappa Nu Eminent Member in 1976. He was also an IRE and IEEE Fellow. He had two children, William Balfour and Anne Elizabeth, with his first wife Muriel, who passed away. He married Inez Chapman, and they had one daughter, Elizabeth. Pickering died on 16 March 2004 at his home in La Canada Flintridge, California.✦

Electrical Engineer
and Corporate Executive

Walker L. Cisler

1969

Eta Kappa Nu Eminent Member

WALKER LEE CISLER'S leadership at Detroit Edison promoted the development of peaceful uses for nuclear power. Cisler was born in Marietta, Ohio on 8 October 1897. He earned his B.S. and M.S. degrees from Cornell University in 1920 and 1922, respectively. In 1922, he joined Public Service Electric and Gas Company and advanced to Assistant General Manager of the Electrical Department. In 1943, he left Public Service Electric and Gas and accepted a position with the Detroit Edison Company. During World War II, Cisler worked in the War Productions Building and was eventually commissioned Lieutenant Colonel responsible for rehabilitation of electric, gas, and water facilities in the Mediterranean. He was then appointed Colonel and head of the Public Utilities Section of the Supreme Headquarters Allied Expeditionary Forces. Following his retirement from the service in 1945, he served as a consultant for the Atomic Energy Commission and Defense Department. In 1945, he was named Chief Engineer of Power Plants with Detroit Edison. Two years later he was appointed Vice-President of Employee Relations. In 1951, he became a member of the board of directors, and subsequently he was appointed President and General Manager. Cisler was named CEO of Detroit Edison in 1954, and in 1964 he became Chairman of the Board. He retained both positions until his retirement in 1971.

During his tenure as CEO of the Detroit Edison Company, Cisler promoted the development of nuclear energy for peaceful purposes. In 1954, President Eisenhower signed the Atomic Energy Act, ending a long period of government monopoly in atomic energy. Cisler promoted the planning, financing, and construction of reactors.

Addressing the responsibilities of the newly founded Atomic Energy Forum, he called for a greater industry role in the exchange of ideas and resolutions to problems that plagued business organizations. In 1954, after a lengthy tour of European power facilities, Cisler noted in the Atomic Industrial Forum's Annual Report, "Everywhere I found a deep interest in the peaceful uses of atomic energy. It is reasonable to believe that atomic energy in the form of electric power will have a significant influence in supplementing existing conventional energy resources." The following year, he was appointed to a presidential task force studying disarmament. Meanwhile, Edison continued its growth by adding the St. Clair Power Plant, breaking new ground for Enrico Fermi Atomic Power Plant (Fermi-1), and starting the River Rouge Power Plant, all in 1956. St. Clair became the largest power plant in the world. Cisler presided over this tremendous growth and added several other power plants by 1975.

His dedication to atomic energy research earned Cisler several awards and honors, including the George Westinghouse Gold Medal for eminent achievement in the power field of mechanical engineering in 1954, the Edison Medal from the Institute of Electrical and Electronics Engineers (IEEE) "For his achievement in the power industry… for services to his country…and for his broad contributions to the profession of engineering" in 1965, the John Fritz Medal, awarded for outstanding contributions in engineering in 1966, and the Centennial Award from the American Society of Mechanical Engineers in 1980. He was a Fellow of the IEEE and the American Institute of Electrical Engineers (AIEE). In addition, he was named a Fellow of the American Institute of Management in 1952, the American Society of Mechanical Engineers, and American Management association in 1955. Eta Kappa Nu named him an Eminent Member in 1969. Cisler died 18 October 1994. He was married to Gertrude Rippe, and they had three adopted children.✦

Texas Instrument Chairman
and IRE President

Patrick E. Haggerty

1969

Eta Kappa Nu Eminent Member

PATRICK HAGGERTY'S guidance and enthusiasm catapulted Texas Instruments into a position of technological leadership and development. Born 17 March 1914 in Harvey, North Dakota, Haggerty became interested in radio technology and at an early age and became one of North Dakota's first ham radio operators. In 1936 he received his B.S.E.E from Marquette University. During his senior year in college he went to work for Badger as a part-time engineer. By 1942 he was assistant general manager in charge of engineering, manufacturing, and administrative functions. He left Badger in 1942 and joined the Navy, eventually serving as Head of Electronics Production Branch of the Electronics Components Group during World War II. Following the war in 1945 he joined the Geophysical Service Incorporated as General Manager of the Laboratory and Manufacturing Division. Haggerty was responsible for research, engineering, and manufacturing. In 1951 GSI became Texas Instruments (TI). Haggerty served as Executive Vice President from 1951 to 1958. In 1958 Haggerty became President and in 1967 he was named Chairman. Haggerty's influence and leadership moved TI from a corporation that assembled components to one that led the industry in electronics technology.

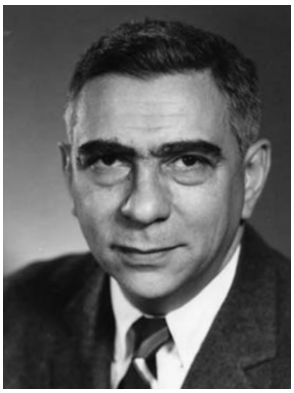
In 1953, Haggerty led the company's initiative to produce transistors. By the end of 1953 and under the direction of Mark Sheppard Jr., TI was producing geranium transistors. Although initially expensive, Haggerty believed that initiating a portable radio market would stimulate demand for transistors and would create the need for high-

volume manufacturing thereby lowering costs. The Regency radio was introduced in 1954 and set the stage for a technological revolution. Under Haggerty's leadership, new research engineers were hired and in 1958 one of them, Jack Kilby, invented the integrated circuit. Haggerty's influence was also paramount in the development of new military technologies. TI developed technologies in laser guidance, infrared night-vision equipment and airborne radars. Under Haggerty's leadership TI also developed the single-chip microprocessor essential to operating many electronic devices. Haggerty also served as President of the Institute of Radio Engineers (IRE) during its merger with the American Institute of Electrical Engineers (AIEE) and following the merger served as the first President of IEEE.

Haggerty was serving as General Director of TI when he died 1 October 1980 in Dallas Texas. During his career Haggerty earned many awards and honors including the Electronic Industries Association's Medal of Honor in 1967, IEEE's Founders Award in 1968 for outstanding contributions to the leadership of the electrical engineering profession, and Western Electronics Manufacturers Association Medal of Achievement in 1972. He was named Eta Kappa Nu Eminent Member in 1969. Haggerty also earned numerous honorary doctorates and published several articles on management, research and development. He and his wife, Beatrice, had five children.✦

Research Director and
Naval Research Chief Scientist

Emanuel R. Piore



1969

Eta Kappa Nu Eminent Member

EMANUEL PIORE'S leadership and innovation established IBM as a technological leader. Born in Wilno, Russia on 19 July 1908, his family immigrated to the United States when he was nine years old. In 1924, Piore became a naturalized citizen. He attended the University of Wisconsin where he earned his B.A. degree in 1930 and his Ph.D. in 1935, both in physics. Immediately following completion of his doctorate, he accepted a position at the Radio Corporation of America (RCA) where he worked on phosphorous for television tubes. In 1938, CBS hired Piore as an engineer working on the development of color television. He headed the company's television laboratory until 1942. When the U.S. entered World War II, he became a senior physicist with the Navy Department and later headed the electronics research branch of the Office of Naval Research (ONR). During the war he served on the staff of the Deputy Chief of Naval Operations for Air. Following the war, he became the first civilian to be named chief scientist of the Office of Naval Research. Between 1946 and 1955, Piore's influence resulted in increased support for university research. This helped provide a model for the National Science Foundation and the Atomic Energy Commission. While serving as the Chairman of the High Energy Physics Commission, he persuaded federal government officials to fund research on large particle accelerators. In 1955, Piore left the ONR and was named vice president for research of the Avco Manufacturing Corporation. The following year he became research director for IBM and in 1960, he was named IBM's Vice-President and chief scientist. He also served as a member of the IBM Board of

Directors between 1962 and 1973.

Piore's arrival at IBM marked a major turning point in the corporation's approach to research and development. Prior to 1956, the company placed its principle emphasis on manufacturing. Piore established a separate research division to reduce the influence of product development on research priorities. Piore made IBM an enticing place for researchers and greatly improved ties with university researchers. In addition, he established the position of IBM Fellow, which rewarded the best researchers. Piore's emphasis on research led to the publication of high quality work and stressed the importance of a strong patent position. As a result of his leadership and devotion to research, more than half of the professional staff at the research division held Ph.D.s. Piore's willingness to take risks also encouraged IBM to experiment with plans to build a cryogenics computer based on cryotrons and another to use microwaves to power computers. Although both failed, these attempts plus other successes established IBM's dominance in the technological field.

Piore served as a member of the National Science Board and was a trustee of the Sloan-Kettering Institute for Cancer Research. He also helped found the National Science Foundation and served on the Science Advisory Committee for Presidents Eisenhower and Kennedy. Following his retirement from IBM in 1973, Piore remained active on IBM's advisory board and also held a position as adjunct professor at Rockefeller University. He was a member of the American Academy of Arts and Sciences, the American Physical Society, the American Philosophical Society, the National Academy of Sciences, and the National Academy of Engineering. Piore's hard work and leadership earned him many awards including the Industrial Research Institute Award in 1967, and the Distinguished Civilian Medal from the Department of the Navy. He was an IRE and IEEE Fellow. In 1976 IEEE established the Emanuel Piore Award to recognize achievements in the field of information processing that contributes to the advancement of science and the betterment of society. Eta Kappa Nu named Piore an Eminent Member in 1969. He died on 9 May 2000 at the age of 91. His wife of seventy years, Nora, died in June 2000. They had three children. ✦

Electrical Engineer
and Utilities Executive

Edgar L. Kanouse

1970

Eta Kappa Nu Eminent Member

EDGAR L. KANOUSE is known for his contributions to new types of high voltage power systems. Born 23 August 1910 in Amarillo, Texas, he received his B.S. degree from the University of Oklahoma in 1932, his M.S. degree in from California Institute of Technology in 1933, and his Ph.D. from Stanford University in 1941, all in electrical engineering. Between 1940 and 1943, he held the Harris J. Ryan High Voltage Residential Fellowship at Stanford University. He began working with the Los Angeles Department of Water and Power in 1936 as a junior electrical engineer in testing laboratories. In 1944, he was appointed head of the Transmission Engineering and Research Section and Technical Secretary and Committee Engineer for the Department's System Planning Committee. In 1952, he was made Transmission Systems Engineer in charge of all overhead and underground distribution. Kanouse advanced to Assistant Chief Engineer in 1965 and to Assistant General Manager and Chief Engineer in 1966. The following year he was appointed General Manager and Chief Engineer of the Department. In addition, Kanouse has been a member of the Board of Directors of the American Public Power Association, the Electric Utility Industry Task Force on Environment, the Governor's Utility Advisory Committee, and numerous other international, national, state and local groups. Kanouse retired from LADWP on 1 May 1972.

He was named an American Institute of Electrical Engineers (AIEE) Fellow in 1958 "For contributions to the art of high voltage power transmission." In addition he presented several papers before the

International Conference on Large Electric High Tensions Systems in Paris, France. Eta Kappa Nu named him an Eminent Member in 1970. Kanouse died 16 August 1991. He was married to Betty Hitchcock, and they had two sons, David and Kent.✦

Electrical Engineer and Educator

Edward C. Jordan

1974

Eta Kappa Nu Eminent Member

EDWARD JORDAN'S research and leadership greatly contributed to the development and growth of major research programs and graduate teaching at the University of Illinois. Jordan was born in Edmonton, Alberta, Canada on 31 December 1910. His interest in electrical engineering began in high school. He earned both his B.S. and M.S. degrees in electrical engineering from the University of Alberta in 1934 and 1936, respectively. Jordan then sought employment in the electronics industry. However, because the Depression limited his options, he worked one year as an electrical power engineer in the nickel mines of Sudbury, Ontario. In 1937, he left Sudbury to study at Ohio State University, where in 1940, despite impaired hearing, he earned his Ph.D. He taught at the Worcester Polytechnic Institute before joining the electrical engineering faculty at Ohio State. In 1945, Jordan's friend and colleague William Everitt was appointed head of the Department of Electrical Engineering at the University of Illinois. That same year Jordan accepted a position there as an associate professor. By 1954, he had become head of the electrical engineering department. He then moved from teaching into academic administration, guiding the department through revolutionary changes over the next twenty-five years.

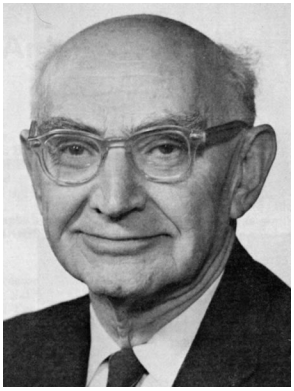
Jordan's early research preceded his leadership in the academe. As a graduate student, his work led to the development of an automatic gain control system, which provided a 30-decibel compression ratio for radio. However, he is most noted for his research on radio and electromagnetic waves. In 1942, he collaborated with Everitt in

writing the textbook, *Principles of Radio.* In 1950 he co-authored *Electromagnetic Waves and Radiating Systems* with Keith G. Balmain. This work, which was revised in 1968, influenced electrical engineering students for forty years. Besides Jordan's research and contributions to essential texts, he built, with minimal resources, one of the most respected electrical engineering departments in the United States. By the time of his retirement in 1979, the University of Illinois had the country's largest electrical engineering department with one hundred professors. Illinois ranked in the top four in surveys of research quality and graduate education. During his tenure, Jordan signed over six hundred Ph.D. dissertations in electrical engineering.

Following his retirement, Jordan worked as Editor in Chief of the seventh edition of the IT&T electronics handbook, *Reference Data for Radio Engineers*. He received many honors and awards throughout his career including the Institute of Electrical and Electronics Engineers (IEEE) Education Medal in 1968 "For leadership in bringing new technological developments into electrical engineering education and in creating an integration of research with education in a major department" and IEEE's Centennial Medal in 1984. In 1953, he was elected Fellow of the Institute of Radio Engineers (IRE) and in 1967 was made a member of the National Academy of Engineering for his radio direction finding and antenna research. Eta Kappa Nu named him an Eminent Member in 1974. His first wife died in 1986. He later married Caroline Egbert. Jordan died 18 October 1991. He had three sons, three grandchildren, and three stepdaughters.✦

Electrical Engineer and Educator

Eric T. B. Gross



1976

Eta Kappa Nu Eminent Member

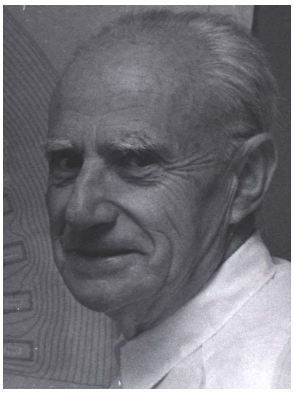
ERIC T.B. GROSS established the first electrical power engineering graduate program in the United States. Born in Vienna, Austria on 24 May 1901, Gross developed an interest in electricity at a young age. He entered the Technical University of Austria where he studied electrical engineering and graduated with distinction in 1923. The following year he joined the Union Electric and Manufacturing Company in Vienna. While working as an engineer Gross made time to continue his studies at the University of Austria and earned a D.Sc. "summa cum laude" in 1932. Six years later Gross, escaping the Nazi advance, accepted an offer from A.E.G. Electric Company Ltd., in London England and worked there as a consulting transmission engineer. One year later he immigrated to the United States. Known for his work on high-speed relaying, lightning protection and grounding of high voltage networks, he found no shortage of opportunities. Gross initially taught at the City College of New York and then accepted a three-year appointment at Cornell as Assistant Professor. Following World War II, Gross joined the faculty at the Illinois Institute of Technology and founded the nation's first graduate program in electrical power engineering. He taught there for seventeen years before accepting a position at Rensselaer Polytechnic Institute (RPI) in Troy New York. There he established the second graduate program in electrical engineering. By the time of his retirement in 1973, he not only established RPI as the United State's most prominent graduate school in electrical engineering, he also managed to increase enrolment from two students to sixty, all supported by fellowships.

Eric Gross' emphasis on theory and practice revitalized the field of electrical power engineering. Educators had largely accepted that few challenges remained in the electrical power field and that time devoted to this endeavor was no longer necessary on college campuses. Gross' research and belief in electrical power engineering revitalized the field, leading to over twenty new graduate and undergraduate programs in electric power engineering in the 1960s. Gross' academic dedication produced highly qualified graduate students and he worked hard to assure their job placement and career development. The fact that Gross remained a practicing engineer augmented his credibility with other like-minded faculty. He was a registered engineer in New York, Illinois and Vermont and authored or co-authored over one hundred technical and scientific articles. Gross also held many patents pertaining to his work on electric power systems protection and grounding. He acted as a consultant to government agencies and utility companies.

Following his retirement in 1973, Gross was named Philip Sporn Professor Emeritus at RPI and continued to foster relationships with his former students. Throughout his career Gross' contributions did not go unnoticed. He served on numerous committees and was the National President of Eta Kappa Nu in 1953-54. He was elected a fellow of IEEE, the New York Academy of Sciences, the American Association for the Advancement of Science and was elected a life patron of RPI. In 1979 he was awarded the Austrian Cross of Honor for Science and the Arts First Class for career achievements in electrical power engineering. He was named Eta Kappa Nu Eminent Member in 1976. Eric Gross died 27 June 1988 in Schenectady, New York. He was married to the former Catherine Rohrer and they had three children, Patrick, Elizabeth and Margaret.✦

Electrical Engineer and Professor

Edward A. Erdelyi



1978

Eta Kappa Nu Eminent Member

EDWARD ERDELYI is known widely for his research on the mechanical performance of rotating electrical machines. Born 13 July 1908 in Hlohovec, Czechoslovakia, he received his B.S. degree from the Czech Technical University in 1926 and his M.S. degree from the German Technical University in electrical engineering and mathematics in Brno, Czechoslovakia. He then earned his diploma in mathematics from Masaryk University, also in Brno. Between 1928 and 1931, Erdelyi worked on rotating machinery in elevators and cranes for Moravian Electrical Engineering in Czechoslovakia. He then joined Private Telephone and Electrical Engineering Company designing power supplies. In 1931, he became head of the planning section, working on electrical installations in manufacturing plants, substations and emergency power plants. In 1941, he left for England and began work for Vickers-Armstrong Aviation, designing electrical equipment for Wellington and Warwick bomber aircraft. The following year, Erdelyi accepted a position with the Royal Air Force (RAF) in the Directorate of Scientific Research and Technical Development. In 1947, he came to the United States and earned his Ph.D. in electrical engineering from the University of Michigan in 1954. In 1956, Erdelyi became senior analytical engineer for General Electric in Erie, PA. However, his love for teaching led him to a career in the academe. He became a naturalized citizen in 1958, and in 1959 he became H. Rodney Sharp Professor of Electrical Engineering. He held this position until 1964 when he joined the faculty at the University of Colorado, Boulder as Professor of electrical engineering. He retired Professor Emeritus in 1975.

In the early 1950s, Erdelyi realized the need for a thorough understanding of the mechanical performance of rotating electrical machines. Using a purely mathematical approach for the analysis of vibrations and noise explored in his doctoral dissertation, his *Tables of Integral Transforms, Vol. 1*, published in 1954, became a standard reference. Erdelyi spent nearly sixteen years developing and perfecting the procedure now known worldwide as the "Colorado Method" for the analysis of the electromagnetic performance of electromechanical energy converters. In the 1960s, he originated the use of mathematical methods for finding steady-state transient magnetic field distributions in rotating electrical machines, especially in very large salient pole alternators and turbogenerators. Erdelyi was also known for his teaching and academic leadership. He was in charge of the undergraduate curriculum on electromechanical energy conversion and power systems, and of graduate courses on electromagnetic fields in electrical devices and advanced theory of electrometrical energy.

Erdelyi's contributions earned him many honors and awards including the Engineer of the Year Award in 1958 and the Recognition Award "for outstanding contributions to the field of rotating electrical machinery" in 1967, both from the Erie, Pennsylvania Engineering Society; and the Faculty Research Award from the University of Colorado in 1978. In addition he was presented with an honorary doctorate from Budapest Polytechnic University in 1971. Eta Kappa Nu named him an Eminent Member in 1978. Erdelyi died on 27 July 1980 in Boulder, Colorado. His wife, Gabriella, passed away in 1976.✦

Electric Power Engineer
and HVDC Pioneer

Marcus D. Dodson

1984

Eta Kappa Nu Eminent Member

MARCUS DODSON'S work on high voltage systems helped produce the United State's first and largest High Voltage Direct Current system. Dodson was born 26 March 1924 in Science Hill, Kentucky. In the war years, 1943 through 1945, Dodson served in the US Marines, and he participated in major battles, including fighting at the Marshall Islands, Guam, and Okinawa. He later served in Tsingtao, China. Following his discharge from military service Dodson entered the University of California Berkeley, where he received his B.S. Degree in Electrical Engineering. He later received an M.S. degree in electrical engineering from the University of Southern California. As a graduate student, he led a small team to study a means of transporting the excess hydroelectric power being generated in the Pacific Northwest to the Los Angeles area. Following completion of his graduate work he accepted a position with the Los Angeles Department of Water and Power and was later promoted to Resident Electrical Engineer for the construction of the City of Los Angeles Department of Water and Power's San Fernando Valley, Haynes, and Scattergood power-generating plants. These were large plants, each capable of producing at least 500 MW.

Following Dodson's AC generation experience, he became involved with his first love, the High Voltage Direct Current (HVDC) system that he had studied at Berkeley. He was named Resident Electrical Engineer for the Pacific Intertie Station, South Terminus. This powerful system was constructed in 1970 under his professional license. The Pacific Intertie was made possible by the adaptation of

the new mercury arc rectifier technology. It was originally developed to transport power by underwater cable across the fjords in Sweden. Working closely with Dr. Uno Lamm, the developer of this technology, on the details of the design of the world's largest Faraday cage, Dodson oversaw its construction. The 800-KV system provided Los Angeles, Glendale, Burbank, Pasadena, and the Southern California Edison Company with power primarily from the Grand Coulee Dam during daylight hours, and it provided the Pacific Northwest with power from the Los Angeles area above generating capacity at night. Following a major earthquake in 1971, Dodson served as Project Engineer for the 22 million dollar reconstruction project.

In addition to his valuable contributions to HVDC technology, he also made time to be an active member of the Institute of Electrical and Electronics Engineers (IEEE). Dodson also served as a National Director and President for Eta Kappa Nu. Dodson's contributions earned him many awards and honors including IEEE's Centennial Medal in 1984 and Millennium Medal in 2000 and HKN's Distinguished Service Award. Eta Kappa Nu named him Eminent Member in 1984. In addition, he is a Fellow of the Institute for the Advancement of Engineering (IAE). Dodson currently resides in Cypress, California with his wife of 57 years, Ada DiStasio Dodson. They have two sons and two daughters and four grandchildren.✦

Electric Power Engineer
and Education Reformer

Larry Dwon

1984

Eta Kappa Nu Eminent Member

LARRY DWON provided leadership at American Electric and Gas, and his dedication to teaching helped steer engineering education in a more practical direction. Born in 1913 in New York City to Polish and Ukrainian immigrants, Dwon earned scholarships to attend Cornell University graduating with an E.E. degree in 1935. In 1954, he earned an MBA degree from NYU Graduate School of Business Administration. He then joined Diehl Manufacturing Company designing electrical motors. His desire to work in power engineering led him to American Gas and Electric Company, which later became American Electric Power Service Corporation (AEPSC). Dwon remained with AEPSC for forty years, working twenty years in engineering and twenty in management. During World War II, he was granted a leave to join the Office of Science and Research Development, first assigned to Harvard Radio Research Labs and then at Bell Telephone Labs. Following the war he returned to AEPSC and taught electrical and illuminating engineering programs at the Pratt Institute and the Polytechnic Institute of Brooklyn. Following his retirement in 1978, he continued to teach at North Carolina State University.

Larry Dwon and colleague Philip Sporn were concerned that engineering education was moving away from practice and synthesis, and their efforts became important in engineering education reform. Dwon and Sporn believed that engineering education had evolved into an educator-dominated system, thereby neglecting input from practicing power engineers. When Sporn concluded an impassioned

speech he made to his colleagues at AEPSC, he turned to Larry Dwon and said, "You have to do something!" Dwon responded by drafting a proposal, with Sporn's blessing, that stated all matters concerning engineers, technologists, and technicians involving college relations, recruiting, training, continuing education and development should be moved from personnel to engineering departments. This initiative improved AEPSC's relations with engineering schools. Dwon's crusade that he embarked upon in 1955 was now successfully completed. He was then named Manager of Engineering Manpower. In his new position, he developed procedures for efficient utilization of technically educated human resources, improved college relations, engineering recruitment, and in-house training and education programs, and conducted salary and manpower utilization surveys.

Following his retirement, Dwon continued as a consultant until his stroke in 1992. He remains a dedicated volunteer in Eta Kappa Nu and the Institute of Electrical and Electronics Engineers (IEEE), organizations he has served prominently and continuously for over 70 years. Perhaps his greatest contribution to Eta Kappa Nu is the History of the Association, which he wrote in 1976. He has also served as the Association's President and as chairman of several national committees. In IEEE he conceived the need for and helped to found and develop the Power Engineering Education Committee. He served on the Education Advisory Board and volunteered extensively in IEEE-USAB, now IEEE-USA. His work with IEEE Student Professional Awareness Conferences (SPACs), which he conceived and helped to develop, has received many commendations and culminated in the Dwon Hall of Fame, created in 2002 to recognize outstanding IEEE Student Branches. Throughout Dwon's career he earned many awards including the Eta Kappa Nu Distinguished Service Award in 1976, the EEI Special Citation for Leadership in establishing relations with engineering educators in 1977, and the IEEE Centennial Medal for Leadership in Power Engineering Education. He is a Fellow of IEEE. He wrote and published many technical papers and articles and spoke at over 200 SPACs and before other audiences. Eta Kappa Nu named Dwon an Eminent Member in 1984. He was married to Mary Skala who died in February 2003. They had two sons. Larry continues activities with the help of his computer and the mobility of a wheelchair.✦

Electrical Engineer
and Company Executive

Howard H. Sheppard

1984

Eta Kappa Nu Eminent Member

HOWARD SHEPPARD is widely known for his creation of Relay Associates in 1976. Born in Pennsylvania in 1911, Sheppard attended the University of Pennsylvania's School of Engineering, earning his Bachelor's and Masters Degree in electrical engineering in 1932 and 1933 respectively. Following graduation, Sheppard earned his license in General Electrical Engineering and went to work for Rumsey Electrical Company in Conshohocken, PA. Sheppard remained with Rumsey Electric for 38 years, retiring as the company's senior vice-president in 1976. Following his retirement Sheppard founded Relay Associates Incorporated in Conshohocken. Relay Associates specialized in designing, assembling and testing protective relay and control panels for the utility industry. Sheppard was instrumental in the development of LJ relays, which are used in high voltage utility substations. The system entails a high speed auxiliary relay that trips high voltage circuit breakers during an overload. Today Relay Associates continues to successfully develop and manufacture electrical relays to help prevent blackouts.

Sheppard also made contributions to several engineering organizations. He served as president of the Philadelphia chapter of the Institute of Electrical and Electronics Engineers Inc., of which he was elected a Fellow in 1986. He also served in the Pennsylvania Society of Professional Engineers and was Eta Kappa Nu's national President. Sheppard also served on the advisory board of the Pennsylvania Gazette. His commitment to electrical engineering research led to several awards, including the University Alumni

Award of Merit in 1967 and the D. Robert Yarnall Award in 1986 for outstanding contributions in the field of engineering. Eta Kappa Nu named him an Eminent Member in 1984. He also was a member of the Engineers Club of Philadelphia, the Union Club, and the Philadelphia Cricket Club. Sheppard died in Blue Bell, Pennsylvania on 1 February 2000. He was married to Margaret Sinclair for 61 years. They had two daughters and a son: Jane, Susan and Norman.✦

Professor and Electrical Engineer

Samuel Reid Warren

1984

Eta Kappa Nu Eminent Member

SAMUEL WARREN'S research and scholarship help promote electrical engineering principles in the medical field. Warren was born in Philadelphia, Pennsylvania on January 31, 1908. Through a scholarship and summer jobs at the J.C. Holtby radio store in Lansdowne, Pennsylvania, and Bell Telephone Co., he was able to enter the Moore School of Electrical Engineering at the University of Pennsylvania. In 1928 Warren earned a B.S. degree in electrical engineering and an MA degree the following year. With the encouragement of his professors Warren sought a doctoral degree but the Depression delayed this accomplishment. In 1937 he earned a Sc.D. in Electrical Engineering. While working on his doctoral degree Warren was appointed Instructor at the Moore School in 1933. Due to his distinguished research and the respect of faculty members he became Assistant Professor and an associate in radiology physics in the Graduate School of Medicine in 1939. Warren's research augmented the medical school's emphasis on training physicians on the physics of X-rays. As a result he was named Full Professor in 1949. Soon after Warren's appointment he became Vice Dean in 1951. With the reorganization of the Engineering Schools at the University of Pennsylvania, Warren became Associate Dean for Undergraduate Engineering Affairs, a position he held until 1973.

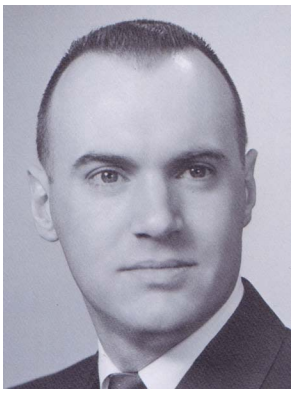
Warren made profound contributions to the University of Pennsylvania's engineering program. His early interests were influenced by his work with Charles Nathan Weyl. In 1929 Weyl asked Warren to assist him in his research funded by the National

Tuberculosis Association. Their research involved analysis and use of X-ray machinery in chest examinations. On Warrens's suggestion, the research team performed on-site research in tuberculosis sanatoria in the United States and Canada. By 1937 Warren and Weyl had written one book and 15 articles on the subject. Warren continued on with this program until 1944 and co-wrote three more books on the topic. In 1947 Warren founded the University's Radiation Safety Committee and later chaired that committee as well as others concerned with educational policy. His pioneering work brought the field of medicine and engineering together at the University of Pennsylvania. Warren's experience also led him, as Associate Dean, to call for more diversified education among engineering students. He believed that students should have background in the humanities to avoid over specialization and isolation.

Following Warren's retirement in 1976 he continued to advise undergraduates and also remained active in several professional organizations. Warren's commitment and hard work led to many awards and honors including a citation for outstanding leadership in the application of engineering principles in the medical field from the AIEE in 1953 and the D. Robert Yarnall Award for outstanding contributions in the field of engineering to society from the University or Pennsylvania Engineering Alumni Society in 1976. He was named Eta Kappa Nu Eminent Member in 1984. Samuel Reid Warren passed away January 13, 1996. He was married to Marian Stradling and they had two sons.✦

Engineer and Editor

Donald Christiansen



1985

Eta Kappa Nu Eminent Member

DONALD CHRISTIANSEN'S editorial direction of *IEEE Spectrum* turned the publication into one of the most respected science and engineering magazines in the world. He was born 23 June 1927 in Plainfield, New Jersey. Christiansen's father, who was a mechanical designer and chief design draftsman for Bendix Aviation Corporation, sparked his interest in engineering. Christiansen emulated his father, building experimental electrical gear as a pre-teenager. In high school he gravitated to the science and mathematics courses, and in his teens worked on assembly lines for Cornell Dubilier, makers of heavy-duty capacitors for the Navy, and Kingston-Conley, manufacturers of fractional horsepower motors. At 17 he enlisted in the Navy and trained as a radio technician. At the end of World War II, he entered Cornell University, where in 1950 he earned his B.E.E., majoring in communications engineering. While at Cornell he worked as an engineering co-op intern for Philco Corporation, where he was assigned to airborne radar projects in the company's government projects laboratory. Upon graduation he went to work for the CBS Electronics Division in Danvers, Mass., where he gained valuable experience in vacuum tube and semiconductor technology. His experience with Philco and CBS paved the way for his new career in science journalism. In 1962, he became the solid-state editor for *Electronic Design* and, in 1963, accepted a position as Senior Editor for *EEE Circuit Design Engineering*. In 1966 he was recruited by McGraw-Hill's *Electronics Magazine* and by 1968 had become its editor-in-chief. In 1971 an IEEE search committee selected Christiansen as the first professional editor of its flagship

publication, *IEEE Spectrum*. Christiansen recruited a staff of engineer-journalists having skills that covered the broad interests of electrical and computer engineers. In 1972 he assumed the additional duties of *Spectrum* publisher and chairman of its editorial board.

Folio Magazine's March 1991 issue described Christiansen's tenure at *IEEE Spectrum*: "In 1971 [he] took over *Spectrum*, a small journal of the Institute of Electrical and Electronics Engineers. With little fanfare but a lot of fierce determination, he turned it into one of the foremost science and engineering magazines in the world, one that challenges not just the scientist's mind, but his conscience as well." In 1993, *IEEE Spectrum* won the prestigious National Magazine Award in the reporting category and had a readership of over 320,000 electronic, electrical and computer engineers in 150 countries. Under Christiansen's leadership, *Spectrum* won four National Magazine Awards and numerous other editorial awards.

When he was named Editor Emeritus of *Spectrum* in 1993, he continued to work on IEEE projects, helping to launch the IEEE-USA magazine, *Today's Engineer*, and writing a column, "Backscatter," for its online edition. Christiansen has been an active member of Eta Kappa Nu since his election as an undergraduate at Cornell. In 1985 he was named an Eminent Member and in 1999 received its Distinguished Service Award. He has served as chairman of its Outstanding Young Electrical Engineer Award committee and its Karapetoff Award committee, and is chairman of its Eminent Member committee.

Through its third edition, Christiansen co-edited McGraw-Hill's *Electronics Engineers' Handbook* with its founder, Donald Fink. Upon Fink's death, he became its editor-in-chief. It is one of the most widely used reference books in the fields of electronics engineering and related disciplines. Christiansen's interests include the history of science and technology, engineering education, and ethics in engineering and engineering management. He served as a member of the National Research Council Commission on Education and Utilization of the Engineer, and initiated the *IEEE Spectrum* Precollege Math/Science Education Award to recognize innovative projects that stimulate young people's interest in technical careers.

Christiansen has received many honors, including the IEEE Centennial Medal in 1984, the IEEE Gruenwald Award for Outstanding Leadership as Publisher and Editor-in-Chief of *IEEE Spectrum*, and the Citation and Medal for the Advancement of Culture from the Flanders Academy of Arts, Science, and Literature in 1980. He is an IEEE Fellow, a Fellow of the Radio Club of America, and a Fellow of the World Academy of Art and Science. Christiansen married Joyce Ifill in 1950. She died in 2003. He has two daughters, Jacqueline and Jill, and four grandchildren.✦

Engineering Manager
and Research Analyst

William E. Murray

1987

Eta Kappa Nu Eminent Member

WILLIAM MURRAY'S extensive research and technical expertise greatly contributed to the technology used on NASA's most sophisticated manned space vehicles. Born on 14 March 1924, in Chickasha, Oklahoma, Murray entered the University of California Berkeley in 1941. Two years later he was called to active duty during World War II. He was commissioned Second Lieutenant in the US Army Signal Corps, and later assumed command of the Air Base Installation Detachment in Habbaniyah, Iraq, three miles from Fallujah. Murray later returned to the U.S. as First Lieutenant. In 1946, he returned to UC Berkeley and completed a five year program in three and half years, receiving his B.S. degree in Engineering. Between 1947 and 1949, Murray worked for the C.F. Braun Company in Alhambra, California, where he designed and prepared specifications for plant switchgear and controls for large "turnkey" chemical plants and oil refineries. During this time he also obtained his Professional Electrical Engineering License. Between 1949 and 1950, he worked on the C124 Globemaster electrical and radio systems for Douglas Aircraft Company. Following the outbreak of the Korean Action, Murray was recalled to active duty, where he commanded Radio and Message Center Operations. Following his discharge in 1952, he accepted a position with Los Angeles Department of Water and Power working on overhead transmission line power distribution for high megawatt power systems. In 1954, he completed his M.S. degree in electrical engineering at the University of Southern California. In addition, he earned a California Life Certificate in Engineering Education in 1960. In 1961, Murray

returned to Douglas Aircraft and significantly contributed to the company's research on missile and space technology during the company's transitions to McDonnell-Douglas Corporation and then the Boeing Company. Murray progressed in his career with Douglas, holding several vital positions including Principal Staff Engineer responsible for electric power and research and development, Program Manager for All-Electric Aircraft Programs, and Project Manager for Electric Power on Reusable Space Vehicles. Murray retired in 1999 as Program Management Manager Level Five.

In 1969, Murray was selected to be Branch Chief Electrical Systems for Advanced Manned Spacecraft. He oversaw system research and development analysis, definition, design, studies, and selection of all electrical systems on manned space vehicles, including Skylab, Space Tug, the Manned Orbiting Research Lab (MORL) and the earliest version of the Modular Manned Space Station. During the early 1970s, Murray led several technology diversification program designs, including the Solar One Project at Mojave, California, a Zinc-Chlorhydrate Battery Program, the Maglev high speed railroad project, and the Wind Power Aerogenerator program, which now has generators on the Southern California Edison system in California. Murray then played an active role as a consulting engineer on the Space Station Alpha, Space Station Freedom, and the International Space Station now orbiting the earth. In addition, many of his invention disclosures to NASA were incorporated in the International Space Station's power system. Murray's research and development work with Douglas Commercial Aircraft Division advanced conceptual aircraft designs in electronics, cockpit control and electrical power systems on MD80, MD90, MD11 and C17 aircraft.

In addition to his contributions to research and development, Murray has been active in Eta Kappa Nu for more than 50 years. He served as the organization's Director in 1972, Vice-President in 1973, and President in 1974. He has also held several elected offices with the Institute of Electrical and Electronics Engineers (IEEE), including Director of (Western USA) Region 6, and he became a Life Senior Member in 1990. Murray is a lifetime member of Eta Kappa Nu and Tau Beta Pi and is Fellow of the Institute for Advancement of Engineering. Murray has received many awards and honors

throughout his career, including five NASA Citations for Technical Advancements, five McDonnell Douglas Corporation Citations for Professional Achievement, and IEEE's Centennial Leadership Award and Citation in 1984. Eta Kappa Nu named him Eminent Member in 1987. Today Murray resides in California. His wife Jeannie died in April, 2004. They had five sons, 13 grandchildren, and four great-grandchildren.✦

Electrical Engineer
and Corporate Executive

Robert W. Lucky

1993

Eta Kappa Nu Eminent Member

ROBERT LUCKY'S research and leadership has greatly contributed to communications technology. Born 9 January 1936 in Pittsburgh, Pennsylvania, he attended Purdue University where he received his B.S. degree in electrical engineering in 1957, and his M.S. and Ph.D. degrees in 1959 and 1961 respectively. Following graduation, Lucky began his telecommunications career with AT&T Bell Laboratories in Holmdel, New Jersey. While with AT&T he explored various ways of sending digital information over telephone lines. His research and sound managerial skills led to promotion through several levels of management. In 1982, he was appointed Executive Director of the Communications Sciences Research Division, where he was responsible for research on the methods and technologies of future communication systems. While with Bell Labs, Lucky also took on additional responsibilities, such as accepting the chairmanship of the Science Advisory Board for the U.S. Air Force from 1986 to 1989. In 1992, Lucky left Bell Labs to become Corporate Vice-President of Applied Research at Bellcore, Red Bank, New Jersey. He then continued in that role at Telcordia Technologies until 2002.

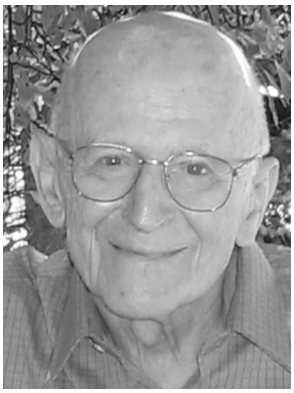
While with Bell Labs, Lucky invented the adaptive equalizer. This technology corrected distortion in telephone signals and made possible high-speed data transmission. His research also led to the publication of *Principles of Data Communications*, which he co-authored. This text became one of the most cited texts in the communications field for a decade. Lucky's *Silicon Dreams*,

published in 1989, is a semitechnical discussion of the forms of information we must deal with in this information age. His most recent work, *Lucky Strikes Again,* published in 1993, is a humorous look at the problems engineers encounter, and is based largely on "Reflections", his popular columns that have run regularly in IEEE Spectrum since 1982. This work takes good-natured swipes at corporate bureaucrats, instructs how to cut through the red tape, and advises bureaucrats when to look the other way. Lucky has also been an active leader for IEEE. He served as editor of the *Proceedings of the IEEE* between 1974 and 1976, Vice President for Publications in 1978 –1979, and Executive Vice President in 1981-1982.

Lucky's contributions have earned him many awards and honors including the Marconi International Fellowship in 1987 for contribution to data communications, the Distinguished Civilian Contributions Medal of the U.S. Air Force, and the IEEE Edison Medal in 1995. Lucky was named Eta Kappa Nu Eminent Member in 1993. He has authored seventy technical publications, holds eleven patents and has received four honorary doctorates. He resides with his wife, Joan, in New Jersey.✦

Engineer and Educator

Berthold Sheffield



1993

Eta Kappa Nu Eminent Member

ELECTRICAL ENGINEER Berthold Sheffield developed the world's first traffic control system using radio for a US Steel Company's mining railroad in Venezuela. Born in 1910 in Heilbronn, Germany, Sheffield emigrated with his parents and brother in 1923. During his childhood, Sheffield's parents gave him a book about the discovery of radio waves by Heinrich Rudolf Hertz, a German physicist, and the use of this technology by Italian physicist Guglielmo Marconi. His early interest in technology flourished when he reached the United States. In 1929 he won the David Sarnoff Scholarship for radio operating. Sarnoff, one of Sheffield's heroes, congratulated him in person. During early adulthood, Sheffield was a radio operator on a freighter from New York to Norfolk, VA. He claimed it was a rough job, which he would never do again. In 1937 Sheffield began a thirty-six year career with the Radio Corporation of America (RCA). During that time he received a B.E.E. degree from the Polytechnic Institute of Brooklyn in 1950 and did graduate work in probability, statistics and modulation theory. He has published numerous papers and contributed to several books.

During the 1950s, while working at RCA International Division, Sheffield developed what he calls "a fascinating project that's really my monument", the first centralized traffic control system for a railroad using radio. The technique that Sheffield developed used radio to operate the railroad's signals and switches. Trains transported iron ore from the mines of the Orinoco Mining Co. in Venezuela, to a port on the Orinoco river. Ore-carrier ships took the

ore to US Steel Co's refineries in Morrisville, PA. The project took three years to complete, although Sheffield was asked to design it in two hours. In subsequent assignments at RCA Astro, Sheffield contributed to satellite communications projects for many years.

After retirement from RCA in 1973 Sheffield remained active. Throughout the 1970s and 80s he served as Telecommunications Consultant to several firms including MCI, Western Union Telegraph and RCA Space Center. Sheffield also taught telecommunications courses at Mercer County Community College and Trenton State College and continued to work on a variety of engineering projects. He wrote and published a course titled: "Planning for a Successful Retirement". He served on the Advisory Committee for the Jointure of Community Education in Montgomery Township, NJ between 1985 and 1989. Sheffield's devotion to research and service have led to several awards including the Distinguished Service Award of Eta Kappa Nu in 1982 and the Distinguished Adjunct Professor Award for teaching excellence at Trenton State College in 1986. In 1992 he was named Eta Kappa Nu Eminent Member. Sheffield states that he owes a great deal to his wife Gertrude, who passed away in 1980. His older daughter, Dr. Margot Kruskall, is Professor of Pathology at Harvard Medical School. His younger daughter, Denni Day, owns a veterinary consulting business.✦

Inventor and Educator

Nick Holonyak Jr.

1998

Eta Kappa Nu Eminent Member

NICK HOLONYAK'S research led to the development of the first practical visible-spectrum LED and the first semiconductor laser to operate in the visible spectrum. Born on 3 November 1928 in Zeigler, Illinois, Holonyak was the son of Slavic immigrants in the southern Illinois coal country. Growing up there, he recalls hours of arduous work with a railroad crew in the summer of 1946 as his impetus for pursuing education. Shortly thereafter he entered the University of Illinois and received a BS degree in electrical engineering in 1950. Holonyak then pursued his graduate work under the direction of two-time Nobel Prize winner John Bardeen. A Texas Instruments Fellow in Semiconductor Physics, Holonyak transferred from vacuum-tube research into Bardeen's semiconductor research lab. He was Bardeen's first student. The decision proved fruitful, as semiconductors became the technology of the future. He earned his M.S. in 1951 and his Ph.D. in 1954, both in electrical engineering. In 1954, he went to work for Bell Labs. The following year, he entered U.S. Army and served at Fort Monmouth, New Jersey and in Yokohama, Japan. In 1957, he joined the Advanced Semiconductor Laboratory at General Electric, where he contributed to switching technology. After six years with GE, he returned to the University of Illinois as a professor in the Department of Electrical and Computer Engineering.

Holonyak's research with Bell Labs led to the development of diffused-impurity oxide-masked silicon device technology, which included transistors, p-n switches and thyristors. This technology is

fundamental to all symmetrical switches, including the basic elements in the wall dimmer switch. In 1960, he invented closed-tube vapor phase epitaxy of III-V semiconductors. In 1962, he became the first to construct a visible-spectrum semiconductor laser, which led to his development of the first practical LED used in optoelectronic devices. Holonyak's research continued at the University of Illinois. He and his graduate students made several discoveries. In 1977, they developed p-n quantum-well lasers, and they were the first to achieve continuous-wave room-temperature laser operation of quantum-well heterostructures and superlattices, in 1978. In the 1990s, Holonynak and his students were the first to demonstrate the use of a tunnel junction for lateral current conduction in vertical-cavity surface emitting lasers.

Holonyak continues his research at the University of Illinois. He has received numerous honors and awards, including the IEEE Morris N. Liebmann Award in 1973, the IEEE Edison Medal in 1989, the National Medal of Science in 1990, Eta Kappa Nu's Karapetoff Award in 1994, and the IEEE Medal of Honor in 2003. He has published 500 papers, holds 30 patents, and has coauthored two books on semiconductors. Eta Kappa Nu named Holonyak an Eminent Member in 1998. He is an IEEE Fellow, a member of the National Academy of Engineering and the National Academy of Sciences, a Fellow of the American Academy of Arts and Sciences, and a Foreign Member of the Russian Academy of Sciences. Apart from his work and interests in semiconductor materials and devices, and research with his graduate students, he enjoys reading, running, and weightlifting. He is fluent in a second language, the Carpatho-Russian of his immigrant parents. His wife, Katherine, is a member of the nursing profession.✦

Computer Designer
and Corporate Founder

Gene Amdahl

1999

Eta Kappa Nu Eminent Member

GENE AMDAHL'S pioneering work with IBM facilitated the founding of his own company and one of IBM's chief competitors, the Amdahl Corporation. Born in South Dakota in 1922, Amdahl received a B.S. degree in engineering physics from South Dakota State University in 1948 and his Ph.D. in theoretical physics from the University of Wisconsin in 1952. While working on his doctorate he designed his first computer, the Wisconsin Integrally Synchronized Computer. In 1952 he accepted a position with IBM and became the chief design engineer of the IBM 704. Amdahl left IBM in 1956 but returned five years later after working for other computer companies. In 1970, after pioneering computer technology with IBM, Amdahl founded his own company, Amdahl Corporation, in Sunnyvale, California. His intent, against the advice of many in the computer technology field, was to compete with IBM. His company not only survived, it prospered. With the success of Amdahl Corporation, Amdahl stepped down as chairman in 1979 and founded Trilogy Systems Corporation. Trilogy did not prove to be the success Amdahl desired. In July 1997 the Amdahl Corporation was sold to Fujitsu with all management intact.

While Amdahl is largely known for creating corporations, he also was instrumental in the development of vital computer technologies. During his employment with IBM Amdahl worked to develop the IBM709 and to start a computer called Stretch. This eventually became the IBM 7030, which was based on transistor technology. During the 1960s he gained notoriety as a developer of the IBM System 360. The 360 series became one of the greatest successes in

the computer industry and produced enormous profits for IBM. Amdahl's creation of Amdahl Corporation in 1970 led to the development of the first computer clones known as "plug-to-plug compatibles." Amdahl's development of large-scale integrated circuitry allowed the company to capture a significant portion of the mainframe market with its 470 series followed by its 5800 series. These innovations made Amdahl a widely recognized entrepreneur in the computer industry.

Following Amdahl's sale, in 1997, of Commercial Data Services, Inc. (CDS), his fourth company, he continued his research on mainframe technology. Amdahl was also an active member and Fellow of several organizations. In 1965 Amdahl became an IBM Fellow and two years later he became a member of the National Academy of Engineering. He was also recognized as the Centennial Alumnus of South Dakota State University in 1986. Amdahl also earned many awards including the ACM/Eckert-Mauchly Award for outstanding innovations in computer architecture, including pipelining, instruction look-ahead, and cache memory in 1987 and IEEE's Computer Entrepreneur Award in 1989. He holds many patents and has received four honorary doctorates. Amdahl was named an Eta Kappa Nu Eminent Member in 1999. He resides in Menlo Park, California. He is married and has three children, two daughters and one son.✦

Electronics Engineer
and Corporation Co-founder

William R. Hewlett

1999

Eta Kappa Nu Eminent Member

WILLIAM HEWLETT co-founded of one of the most successful enterprises in the history of American industry. Hewlett was born in Ann Arbor, Michigan on 20 May 1913. His father was a professor of medicine at the University of Michigan. He attended Stanford where he earned his B.A. degree in 1934. He received his M.S. degree in electrical engineering from the MIT in 1936. Additionally, he received the degree of Engineer from Stanford University in 1939. During his undergraduate years at Stanford he met David Packard, an engineering student. They became fast friends and, in 1939, founded the Hewlett-Packard Company. Their first manufacturing facility was a small garage in Palo Alto, California, and their capital start-up was $538. With the advent of World War II, Hewlett left the fledgling company and served as an army officer. He was on the staff of the Army's Chief Signal Officer and then directed the electronics section of the New Development Division of the War Department Special Staff. Following his return to Palo Alto in 1947, Hewlett-Packard was incorporated and he was named Vice-President. Hewlett was elected Executive Vice-President in 1957, President in 1964, and Chief Executive Officer in 1969. Hewlett's interest in medicine and education led to his involvement with other organizations. Between 1958 and 1968 he was a trustee of Mills College in Oakland California, and of Stanford University from 1963 to 1974. He also was the director of the Kaiser Foundation Hospital and Health Plan from 1972 to 1978.

During the early years, Hewlett-Packard developed its first

marketable invention, the Audio Oscillator. This instrument tested sound equipment for the production of the Walt Disney film "Fantasia" which was released in 1940. This proved to be Hewlett-Packard's first break. Throughout the 1940s and 1950s, the company grew rapidly, becoming a dominant player in the market for electronic test and measurement equipment. In 1966, Hewlett-Packard entered the computer market with the development of the HP 2116A. This device was designed as a controller for electronic systems. Although much of Hewlett's professional career preceded the digital computer era, he played a crucial role in the company's development of the HP 9100 desktop calculator and challenged his engineers to develop a smaller version. In 1972, Hewlett-Packard developed the first pocket scientific calculator. At the time of Hewlett's retirement in 1978, Hewlett-Packard was a billion dollar corporation that had set an example for informal corporate culture that eschewed hierarchy and encouraged individual development.

Following his retirement, Hewlett remained active, serving as Chairman of the Executive Committee until 1983. In 1987, he was named Director Emeritus. Between 1966 and 1994 he served as Chairman of the William and Flora Hewlett Foundation, which he established with his wife Flora. In 1995, he contributed to the founding of the Public Policy Institute of California with an endowment of seventy million dollars. He holds several patents and is a member of the American Academy of Arts and Sciences, and the National Academy of Engineering. He was named a Fellow of the Institute of Radio Engineers (IRE) in 1948 "For his initiative in the development of special radio measuring techniques" and served as the organization's President in 1954. Eta Kappa Nu named him an Eminent Member in 1999. Although Hewlett had become a billionaire, he did not pursue a jet-set lifestyle. He enjoyed the outdoors as evidenced by his love for skiing, fishing and mountain climbing. In 1977, his first wife, Flora, passed away. The following year he married Rosemary Bradford. Hewlett had five children from his first marriage and five stepchildren from his second. Hewlett died 12 January 2001.✦

Inventor, Educator,
and Corporate Executive

C. Lester Hogan

1999

Eta Kappa Nu Eminent Member

C. LESTER HOGAN'S creation of the first microwave gyrator, isolator and circulator inspired McGraw-Hill's *Electronics* magazine in 1980 to name him one of the ten greatest innovators of the previous fifty years. Born in Great Falls, Montana on 8 February 1920, he earned his B.S. degree in chemical engineering from Montana State College in 1942, and his M.S. and Ph.D. in physics from Lehigh University in 1947 and 1950, respectively. Hogan joined the US Navy in 1942. He served at Pearl Harbor as officer in charge of acoustic torpedoes. Following the war, he taught physics at Lehigh until 1950, when he accepted a position with Bell Laboratories. In 1953, Hogan left Bell Labs, accepting another faculty position at Harvard where he became the Gordon McKay Professor of applied physics. He continued his research on ferrites and was advisor to nine Ph.D.s. In 1958, he left Harvard and accepted a position as General Manager of the Motorola Semiconductor Products Division. In 1960, he was promoted to Vice-President of Operations and, in 1966, was named Executive Vice-President. The Motorola Semiconductor, Government Electronics, and Communications Divisions reported to him. In 1968, Hogan was offered the position of President and CEO of Fairchild Camera and Instrument Corporation. He remained there until his retirement in 1984.

Hogan was overwhelmingly successful in each of his many endeavors. While with Bell Labs he invented the gyrator. Excited by this discovery, William Shockley, the inventor of the transistor, encouraged Hogan to continue his research. Hogan's microwave

gyrator used newly available ferrites, and made an inductive circuit behave capacitively. When Hogan joined Motorola in 1958, his role changed from technical innovator to corporate leader. Motorola's small operation had sold three million dollars worth of semiconductors but had yet to turn a profit. One year later the division was showing a profit. Through his leadership, teaching and innovation in semiconductor research, Motorola had become the largest semiconductor producer in the world by the time he left in 1968. He then became President and CEO of Fairchild Camera and Instrument Corporation. As CEO, Hogan led the company from $170 million in sales and $573,000 in profits in 1968 to $384 million in sales and $27 million in profits by the time of his retirement in 1984.

Following his retirement he remained active with Fairchild, serving as vice-chairman of the board. Throughout his noted career he was involved with many organizations. He served as a member of the board of directors of several corporations, and was active on scientific and government advisory committees. He was an advisor to several engineering schools, including Lehigh, MIT, Princeton, and UC Berkeley. He is a Fellow of IEEE and AAAS, and is a member of the American Physical Society. Hogan has received many awards and honors, including the IEEE Frederick Philips Gold Medal in 1976 and the Pioneer Medal of Merit from the IEEE Microwave Theory and Technology Group in 1993. UC Berkeley named the C. Lester Hogan Chair of Computer Science in his honor. He also holds numerous honorary doctorates. Eta Kappa Nu named Hogan an Eminent Member in 1999. His great joy in life has been teaching and mentoring. He is married to Audrey Peters and they have one daughter, Cheryl Lea, and two grandsons.✦

Inventor and Research Director

John R. Pierce

1999

Eta Kappa Nu Eminent Member

JOHN PIERCE'S research at Bell Laboratories was instrumental to the development of communication satellites. Pierce was born in Des Moines, Iowa on 27 March 1910. His work as a science fiction writer funded his education at the California Institute of Technology, where he earned a B.S. in electrical engineering in 1933, a M.S. in 1934 and a Ph.D. in 1936, graduating magna cum laude. That same year he began a thirty-five-year career with Bell Laboratories. While at Bell Labs, Pierce worked in a number of projects, including research on electron multipliers, reflex klystrons, traveling wave tubes, and microwaves. He held many executive positions with Bell Labs including Director, Electronics Research from 1952 to 1955; Director, Research-Communications Principles from 1958 to 1962; Executive Director, Research: Communications Principles and Systems Division from 1963 to 1965; and between 1965 and 1971 Pierce served as Executive Director, Research: Communications Sciences Division.

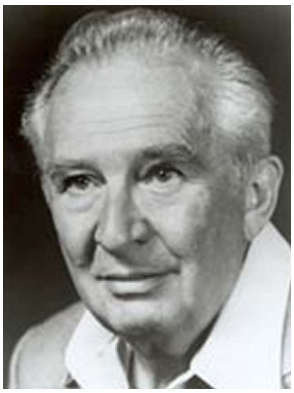
Pierce's conviction that satellites could greatly enhance communications technology fueled his drive to send satellites into space. In 1955 Pierce offered a comprehensive proposal for satellite communication. By 1960 Pierce's vision had become reality. The successful testing of the Echo satellite communications experiment led to the development of Telstar in 1962. The Telstar satellite used Pierce's innovative technologies in communications electronics, including the traveling-wave tube and electron-gun geometry. Used in beam tubes, electron-gun geometry gives space-charged-limited

flow of electrons, which provides the maximum beam density theoretically possible. Pierce's work with permanent magnets, using them to reduce the weight of traveling-wave tubes, was integral to their successful use in satellites. Pierce's research resulted in the theoretical development of the possibilities of communications satellites and of broadband digital transmissions via pulse code modulation and multivalent signals. In 1971, Pierce went to work for Cal Tech as Professor of Electrical Engineering.

While teaching at Cal Tech, Pierce was involved with a number of professional societies. He was a member of the National Academy of Sciences and the National Academy of Engineering, and he was a Fellow of the Institute of Electrical and Electronics Engineers. Throughout Pierce's illustrious career he earned many awards and honors including the Edison Medal, the National Medal of Science, and the IEEE Medal of Honor. He was named Eta Kappa Nu Eminent Member in 1999. Pierce also held over ninety patents and authored fourteen technical books and over two hundred technical articles. John Pierce passed away 2 April 2002. He was married to Ellen R. McKown, and they had a son and a daughter.✦

Electrical Engineer, Inventor,
and Entrepreneur

Jacob Rabinow



1999

Eta Kappa Nu Eminent Member

JACOB RABINOW'S research, creativity and leadership led him to make numerous important inventions and to carry out many successful business ventures. Rabinow was born in Kharkov, Ukraine on 8 January 1910. The son of a shoemaker, he lived in Siberia during the Russian Revolution. He moved to China and then to New York City in 1921. Inspired by the fiction of Jules Verne and the mechanization of his father's shoe factory, he studied electrical engineering at the City College of New York, earning his B.S. and M.S. degrees in 1933 and 1934 respectively. Between 1934 and 1938 he worked as a radio engineer with Sterling Radio Labs and Halson Radio Corporation. In 1938, he joined the National Bureau of Standards as a mechanical engineer. During World War II, he became Chief of the Electro-Mechanical Ordinance Division. In the early 1950s, his inventions were largely in defense systems, including mechanical and safety elements of fuses and the guidance systems for missiles. In 1954, Rabinow left government employ to create his own company, Rabinow Engineering Company. It was here that he developed many of his well-known inventions. Ten years later, his company joined Control Data Corporation (CDC), and he served as CDC Vice-President until 1972. In 1968, Rabinow formed the RABCO Company to manufacture straight-line phonographs. RABCO was later sold to Harmon-Kardon. In March 1972, Rabinow rejoined the National Bureau of Standards. When he retired in 1975 he was the Chief Research Engineer.

Following the founding of Rabinow Engineering Company, Rabinow

made his most noted inventions. He developed an automatic mail-sorting system that revolutionized the postal service. In 1960, he developed his "reading machine." This device read letters and numbers by means of optical character recognition. The mechanism recognized letters and numbers as specific patterns of dots, which are compared to all letters and numbers to find the closest match. The technology is still used today to read bank checks, credit-card information, and IRS documents, some at the rate of 14,000 characters per second. Rabinow also connected reading machines and dictionaries to automatically correct mistakes as early as 1954, predating computer spell checking. He developed a conveyor belt card sorter for the Census Bureau and a magnetic memory device (precursor to the modern hard disk drive). In 1954, Rabinow developed the first automobile clutch to work by magnetic and not electrostatic charge, and in 1959, he invented a self-regulating clock. He was issued 229 U.S. patents.

Following his retirement in 1975, he returned to the National Bureau of Standards, now the National Institute of Standards and Technology, as a consultant in the field of energy related inventions until 1989. In 1990, he published *Inventing for Fun and Profit.* Rabinow received many awards including the President's Certificate of Merit in 1948, the Institute of Electrical and Electronics Engineers (IEEE) Harry Diamond Award "For important inventions in ordnance and automatic control" in 1977, and the Lemelson-MIT Lifetime Achievement Award in 1998. The Institute of Radio Engineers (IRE) named him a Fellow in 1956, and Eta Kappa Nu named him an Eminent Member in 1999. Rabinow died 11 September 1999. He was married to Gladys Lieder, and they had three children.✦

Arpanet Developer, Educator,
and Corporate and Cultural Leader

Leo L. Beranek

2000

Eta Kappa Nu Eminent Member

LEO BERANEK'S research contributed greatly to the development of modern acoustics and the Internet. Beranek was born in Solon, Iowa on 15 September 1914. His father sparked his interest in technology by purchasing a radio for the family in 1923, a single-tube Crosley. Beranek entered Cornell College in 1931, but due to financial difficulties left in his junior year to accept a position with Collins Radio Company. He returned to Cornell and earned his B.A. degree in 1936. In a fortunate twist of fate, he stopped on the side of the road in 1935 to help a stranger change a flat tire. The stranger was Glenn Browning, a leading radio engineer in Boston. Browning encouraged Beranek to apply to Harvard despite the institution's high cost. He did so, was accepted, and earned his M.S. degree and his Ph.D. in 1937 and 1940, respectively. In 1940, he was asked to direct a war project for the National Defense Research Committee concerning acoustics research on jet engines. It was Harvard's first contract with a U.S. government agency. During this time, 1945 and 1946, he became a physics instructor at Harvard and eventually directed electro-acoustics research there. In 1947, he accepted a position as an associate professor at MIT, where he taught until 1958. In 1948, Beranek co-founded and became president of Bolt, Beranek and Newman (BBN). Under his leadership, the firm shifted its emphasis from acoustics to computer science. In 1971, he left BBN to co-found Boston Broadcasters Inc., WCVB-TV Channel 5 in Boston, where he served as CEO until 1982.

As president of BBN, Beranek pioneered the technology of the

Internet's predecessor, Arpanet. The Advanced Research Projects Agency (ARPA) selected BBN to develop the Interface Message Processor (IMP). BBN not only successfully developed the IMP, they also became the control center for the entire network. Beranek's acoustics research led to major changes in the jet aircraft industry. As a result, by 1958 modifications in noise standards required airplanes to carry exhaust mufflers and use noise-reducing take-off flight patterns. His acoustics research set the standards for acceptable noise levels in schools, offices and factories. He published two books on acoustics of concert halls and opera houses. His leadership at WCVB-TV led to an article title in the New York Times, "Some Say This Is America's Best TV Station."

Following the sale of WCVB-TV in 1982, Beranek served as Chairman of the Boston Symphony Orchestra from 1983 to 1987. He then served as full-time volunteer president of the American Academy of Arts and Sciences from 1989 to 1994. In 2003, he published his second edition of *Concert Halls and Opera Houses: Music, Acoustics and Architecture.* Beranek has received many awards including the Gold Medal Award from the Audio Engineering Society in 1971, the Abe Lincoln Television Award for the best operated television station in the United States in 1976, the Scholar-Patriot Distinguished Service Award from the American Academy of Arts and Sciences in 2000, and the National Medal of Science in 2003. He is an Institute of Electrical and Electronics Engineers (IEEE) Fellow and was named an Institute of Radio Engineers (IRE) Fellow in 1952. Eta Kappa Nu named him an Eminent Member in 2000. Beranek resides in Cambridge, Massachusetts and has two sons, James and Thomas.✦

Electrical Engineer and
Biomedical Computing Pioneer

Thelma Estrin

2000

Eta Kappa Nu Eminent Member

THELMA ESTRIN was one of the first to use computer technology to solve problems in health care and in medical research. Estrin was born in New York City on 21 February 1924. Her parents encouraged her to attend college, which was uncommon for women at that time. She received her B.S. and M.S. degrees in 1949, and her Ph.D. in 1951, all in electrical engineering from the University of Wisconsin. Most of the professors she worked with did not take her seriously and expected her to eventually leave the field. Determined to maintain her career, she went to work at the Electroencephalography Department of the Neurological Institute at Columbia Presbyterian Hospital (New York) in 1951. In 1956, her husband Gerald accepted a position at UCLA as an associate professor in the School of Engineering and Applied Science. During this time Estrin taught at Valley College in Los Angeles. In 1960, she joined the newly formed Brain Research Institute (BRI) at UCLA. In 1970, she became Director of the Data Processing Laboratory and provided computer support for many research projects and helped many scientists make use of computers. In 1980, Estrin became a professor in residence in the Computer Science Department at the School of Engineering and Applied Science at UCLA. She retired in 1991.

Her fascination with computer technology led Estrin to help design Israel's first computer, the WEIZAC, in 1954. During Estrin's tenure at UCLA, she designed and implemented one of the first systems for analog-digital conversion of electrical activity from the nervous system. This was a precursor to the use of computers in medicine.

Estrin's interest in EEG research led to many ground-breaking articles, including her 1961 piece, "Recording the Impulse Firing Pattern," which examined digital techniques to explore spike patterns originating in neurons. Other papers pertained to mapping the brain with the help of computers. In 1975, Estrin developed a computer network between UCLA and UC Davis. In 1977, she was elected president of IEEE Engineering in Medicine and Biology Society. Four years later she became the first woman elected to a national office in IEEE, serving as Vice-President. Estrin also became the first woman to join the board of trustees of the Aerospace Corporation. Her leadership on that board encouraged many other women to pursue careers in aerospace engineering.

Estrin has received many awards and honors, including a Fulbright Fellowship at the Weizmann Institute in Israel to investigate EEG patterns associated with epilepsy, the Outstanding Engineer of the Year Award from the California Institute for the Advancement of Engineering in 1979, the Achievement Award from the Society of Women Engineers in 1981, and the Superior Accomplishment Award from the National Science Foundation in 1984. Eta Kappa Nu named her an Eminent Member in 2000. She is presently involved in the application of science and technology to the advancement of women in computer science fields. Estrin is married and has three daughters, Margo, Judith and Deborah. Estrin calls her children, "my greatest contributions…jointly authored with my husband."✦

Scientist, Science Administrator, and Corporate Leader

Robert Frosch

2000

Eta Kappa Nu Eminent Member

ROBERT FROSCH'S leadership skills were fundamental in the development of new technologies at NASA and General Motors. Born 22 May 1928 in New York City, he attended public schools in the Bronx, where he graduated when he was fifteen. He applied to Columbia University but because Columbia would not accept students younger than 16 his admission was delayed. When Frosch was finally admitted to Columbia University he earned both his undergraduate and graduate degrees in theoretical physics. Before his successful dissertation defense in 1952, he joined Hudson Laboratories of Columbia University, which was under contract to the Office of Naval Research. While there, Frosch worked as a research scientist and later became Director of Research. In 1963, he accepted a position as Director of Nuclear Test Detection (Project VELA) in Washington DC. In 1966, he became Assistant Secretary of the Navy for Research and Development and was responsible for all Navy programs of research, development and engineering. In 1973, he became Assistant Secretary General of the United Nations and was responsible for overseeing environmental matters. Between 1977 and 1981, he served as the fifth NASA Administrator, under Jimmy Carter. Because of the change in presidential administrations in 1981, Frosch left NASA and accepted the position of Vice-President of Research for General Motors Research Laboratory. He remained with GM until his retirement in 1993.

During Frosch's career he oversaw the development of many technologies. As Director of the Nuclear Test Detection, he led the

design and development of the computer controlled Large Aperture Seismic Array in Montana. This technology permitted the differentiation of seismic activity and underground nuclear testing. While with the Office of Naval Research he directed research pertaining to underwater sound, sonar, oceanography, marine geology and marine geophysics. He managed 300 employees with an annual budget of $3.5 million. He also directed the Project ARTEMIS, an experimental active sonar system. During Frosch's tenure with NASA he directed efforts to develop the Space Shuttle and oversaw testing of the first orbiter, Enterprise. Frosch's previous environmental research contributed to his leadership at General Motors. While Vice President at GM, he led major developments in vehicle emissions control, cleaner fuels, improved automobile safety, systems engineering and electronics. His desire to discover alternative transportation technologies led to research on a new generation of electric and hybrid vehicles.

Following Frosch's retirement from GM in 1993, he became a senior research fellow at the Kennedy School of Government at Harvard University. Throughout Frosch's career he earned many awards including the Navy Distinguished Public Service Award in 1969, the NASA Distinguished Service Medal in 1981, the Institute of Electrical and Electronics Engineers (IEEE) Founders Medal in 2001 "For a career of significant advances in aerospace and automotive technology, and industrial ecology, and for skilled administration of R&D in industry, government, and academia", and the Arthur M. Bueche Award in 2003. Frosch is a Fellow of the IEEE and a member of the U.S. National Academy of Engineering, the American Academy of Arts and Sciences, Phi Beta Kappa, and Sigma Xi. Eta Kappa Nu named him an Eminent Member in 2000. Frosch currently resides in Cambridge, Massachusetts.✦

Engineer, Research Director,
and Corporate Leader

Ivan A. Getting

2000

Eta Kappa Nu Eminent Member

IVAN GETTING'S leadership at the Aerospace Corporation led to the development and implementation of the Navistar navigation system. Getting was born in New York on 18 January 1912. An Edison scholar at MIT, he received his B.S. degree in physics in 1933. He then attended Oxford University as a Rhodes scholar and earned his Ph.D. in astrophysics in 1935. Between 1935 and 1940, he was a Junior Fellow at Harvard University. In 1940, he joined MIT working in the Radiation Laboratory as Director of the Division on Fire Control and Army Radar. By 1945, he had become an associate professor in electrical engineering, and full professor one year later. He was also the head of the Radar Panel of the Research and Development Board of the Department of Defense. In 1951, Getting became Vice-President of Research and Engineering at Raytheon Company. In 1960, he became the founding President of the Aerospace Corporation. His leadership led to extraordinary developments in satellite-based navigation. In 1977, Getting retired and was named President Emeritus of the Aerospace Corporation.

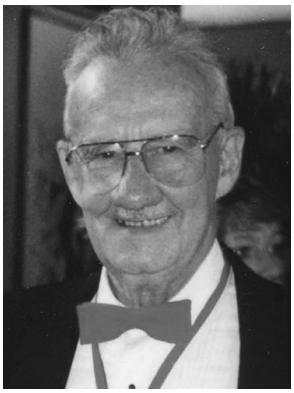
Throughout his career Getting made numerous contributions to radar technology. While serving as Director of the Division on Fire Control and Army Radar, his group developed the first automatic microwave tracking fire-control radar, the SCR 584, which was credited with sparing London from Hitler's V-1 rockets during World War II. As Vice-President of Research and Engineering at Raytheon, Getting led the company's response to an Air Force request for a guidance system. Raytheon suggested the first three-dimensional, time-

difference-of–arrival position-finding system, which would eventually be used with ICBMs. When Getting left Raytheon, this proposed technique was one of the most advanced forms of navigation technology in the world. Getting's contributions continued while he served as President of Aerospace Corporation. Under his leadership Aerospace developed the concept essential for the Global Positioning System. The system now is a constellation of 24 satellites that uses transmitters and atomic clocks to calculate locations around the world. Aerospace also led the planning for new ballistic missile systems, oversaw the space launch system, and developed high-power chemical lasers.

Following Getting's retirement he served as a consultant to and board member of various companies. During his career, he received many awards and honors including the U.S. Medal of Merit in 1948, the Air Force Exceptional Service Award in 1960, the Institute of Electrical and Electronic Engineer's Pioneer Award in 1975 and Founders Medal in 1989, and the John Fritz Medal in 1998. Getting was also a Fellow of the Institute of Radio Engineers (IRE). Eta Kappa Nu named him an Eminent Member in 2000. In his later years, he enjoyed playing the piano, sailing and orchid growing. Getting died 11 October 2003. He had three children with his first wife Dorothea, who passed away in 1976: Nancy, who is a counselor, Ivan, a geophysicist, and Peter, a professor of physiology. He later married Helen A. Griggs.✦

Engineer, Inventor,
and Entrepreneur

Wilson Greatbatch



2000

Eta Kappa Nu Eminent Member

WILSON GREATBATCH'S research led to the development of the first successful implantable human pacemaker. Born in Buffalo, New York on 6 September 1919, he served in the US Navy for five years during World War II, partly as a rear gunner in the South Pacific. Following the war, he used the GI Bill to earn his B.S. degree from Cornell University in 1950. He later received his M.S. degree in electrical engineering from the University of Buffalo in 1957. However, Greatbatch's work in electrical engineering preceded his academic achievements. In 1952, he worked as an associate engineer with the Cornell Aeronautical Laboratory in Buffalo and designed a helicopter air-speed computer, which was the laboratory's first transistorized device. One year later, he became an assistant professor of electrical engineering at the University of Buffalo. While there he worked with the Chronic Disease Research Institution analyzing high-frequency heart-sound components. In 1957, he accepted a position as Division Manager at Taber Instrument Corporation. While with Taber, Greatbatch made his most renowned discovery, the implantable pacemaker. His success led to the creation of a company to manufacture pacemakers.

While researching heart sounds and electrical pulse in the late 1950s, Greatbatch discovered a way to regulate the human heart. In 1958, he approached William Chardack, who was the chief of surgery at the Veteran's Administration Hospital in Buffalo. Greatbatch used his own money to construct 50 pacemakers, 10 of which were implanted into humans. These first 50 pacemakers were made in the barn behind

his house. (The barn was disassembled and moved to the Clarence Historical Museum in the mid-1990s). He patented his discovery and formed Wilson Greatbatch Incorporated in 1960. In 1961, he licensed the technology to Medtronic Incorporated. Medtronic is now the largest manufacturer of pacemakers. Greatbatch's discovery catapulted him from researcher to wealthy entrepreneur. In 1963, Mennen-Greatbatch Electronics Incorporated was created and purchased the assets of Greatbatch Incorporated. In 1964, Greatbatch developed Wilson Greatbatch Limited, which sold medical equipment in Eastern European Countries. He funneled much of his own money into new research projects. One of these, the corrosion-free lithium battery, remedied the short battery life of the earlier zinc-mercury battery. By the early 1970s, the life of the pacemaker was extended from two to ten years. The success of the battery was so great that Greatbatch created a separate company to manufacture them. Greatbatch's son Warren ran the 30 million dollar company for over twenty years. Wilson Greatbatch Technologies, Inc., a publicly traded corporation, presently sells over 80 percent of all pacemaker batteries. During the 1980s and 1990s, Greatbatch has spent much of his time with John Stanford of Cornell University researching the Human Immunodeficiency Virus (HIV), and they were recently awarded a patent on a way to inhibit a similar viral infection in cats. More recently, he has founded yet another company, Greatbatch Enterprises Corp. in Clarence, New York. He, along with his staff of engineers, has been working on improved energy sources for implantable devices. In addition, Greatbatch has been intensely interested in nuclear fusion and interplanetary space travel.

Throughout his career, Greatbatch earned many awards including the National Medal of Technology in 1986, the Lemelson/MIT Career Achievement Award in 1996, and the National Academy of Engineers Fritz J. and Dolores H. Russ Prize in 2001. He was the first winner of Eta Kappa Nu's Vladimir Karapetoff Award. Greatbatch has been awarded five honorary doctorates and holds more than 320 US and foreign patents. He is a member of the National Academy of Engineering, IEEE, American College of Cardiology, Royal Society of Health (UK), and Electrochemical Society. Eta Kappa Nu named him an Eminent Member in 2000. Greatbatch resides in Buffalo, New York with his wife, Eleanor. They have five children.✦

Inventor and Corporate Leader

George H. Heilmeier

2000

Eta Kappa Nu Eminent Member

GEORGE HEILMEIER'S research laid the groundwork for the use of liquid crystal display in calculators, watches and computers. Heilmeier was born on 22 May 1936 in Philadelphia, Pennsylvania. In 1958, the same year he earned his B.S. degree in electrical engineering from the University of Pennsylvania, Heilmeier went to work for RCA Laboratories. He then moved to Princeton where he earned his M.A., M.S.E. and Ph.D. degrees in solid-state electronics in 1962. Soon after graduation he began working on electronic and electro-optic devices for RCA. His hard work and research led to his promotion as head of Solid State Device Research in 1966. Four years later he was selected as a White House Fellow working on research, planning and technology assessment for the Secretary of Defense. In 1975, he became Director of the Defense Advanced Research Projects Agency (DARPA). There he initiated programs in stealth aircraft, space-based lasers, and reconnaissance systems. In 1977, he left DAPRA and was named Vice-President of Texas Instruments. In 1983, he was promoted to Senior Vice President and Chief Technical Officer. After a successful career with Texas Instruments, Heilmeier was elected President and Chief Executive Officer of Bellcore (Bell Communications Research) now Telcordia, in 1991. He remained there until his retirement in 1997.

Heilmeier is well known for his research and corporate leadership. While working at RCA in the mid 1960s, he discovered several new electro-optic effects and developed liquid-crystal displays, which were used in alarm clocks, watches, computers, and other electronic

devices. While he served as head of DARPA, the agency pioneered the first stealth aircraft and continued to advance ARPANET, the forerunner of the Internet. During his tenure with Texas Instruments, he managed projects in petroleum exploration, systems technology, microelectronics and software. After joining Bellcore in 1991, Heilmeier transformed the company from a narrowly focused conglomerate to a global commercial business. In 1993, he drafted a landmark public-policy statement, "Technology for America's Economic Growth, A New Direction to Build Economic Strength." The CEOs of AT&T, GTE, MCI, Sprint, Bell Atlantic, Nynex, Pacific Bell, Bell South, U.S. West, Southwestern Bell and Ameritech signed this initiative.

Following his retirement in 1997, Heilmeier was named Chairman Emeritus of Telcordia. He holds 15 U.S. patents and is a member of numerous organizations. Throughout his career, Heilmeier earned several awards including the David Sarnoff award in 1968, the National Medal of Science awarded by President Bush in 1991, and the Institute of Electrical and Electronics Engineers (IEEE) Medal of Honor in 1997. Eta Kappa Nu named him an Eminent Member in 2000. Today Heilmeier remains active and resides in Dallas, Texas.✦

Engineer, Physicist, Inventor,
and Nobel Laureate

Charles Townes

2000

Eta Kappa Nu Eminent Member

CHARLES TOWNES' research in quantum electronics earned him a Nobel Prize in 1964 "for fundamental work in quantum electronics which has led to the construction of oscillators and amplifiers based on the maser-laser principle." Born on 28 July 1915 in Greenville, South Carolina, he earned his B.S. and B.A. degrees in physics and modern languages from Furman University in 1935. He then earned his M.S. degree at Duke University and a Ph.D. at the California Institute of Technology in 1936 and 1939 respectively. Though his degrees were in physics, both his master's thesis and his Ph.D. dissertation involved a great deal of engineering. Townes became a member of the technical staff at Bell Telephone Laboratories in 1939 and remained there until 1948, when he accepted a faculty position at Columbia University as Professor of Physics and later became Executive Director of the Columbia Radiation Laboratory and Chairman of the Physics Department. Between 1959 and 1961, while on a leave of absence, he served as Vice-President and Director of Research of the Institute for Defense Analysis in Washington, D.C. In 1961, he was appointed Provost and Professor of Physics at MIT. In 1966, he resigned in order to return to more intensive research, particularly in the fields of quantum electronics and astronomy. He was appointed University Professor at the University of California in 1967. In July 1986, he was named University Professor Emeritus, and in 1994 he became a professor in the graduate school.

At Bell Labs Townes worked on various technologies, including cathode ray tubes, microwave oscillators, and, during World War II, a

radar bombsight. His work on radar led him to research the interaction of microwaves and molecules. After the war he became one of the founders of the new field of microwave spectroscopy. In 1951, he conceived of a new way to generate millimeter waves. His development of the maser (microwave amplification by stimulated emission of radiation) was soon being used as an amplifier and as an oscillator. Seeking to expand the frequency range of the maser, Townes collaborated with Bell Labs researcher Arthur Schawlow in writing a landmark paper in 1958 on the conditions necessary to make masers operate at infrared, visible, and ultraviolet wavelengths. This paper stimulated a great deal of work, and in 1960 Ted Maiman at Hughes Research succeeded in getting such a device (now known as a laser) to work. From the mid 1960s on, Townes has directed much of his attention to astronomy, pioneering in the new fields of molecular astronomy and infrared interferometry.

Townes has always regarded himself as a member of the engineering community as well as the physics community. Early in his career he joined the Institute of Radio Engineers (IRE), and he has published many articles in engineering journals. He also holds numerous honorary degrees. He is an IRE Fellow and has received numerous awards and honors including the IRE's Morris N. Liebmann Award in 1958, the American Institute of Electrical Engineers (AIEE) David Sarnoff Award in 1961, the Institute of Electrical and Electronics Engineers (IEEE) Medal of Honor in 1967, and the National Medal of Science in 1982. Eta Kappa Nu named him an Eminent Member in 2000. In 1941, Townes married Francis Brown, and in 1991 the couple celebrated their golden wedding anniversary along with their four daughters and six grandchildren.✦

Electrical Engineer, Researcher, and Professor

John R. Whinnery

2000

Eta Kappa Nu Eminent Member

JOHN WHINNERY'S research and scholarship made a great contribution to our understanding of microwave technology. Whinnery was born in Read, Colorado on 26 July 1916. He received his B.S. degree and his Ph.D. in electrical engineering from Berkeley in 1937 and 1948 respectively. While working on his doctorate Whinnery went to work with General Electric Company in Schenectady, New York. There he researched problems in waveguide discontinuities, microwave tubes and radar applications. During this time he was also active in war training classes. In 1946 he began a long career at the University of California Berkeley, holding positions as Lecturer, Associate Professor, and Professor. Between 1952 and 1956 Whinnery chaired the Electrical Engineering Department and from 1959 to 1963 he was Dean of the College of Engineering. In 1951 Whinnery went on leave and acted as director of the Microwave Tube Research Section of the Hughes Aircraft Company. In 1959, he was awarded a Guggenheim Fellowship at the Federal Institute of Technology in Zurich, Switzerland. Following his return, Whinnery carried out research in quantum electronics at Bell Laboratories Inc. between 1963 and 1964. In 1980 he was appointed University Professor at Berkeley.

John Whinnery's greatest contribution was the understanding produced through his research. His work contributed to the improvement of microwave oscillators and amplifiers and the application of these to radar systems. He has authored and co-authored articles and books on microwave oscillators, optical

waveguides, electromagnetic waves, and communications applications of lasers. In 1944 he co-authored *Fields of Waves in Modern Radio* with Simon Ramo. The book has had four revisions (three were with co-authored with T. Van Duzer). This text is still in use today. Whinnery has also served as an educational leader. His devotion to his students and the direction he provided greatly contributed to the growth of engineering research at Berkeley, and moreover produced several outstanding students whose research impacted the field of electrical engineering. Whinnery also served on numerous government advisory committees, including the Advisory Group on Electron Devices, the Science and Technology Advisory Committee to NASA for the Apollo Program, and the Standing Committee on Controlled Thermonuclear Research for the former Atomic Energy Commission.

Whinnery is also a true Renaissance man. He is poet, a children's stories author, and a connoisseur and vintner of fine wines, all of which have kept him busy following his retirement from Berkeley in 1986. Whinnery has been awarded numerous accolades throughout his respected career including ASEE's Lamme Medal in 1974, IEEE's Medal of Honor in 1985, and the National Medal of Science awarded by President Bush in 1992. He is married to Patricia Barry, and they have three daughters. John Whinnery currently resides in Walnut Creek, California.✦

Engineer, Author,
and Corporate Chief Executive

Norman R. Augustine

2001

Eta Kappa Nu Eminent Member

NORMAN AUGUSTINE'S leadership in the U.S. aerospace industry greatly contributed to technical and managerial solutions to the challenges in civil defense and homeland security systems. Born in Denver, Colorado on 27 July 1935, he received his B.S. and M.S. degrees in Aeronautical Engineering from Princeton University in 1957 and 1959 respectively. In 1958, he joined Douglas Aircraft Company and rose to Program Manager and Chief Engineer. In 1965, Augustine served in the Office of the Secretary of Defense as an Assistant Director of Defense Research and Engineering. In 1970 he joined the LTV Missile and Space Company as Vice-President of Advanced Programs and Marketing. Three years later, he accepted a position as Assistant Secretary of the Army, and in 1975 he was promoted to Under Secretary. Between 1987 and 1995 he served as Chairman and CEO of the Martin Marietta Corporation. Augustine became president of Lockheed Martin upon the formation of that company in 1995. He then became CEO in January of 1996 and later Vice-Chairman and Chairman. He retired in 1997, although he continues to serve as Chairman of the Executive Committee of Lockheed Martin.

Augustine's guidance and research at Martin Marietta led the technology intensive enterprise through mergers and acquisitions that eventually led to the creation of Lockheed Martin, one of the world's leading diversified technology companies. Throughout his tenure with Martin Marietta and Lockheed Martin, he chaired numerous panels working to maintain the U.S.'s technological leadership.

Under Augustine's direction, Lockheed Martin developed a corporate ethics program that provided clear guidelines about ethical behavior in the workplace. Following Augustine's acceptance of the Marymount University Ethics Award in 1998, he stated quite presciently that in these times of corporate scandal, "I think ethical behavior goes far beyond compliance with the law… Our entire business world, entire relationships with each other-all the things we are involved in, depend on that basis of ethical comportment." During the 1990s he also found time to research and write. In 1990, he co-authored with Kenneth Adelman *The Defense Revolution*, *Intelligent Downsizing of America's Military*. In 1997 the sixth edition of *Augustine's Laws* provided an informative and humorous guide to the political and business world. That same year he authored *Augustine's Travels*, which explores ethics, leadership, and competition.

Following his retirement from Lockheed Martin, Augustine became a lecturer with the rank of professor at Princeton University's School of Engineering and Applied Science. He taught there for two years. Augustine also served as Chairman and Principal Officer of the American Red Cross for nine years. Over the course of his career Augustine received many awards including the National Medal of Technology, the Distinguished Service Medal from the Department of Defense, and the NASA Distinguished Public Service Medal. He was also named one of Business Week's "Top 25 Managers of 1996," and first among Defense Business' forty leaders in Global Security and Aerospace. Eta Kappa Nu named him an Eminent Member in 2001.✦

Engineer and Inventor

Charles Concordia

2001

Eta Kappa Nu Eminent Member

WORLD-RENOWNED systems engineer Charles Concordia enhanced nearly every aspect of power systems dynamics. Concordia was born 20 June 1908 in Schenectady, New York. His father was a music teacher, which contributed to Concordia's love of classical music. In school, he excelled at physics and in 1926, at the age of eighteen, Concordia went straight from high school to a job at General Electric. That same year, he joined the Schenectady Section of the American Institute of Electrical Engineers (AIEE). His early years with General Electric were spent working on television and radio research. After four years in the General Electric Laboratory, he joined GE's prestigious Advanced Engineering Program, graduating in 1934. He became an applications engineer in binary system dynamics. During World War II, he worked on generators and turbines for naval destroyer propulsion, researched superchargers for airplanes, and helped develop electrical drives for Navy ships. Following the war, Philip Brown sought Concordia's help with a proposal for a pumped hydro storage project. During the 1950s, he worked with NASA's predecessor, the National Advisory Committee for Aeronautics, solving a serious problem with a wind tunnel used for testing a scaled-down model of aircraft at or near the speed of sound. In the 1960s, he continued his research on systems control, which grew more and more intricate with the technological developments that occurred in the 1960s and 1970s. In 1971, Concordia was awarded a D.Sc. from Union College. He retired from GE in 1973.

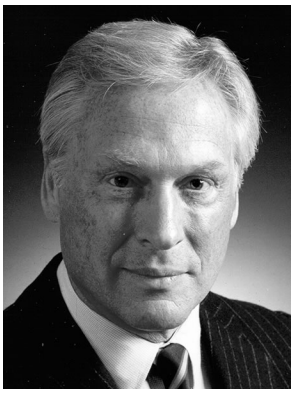
One of Concordia's early inventions applied to railways. While

working in GE's laboratory, he developed a device that detected cracks in rails. His system was based on magnetic field measurements, which avoided the need to clean the rail beforehand, as was necessary in the previous technique that used a Kelvin bridge for measuring the rail's relatively low electrical resistance. In the 1940s, Concordia pioneered the idea that voltage regulators in the synchronous machines affected their stability. contributions His 1944 paper, "Steady State Stability of Synchronous Machines as Affected by Voltage-Regulator Characteristics," has been one of the most cited in the field. His book, *Synchronous Machines-Theory and Performance,* published in 1951, is still cited. In the 1950s, he and Art Lauder, a GE colleague, worked to correct a problem in wind tunnel mechanics. Torsional oscillations between two 22-MW adjustable-speed motors and the wind tunnel fans they drove were threatening to cause shaft failures due to metal fatigue. The damper consisted of a flywheel coupled to the motor shaft by a friction slip device. A few hundred watts of loss in this device reduced the amplitude of the torsional oscillations to a fraction of the shaft's rated torque. In the undamped condition, their amplitude was several times the shaft's rated torque. Today, some 45 years later, the same dampers are still working.

Concordia's reputation as a power systems guru earned him many awards and honors, including the American Institute of Electrical Engineers' (AIEE) Lamme Medal in 1961, the Institute of Electrical and Electronics Engineers (IEEE) Centennial Medal in 1984, and IEEE's Medal of Honor in 1999. He was a Fellow of the AIEE and IEEE, the American Association for the Advancement of Science, and a member of the National Society of Professional Engineers and the National Academy of Engineering. Eta Kappa Nu named him an Eminent Member in 2001. He held several patents and authored more than one hundred and thirty technical papers. Concordia died 25 December 2003. He was married to Francis Butler for fifty-three years.✦

Engineer, Industrialist,
and CEO

Malcolm R. Currie



2001

Eta Kappa Nu Eminent Member

MALCOLM CURRIE'S leadership in business and his service in the U.S. Defense Department contributed to remarkable developments in defense electronics, satellite communications, and automotive electronics. Currie was born in Spokane, Washington on 13 March 1927. In 1944, at the age of seventeen, he joined the U.S. Navy where he attended flight training school. Following his discharge in 1947, he earned his B.A. degree in physics and his M.S. and Ph.D. in engineering physics from the University of California at Berkeley in 1949, 1951 and 1954, respectively. In 1953, he joined the engineering faculty at the University of California, Berkeley. Two years later, he accepted a position as a research engineer with Hughes Aircraft. He researched traveling wave tubes, millimeter waves, lasers, noise theory and noise reduction, parametric amplifiers, electric propulsion, and ion beam semiconductor implantation. In 1968, Currie was named Vice President and Director of Development. In 1973, he left Hughes and accepted a presidential appointment as Under Secretary of Defense Research and Engineering in the U.S Department of Defense. During this time, he was responsible for planning, managing, and guiding through Congress weapons-acquisition programs for the Department of Defense. In 1977, Currie returned to Hughes, and in 1988, became Chairman and CEO of Hughes Aircraft. Hughes is now a world leader in air traffic control and business network products and services. He retired from Hughes in 1992 and later founded Currie Technologies Incorporated, an electric transportation company. He currently serves as a director for the INAMED Corporation.

During his tenure with the Defense Department, Currie initiated and guided programs such as the Global Positioning Systems, Stealth, cruise missiles, F-18, turbine M-1 tank, and early smart weapons, contributing to the foundation of our national security systems today. Following his return to Hughes Aircraft, he led the development of advanced IR and radar missile systems including AMRAAM. Later, as Executive Vice President of Hughes, following the acquisition by General Motors, he led implementation of the merger and also served as President and CEO of Delco Electronics, where he diversified Delco's product lines and transformed Delco from a captive supplier into a world competitive producer of high volume automobile electronics. As CEO of Hughes, Currie led its strategic diversification from defense into such areas as commercial satellite communications and direct broadcast satellites (Direct TV), air traffic control, private business network products and services, and other applications of Hughes' electronics technologies. He also created a new management philosophy and approach to productivity and product quality.

Currie has earned many awards including the Institute of Electrical and Electronics Engineers (IEEE) Fellow Award "For outstanding contributions to microwave tube research and to education," the Defense Department's Distinguished Public Service Medal, the NASA Distinguished Service Medal, and the IEEE Founders Medal "For technical and managerial leadership in the electronics industry" in 1995. Currie is a Member of the National Academy of Engineering, and a Fellow of the American Association for the Advancement of Science, the British Aeronautical Society, the Institute of Radio Engineers (IRE), IEEE, and the American Institute of Aeronautics and Astronautics (AIAA). Eta Kappa Nu named Currie an Eminent Member in 2001. He resides in California with his wife Barbara. He has three children, Deborah, David, and Diana.✦

Electrical Engineer
and Research Executive

Edward E. David Jr.

2001

Eta Kappa Nu Eminent Member

EDWARD E. DAVID'S multiple leadership roles in business and government agencies have created new methods of research and development and augmented corporate-academic research partnerships. Born in Wilmington, North Carolina on 25 January 1925, he earned his B.E.E. degree from the Georgia Institute of Technology in 1945 and his M.S. and Sc.D. in Engineering from MIT in 1947 and 1950 respectively. In 1950, David joined AT&T's Bell Labs, where he concentrated his research on the development of undersea warfare techniques and on communication acoustics. Because the Bell management was so impressed with his expertise, they appointed David engineer in charge of acoustics research in 1956, and in 1965 he was named Executive Director of Research. In 1970, President Nixon asked him to be Science Adviser to the President and Director of the White House Office of Science and Technology. Among other initiatives, David supported the development of the Apollo program, the Hubble Space Telescope and the expanded cancer research program in the National Institutes of Health. In 1973, he became Executive Vice-President of Research, Development and Planning for Gould, Inc. There he directed a staff of 300 scientists in research on batteries and fuel cells. In 1977, David was named President of Exxon Research and Engineering Company. For ten years, he directed the corporation's research, engineering and technical service activities with an operating budget of $500 million. In 1986, he left Exxon and became a business consultant and later created his own company, Edward E. David Inc. He also served as Principle and Vice-President of the Washington

Advisory Group LLC, a consulting and advisory service for industry, academia, and government. David currently serves on the board of directors for DeCorp Inc., Medjet Inc., Reveo Inc., and Spacehab Inc. David, working with Henry MacDonald and Max V. Matthews, both Bell colleagues, connected a computer to a recording and playback apparatus to produce a means for carrying out speech and acoustic research. Throughout the early 1960s, he continued his research on acoustics, and he published an article in *Scientific American* that described how to improve the sound quality of live performances. David argued that electro-acoustic sound reinforcement equipment be included in the design and construction of theaters and concert halls. He also assisted in the development of sound reproduction devices, such as the artificial larynx. Following his appointment as Director of Research, he supervised 200 scientists who were working in computer science, electronic systems, and communication principles. Among many other innovations, cellular telephony and the computer UNIX operating system emerged from his groups. By the time he left Bell Labs in 1970, he had been granted eight patents pertaining to his research in underwater sound, sound localization, and speech processing.

David's guidance on several advisory councils, and his noted corporate leadership has led to numerous awards and honors, including the Industrial Research Institute Medal in 1983, the Arthur M. Bueche Award from the National Academy of Engineering in 1984, the Delmer S. Fahrney Medal from the Franklin Institute in 1985, and MIT's Silver Stein Award in 1991. He was named an Institute of Radio Engineers (IRE) Fellow in 1962. In addition, David has received 12 honorary degrees from the University of Pennsylvania, Rutgers University, Lehigh University, Carnegie Mellon University, the University of Michigan, Rensselaer Polytechnic Institute, and other institutions. David has also co-authored numerous publications, including *Man's World of Sound, Waves and the Ear, and the Man-Made World*. Eta Kappa Nu named him an Eminent Member in 2001. He is married to Anne Hirshberg, and they have one daughter, Nancy.✦

Digital Signal Processing Pioneer

James L. Flanagan

2001

Eta Kappa Nu Eminent Member

JAMES FLANAGAN'S research provided the basis for many of the low-bit-rate coding algorithms now used in telecommunications and electronic voice mail systems. Flanagan was born on a cotton farm in Greenwood, Mississippi on 26 August 1925. At age seventeen he joined the Air Force. One year later he was called to serve in the U.S. Army where he spent two and a half years. He was later assigned to the Air Force where he trained on airborne communications and radar equipment. Following his discharge, he attended Mississippi State University, where he received his B.S. degree in electrical engineering in 1948. He then entered graduate school at MIT, where he worked in the Acoustics Laboratory. He received his M.S. degree in 1950 and taught for two years at Mississippi State before returning to MIT to begin work on his Ph.D. He received his doctorate in 1955. In 1957, he joined AT&T Bell Laboratories where he worked on efficient utilization of bandwidth for voice communication. In 1961, he was promoted to head the Speech and Auditory Department at Bell Labs. Six years later Flanagan was selected to run the Acoustics Research Department. By 1985, he was Director of the Information Principles Research Laboratory. In 1990, Flanagan left Bell Labs, and he is currently Vice-President for Research and Director of the Center for Advanced Information Processing at Rutgers University.

While with Bell Labs, he studied the bandwidth compression of speech and built spectral analyzers for voice signals. Flanagan helped shape the digital signal processing field by converting analog communications designs to digital through the use of computer

technology and digital simulation. He helped develop the phase vocoder and researched possible future uses for speech imitation and recognition technology, as well as multimodal interfaces for networked computer users. Flanagan has written over one hundred technical publications and holds fifty patents. In addition, he is the author of the research text *Speech Analysis, Synthesis and Perception* which has appeared in two editions and five printings and is recognized as a seminal work on the scientific and technical aspects of speech processing systems.

His professional activities include service as president of the Acoustical Society of America, membership in the National Academy of Engineering, and presidency of the Institute of Electrical and Electronics Engineers (IEEE) Acoustics, Speech and Signal Processing Society. He was named an IEEE Fellow for "contributions to reduced-bandwidth speech communications systems and to the fundamental understanding of human hearing". Flanagan has received numerous honors and awards including the IEEE Centennial Medal in 1984, the IEEE Edison Medal in 1986, the Gold Medal of the Acoustical Society of America, and the National Medal of Science in 1996. Eta Kappa Nu named him an Eminent Member in 2001. Flanagan and his wife, Mildred Bell, have three sons, Stephen, James and Aubrey. He and his wife currently reside in New Jersey.✦

Engineering Educator
and CAD Pioneer

Donald O. Pederson

2001

Eta Kappa Nu Eminent Member

DONALD PEDERSON'S development of SPICE (Simulation Program with Integrated Circuit Emphasis) was an extraordinary achievement in combining software engineering, numerical analysis and modeling of transistors for integrated circuit implementation. Born 30 September 1925 in Hallock, Minnesota, he earned his B.S. degree from North Dakota State University in 1948, and his M.S. and Ph.D. from Stanford University in 1949 and 1951 respectively, all in electrical engineering. Between 1951 and 1953, Pederson worked with Electronics Research Laboratory at Stanford University, and in 1953 he joined Bell Telephone Laboratories. Two years later, Pederson joined the faculty at the University of California, Berkeley. In 1960, Pederson established the first integrated circuit fabrication facility to be built at any university. For three decades, Pederson conducted research and trained numerous graduate students who greatly contributed to development of new integrated circuit technologies.

During the mid-1960s, Pederson and his students used an old Bendix computer to attain a deeper understanding of how certain linear circuit designs functioned. This initial research led to the development of the Computer Analysis of Nonlinear Circuits, Excluding Radiation (CANCER). Laurence Nagel, one of the key CANCER developers, claimed that "The name CANCER was a brash statement that this program would never simulate radiation." Pederson's goal, with the help of a star graduate student, Laurence Nagel, was to develop CANCER into a public domain general-circuit

simulator. The name however, had to be changed due to the negative connotations. This led to the creation of the Simulation Program with Integrated Circuits Emphasis (SPICE). SPICE is a general purpose analog circuit simulation program for nonlinear dc, nonlinear transient, and linear ac analyses. This powerful product is used to check the integrity of circuit designs and to predict circuit behavior. Lawrence Nagel worked with Pederson on the development of SPICE2 before joining AT&T. For more than twenty-five years, SPICE has been the standard means of simulating circuits at the transistor level. Pederson's pioneering work also contributed the formation of integrated circuit CAD companies.

Following his retirement in 1991, he was named Professor Emeritus. In 1995 he was elected a Berkeley Fellow. His pioneering research earned him many awards including the Institute of Electrical and Electronics Engineers (IEEE) Education Medal in 1969, the IEEE Centennial Award in 1984, and the IEEE Medal of Honor in 1998 "For creation of the SPICE Program, universally used for the computer aided design of circuits." He was named a Fellow of the IEEE in 1964 and a Life Fellow in 1991. Pederson is a member of the National Academy of Engineering and the National Academy of Sciences and a Fellow of the American Association for the Advancement of Science and the American Academy of Arts and Sciences. Eta Kappa Nu named him an Eminent Member in 2001.✦

Engineer, Corporate Leader,
and Educator

Roland W. Schmitt

2001

Eta Kappa Nu Eminent Member

ROLAND SCHMITT'S role as a business leader with General Electric (GE) and as President of Rensselaer Polytechnic Institute greatly contributed to industrial R&D and to higher education. Born 24 July 1923 in Seguin, Texas, he earned his B.S. and M.S. degrees from the University of Texas and his Ph.D. in physics from Rice University. In 1951 he joined GE, where he worked in development and research for thirty-seven years. Between 1978 and 1986, Schmitt directed the GE Research and Development Center in Schenectady, New York, one of the world's largest and most diversified industrial laboratories. Schmitt was a member of the National Science Board, the policy-making body of the National Science Foundation, from 1982 until 1994 and was its chairman from 1984 until 1988. In 1988 he retired from GE and became President of Rensselaer Polytechnic Institute. He retired from Rensselaer in 1993 and was named President Emeritus. He then chaired a high-level review group reviewing NATO's Science Program.

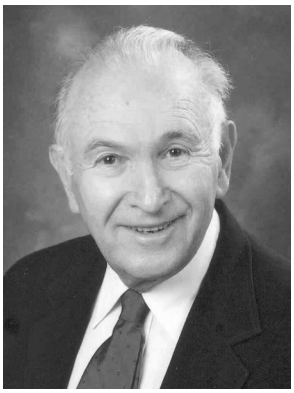
During his tenure as head of GE's Corporate R&D, the center launched many pioneering innovations that were commercialized in GE operating divisions. These included medical imaging, aircraft engines, lighting, and plastics. These product lines and businesses earned profits well above corporate averages. The laboratory exemplified the ability to link forefront science and engineering to profitable commercial goals. While working at Rensselaer Polytechnic Institute, Schmitt completed a successful capital fund campaign and launched several academic initiatives, including a

Center for Innovation in Undergraduate Education and a Center for Entrepreneurship (two areas of significant strength at Rensselaer) and attracted nationally prominent leaders for these initiatives. He also strengthened Rensselaer's traditional links to industry in its research programs. In addition, Schmitt increased Rensselaer's support of entrepreneurial ventures through its Incubator and Technology Park, two highly successful enterprises. Schmitt is also associated with a number of entrepreneurial ventures. He is on the boards of GlobalSpec.com, a B2B business linking design engineers to the catalogs and specifications of design parts vendors; Blasch Precision Ceramics, a high-tech specialty ceramics firm; Logical.Net, an internet and communications firm; and Value Innovations, a technology management software firm. He also serves as an advisor to and investor in Flowerbud.com, a net-based flower firm. He is Founding Director Emeritus of Reveo, a high-tech business development firm, and its subsidiary VRex, a 3-D stereovision products firm.

Schmitt has earned many awards and honors including Institute of Electrical and Electronics Engineers (IEEE) Founders Medal in 1992 "For leadership in addressing competitiveness challenges, and for outstanding contributions to technology transfer," the Hoover Award from a consortium of five major engineering societies in 1993, the Pake Award from the American Physical Society also in 1993, and the Arthur M. Bueche Award of the National Academy of Engineering in 1995. He is a member of the National Academy of Engineering, a foreign member of the Royal Swedish Academy of Engineering Sciences, and a foreign associate of the Engineering Academy of Japan. He is a Fellow of the American Academy of Arts and Sciences, the American Physical Society, IEEE, and the American Association for the Advancement of Science. He also holds eleven honorary doctorates. Eta Kappa Nu named him an Eminent Member in 2001. He is married and has four children.✦

Electrical Engineer and Educator

Mischa Schwartz



2001

Eta Kappa Nu Eminent Member

MISCHA SCHWARTZ is widely recognized for both for his technical contributions to the analysis of communication systems and as an electrical engineering educator. Born 21 September 1926 in New York City, Schwartz received his B.E.E. degree from Cooper Union in 1947, his M.E.E degree from the Polytechnic Institute of Brooklyn in 1949, and his Ph.D. in applied physics from Harvard in 1951. In 1947, he joined Sperry Gyroscope, which funded his doctoral work at Harvard. In 1952, he joined the faculty at the Polytechnic Institute of Brooklyn and served as Department Head between 1952 and 1965. In 1974, he joined Columbia University as a professor of electrical engineering and computer science. He was the Charles Batchelor Professor of Electrical Engineering at Columbia from 1988 to 1996, when he was recognized with Columbia's prestigious Great Teacher Award.

Schwartz's research in radar technology had a profound impact early in his career. In 1954, he published two papers in the *Journal of Applied Physics*, which are considered by many to be classic papers in the field. In 1959, he published the first undergraduate textbook, *Information Transmission, Modulation, and Noise*, to cover modern communication systems from a statistical point of view. Schwartz's book addressed AM, FM, and digital communications from a unified viewpoint, and utilized statistics as well as spectrum analysis. His book, which is now in its fourth edition, has sold over 150,000 copies. In addition to his teaching, research, and consulting, Schwartz has been very active with the Institute of Electrical and Electronics

Engineers (IEEE). He served on the committee which established Communications Society, ComSoc, in the early 1970s, was on the Board of Governors for many years, and was elected Vice President and President of ComSoc 1984-1985. His contributions were noted in the 1984 centennial issue of *IEEE Spectrum*, which listed him among the top ten outstanding electrical engineering educators since 1884. Of his over 50 doctoral students, two have gone on to serve as ComSoc presidents, one has received the U.S. President's Medal of Honor in Technology, at least two are members of the National Academy of Engineering, and several have been elected IEEE Fellows.

Schwartz's contributions to research and teaching have been widely recognized. He received IEEE's Education Medal in 1983, the Edwin Howard Armstrong Achievement Award in 1994 "For outstanding contributions in the field of Communications Technology," and the 1995 Mayor's Award for excellence in technology. Eta Kappa Nu named him an Eminent Member in 2001. He has served on numerous advisory committees and panels of the NBS, the National Science Foundation, and the National Research Council, where his expertise in communications, telecommunications, and computer science has been invaluable.✦

Electrical Engineer
and University President

John Brooks Slaughter

2001

Eta Kappa Nu Eminent Member

JOHN SLAUGHTER'S pioneering work in engineering and education opened the door for thousands of minority students interested in pursuing careers in engineering. Slaughter was born in Topeka, Kansas on 16 March 1934. With the support of his family, he pursued a career in electrical engineering and graduated from Kansas State University in 1956 with a degree in electrical engineering. He then earned his M.S. degree in engineering in 1961 and his Ph.D. in engineering science in 1971, both from the University of California. Between 1956 and 1960 he worked as an electronics engineer for General Dynamics. In 1960, he joined the Naval Electronics Laboratory Center as the Physical Science Administrator for Information Systems for fifteen years. In 1977 he was appointed Assistant Director for the National Science Foundation. Three years later President Ronald Regan named Slaughter the first African American director of the National Science Foundation. In 1982, Slaughter accepted the University of Maryland's offer to serve as Chancellor at College Park. He then became President of Occidental College in Los Angeles in 1988. During Slaughter's celebrated career he also served as the Director of the Applied Physics Laboratory at the University of Washington from 1957 to 1977. In June 1999, he was named President Emeritus of Occidental College. Following his retirement from the academe, he became President and CEO of the National Action Council for Minorities in Engineering (NACME).

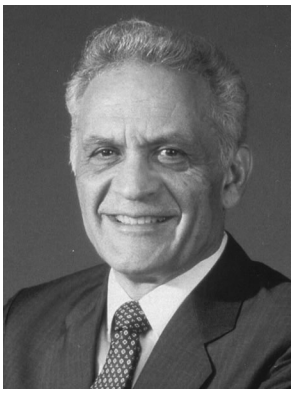
Slaughter is most noted for his devotion to education, public policy

and philanthropy. As President and CEO of the NACME he directed the nation's largest private source of scholarships for minorities in engineering. Since 1980, the Council has provided over 7,000 scholarships to African American, Indian and Latino college students. Slaughter led Occidental College to international prominence for its commitment to excellence and equity and for the sustained high achievement of its students and faculty. Slaughter has also been a vital force in local educational, philanthropic and civic life as a member of the Christopher Commission and the boards of the Music Center, LA Annenberg Metropolitan Project, Town Hall of California, LEARN, and Los Angeles Council on World Affairs. He was co-chair of the California Citizens Commission on Higher Education.

Slaughter's numerous contributions to engineering, education, and equality has led to many awards and honors. He was honored with the first U.S. Black Engineer of the Year award in 1987, the Martin Luther King Jr. National Award in 1997, and the Heritage Award of the Executive Leadership Council in 2001. In addition, he holds honorary degrees from more than 20 institutions. He is a member of the National Academy of Engineering, where he co-chairs its Action Forum on Engineering Workforce Diversity. He is also a member of the American Academy of Arts and Sciences and a Fellow of the Institute of Electrical and Electronics Engineers (IEEE). Slaughter was inducted into the American Society of Engineering Education's Hall of Fame in 1993. Eta Kappa Nu named him an Eminent Member in 2001. He has been married for more than 40 years to Dr. Ida Bernice Slaughter. They have two children.✦

Engineer, Professor,
and Corporate Founder

Amar G. Bose



2002

Eta Kappa Nu Eminent Member

AMAR G. BOSE'S research in audio technology transformed stereo system performance. The son of a political dissident who emigrated from Calcutta, India, Bose was born in Philadelphia, Pennsylvania on 2 November 1929. He became interested in technology early. At age thirteen he began repairing model trains to supplement his family's income. He entered MIT, graduating with a B.S. degree in 1952 and a Ph.D. in 1956, both in electrical engineering. In 1956, he joined the faculty at MIT as a professor of electrical engineering and began to research physical acoustics and psychoacoustics (the study of human perception of sound). His research was in part inspired by his purchase of a stereo, which measured well but sounded poorly. In 1964 Bose's early patents in electronics, communication theory and acoustics allowed him to found the Bose Corporation in Framingham, Massachusetts, twenty miles west of Boston atop a 150-foot-high hill called "The Mountain." For the past four decades, the Bose Company has been one of the most successful producers of electronic equipment, remaining one of the few US electronic companies in a market dominated by Japanese firms.

While teaching at MIT, Bose conducted research in both physical and psycho acoustics, exploring the nature and perception of sound in reverberant rooms. His discovery led to new loudspeaker designs. In 1968, Bose Corporation entered the consumer market with the 901 Direct/Reflecting loudspeaker systems. This technology instantly achieved market success and critical acclaim, paving the way for a regular stream of innovations that have received widespread

consumer acceptance. The 901 System was an industry standard for twenty-five years, producing life-like audio reproduction. Bose Corporation's research also led to the development of the Auditioner Audio Demonstrator. This device takes the specifications of a particular space and demonstrates how the speaker system will sound in that space. Acoustics research helped Bose conquer the automotive sound market. In the 1980s and 1990s, Bose's research introduced the concept of waveguide technology in sound reproduction. This led to the high performance Acoustic Wave and Wave Radio systems, which have received worldwide acclaim. Bose Corporation currently designs and manufactures some of the most sophisticated and highly regarded audio products in the world.

Today Bose is Professor Emeritus at MIT. He has earned more than two-dozen patents, and he still works full time, directing a more than $1.5 billion company, whose products can be found in Olympics stadiums, Broadway theatres, the Sistine Chapel, and the Space Shuttle. A Fellow of IEEE, he has won several prestigious awards, including the "Global Leadership Award" by the Alliance for the Commonwealth in March 2000 and "Best Practices for American Retail Excellence," given by NRF and American Express in February 2000. In addition he was elected to the American Academy of Arts and Sciences in 1991 and inducted to the Radio Hall of Fame in 2000. Eta Kappa Nu named him an Eminent Member in 2002. Bose is married and has two children.✦

Research Engineer
and Corporate Executive

J. Fred Bucy Jr.

2002

Eta Kappa Nu Eminent Member

DURING FRED BUCY'S thirty-two year career with Texas Instruments (TI) he led the development of semiconductor electronics and early development of solid-state systems for oil exploration. Bucy was born in Tahoka, Texas on 29 July 1928. He attended Texas Tech, where he earned his B.S. degree in physics in 1951. He then earned his M.S. degree in physics from the University of Texas in 1953. Upon graduation, he began his career with Texas Instruments. Bucy joined TI as a research engineer in 1953, and became head of the seismic instrumentation development within three years. He was appointed general manager of industrial products in 1961. Two years later, as manager of the apparatus division, he was elected Vice President, and in 1967, Bucy became Group Vice President in charge of the components group. Five years after that he was named Executive Vice President, and in 1974 he was elected a director of TI. In February 1976, Bucy was designated CEO, and he held this position until his retirement in 1985.

His early contributions to research and development included the development of a hybrid analog-digital computer, Seis MAC, which Bucy and his colleagues designed in 1955. Under his leadership as CEO, Texas Instruments introduced the first single-chip speech synthesizer, incorporated in the phenomenally successful "Speak and Spell" toy. To pronounce a word, the device retrieved phonetic information from memory and synthesized the speech sounds. Bucy also presided over the first single-chip digital signal processor in 1982, and the first multiport video random-access memory chip in

1984. By 1980 Texas Instruments' net revenues topped four billion dollars. During Texas Instruments' difficult years grappling with the introduction of computer technology, Bucy was behind the decision to pull out of the computer market, a decision that proved wise.

Among other activities, Bucy is Trustee of Southwest Research Institute and Chairman of the Texas National Research Laboratory Commission, and he was also a member of the Coordinating Board Advisory Committee on Research of the Texas College and University System. Between 1973 and 1991, he served as a member of the Board of Regents of Texas Tech University and Texas Tech University Health Sciences Center. Bucy has earned Distinguished Alumnus and Distinguished Engineer Awards from Texas Tech University, is an IEEE Fellow, a member of National Academy of Engineers, and a life member of the Navy League. Bucy was awarded an Honorary Doctor of Science from Texas Tech University in 1994. Eta Kappa Nu named him an Eminent Member in 2002. Bucy's wife, Odetta Greer, whom he met during childhood, passed away in 2000. He has one son and two daughters, and he currently resides in Dallas, Texas.✦

Electrical Engineer and Educator

Richard J. Gowen

2002

Eta Kappa Nu Eminent Member

RICHARD GOWEN'S leadership as president of the South Dakota School of Mines and Technology was instrumental in the development and implementation of Internet technologies. Gowen was born in New Brunswick, New Jersey on 6 July 1935. He attended Rutgers University, where he began a military career in the ROTC program while earning his B.S. degree in electrical engineering in 1957. Following graduation, he served as an officer in the United States Air Force from 1957 to 1977. He earned an M.S. degree and Ph.D. in electrical engineering from Iowa State University in 1960 and 1962 respectively. He then joined the Air Force and served as a permanent faculty member of the U.S. Air Force Academy. He also served as Director of the Joint NASA—Air Force Space Medical Instrumentation Project, and as a member of the NASA Astronaut Medical Research Launch and Recovery Team. In 1977, he retired from the Air Force and became Vice-President of South Dakota School of Mines and Technology, known as South Dakota Tech, a position he held until 1984. He then became president of Dakota State University in Madison, South Dakota. Three years later, he returned to South Dakota Tech as President, serving until his retirement in June 2003.

During his tenure with South Dakota Tech, Gowen was instrumental in the wide application of Internet technologies. His vision and technical expertise have been a valued asset to other leaders in the state as South Dakota has led the challenge of providing Internet access to every K-12 school through the state's Wiring the Schools

program. Gowen also led South Dakota Tech through its first-ever capital campaign, resulting in major building and renovation efforts, as well as the implementation of computer technologies. He positioned the university as a technology leader in the state and region. Under his leadership, Tech has received national academic recognition. Gowen has demonstrated his commitment to future generations of science and technology leaders through the establishment of a number of outreach programs including the Scientific Knowledge for Indian Learning and Leadership (SKILL), math and science programs aided by on-campus childcare, and science camps for the children of students, faculty, staff, alumni and other community members. He was instrumental in establishing the Children's Science Center that provides hands-on learning in math, science, and technology for children of all ages.

Gowen's professional service and extensive contributions to engineering education have earned him several awards and honors including the Outstanding Engineering Award from Rutgers University in 1977, Institute of Electrical and Electronics Engineers (IEEE) Fellow Award "For contributions to aerospace biomedical engineering technology and to education" in 1982, and IEEE's Centennial Medal in 1984. He served as national President of Eta Kappa Nu and was named an Eminent Member in 2002. Long active in IEEE, he was President of the IEEE Engineering in Medicine and Biology Society and served as Cochairman of the National Academy of Engineering's National Engineering Leadership forum. He served on the board of IEEE and was the organization's Centennial President in 1984. Gowen resides in South Dakota with his wife, Nancy.✦

Systems Engineer
and Corporate Executive

Eberhardt Rechtin

2002

Eta Kappa Nu Eminent Member

EBERHARDT RECHTIN'S work in telecommunications theory, application and policy and his leadership and vision as President and CEO of Aerospace Corporation during the 1980s moved Aerospace into the satellite mission business and greatly improved the company's reputation. The son of German parents, he was born 16 January 1926 in Orange, New Jersey. In 1941, he and his parents relocated to California. Rechtin had already been accepted to California Technical College when World War II began. At age seventeen he volunteered as part of the Naval V12 program, and through a Navy sponsored accelerated degree program he completed his electrical engineering degree in less than three years. Using the GI Bill, Rechtin earned his Ph.D. in electrical engineering from Cal Tech in 1950. Heavily influenced by his work with Professor William H. Pickering, Rechtin worked on ballistic missile and communications technology at the Jet Propulsion Laboratory (JPL) and developed an integrated, coded phase-lock system in 1957 and 1958. In 1958, he became the Chief Architect and Director of the NASA Deep Space Network, and in 1960 Rechtin was named Assistant Director of JPL. In 1967, he became Director of the Advanced Research Projects Agency (ARPA) and significantly changed its funding patterns while redefining its operations and defending its existence during the Vietnam War. After becoming Assistant Secretary of Defense for Telecommunications, Rechtin brought his communications and systems experience to Hewlett-Packard in 1973 and helped manage their development of "smart systems." In 1977, he became president and CEO of the Aerospace Corporation, where he worked to move

Aerospace into the satellite mission business. As President and CEO, Rechtin identified himself as Aerospace's chief architect and strategist. Through his applications of systems architecting, he shaped Aerospace's research and funding operations. Finally, in 1987 Rechtin became a professor of electrical engineering at the University of Southern California. He retired from that position in1995.

Rechtin's contributions exceeded research and education. His membership on NATO's Advisory Group on Aeronautical Research and Development aided the organization's entry into space applications. He subsequently represented the U.S. Department of Defense on NATO committees on research and telecommunications. Between 1967 and 1973, his work in the Department of Defense centered on policy formulation and implementation in defense research, engineering, and telecommunications. His seminal book *Systems Architecting: Creating and Building Complex Systems* is now in its second edition and was co-authored by aerospace engineer Mark Maier. This research examines new domains, including personal computers, inter-satellite networks, health services, and joint service command and control. His recent book, *System Architecting of Organizations: Why Eagles Can't Swim,* assists professionals in obtaining new perspectives when reviewing their own organizations. While teaching at Caltech, he established a graduate program in Systems Architecture. Rechtin has received numerous awards and honors including the Institute of Electrical and Electronics Engineers (IEEE) Alexander Graham Bell Award in 1977, Caltech's Distinguished Alumni Award in 1984, and the International Council on Systems Engineering Pioneer Award in 1999. He was named an Institute of Radio Engineers (IRE) Fellow in 1962 "For contributions to communication theory and space communication." Eta Kappa Nu named Rechtin an Eminent Member in 2002. He is an avid string quartetist and guitarist, and enjoys writing semi-analytical articles on the management scene. Rechtin is married to Dorothy Diane Denebrink, and they have four daughters and a son.✦

Systems Engineer,
Author, and Educator

Andrew P. Sage

2002

Eta Kappa Nu Eminent Member

ANDREW SAGE'S publications have greatly contributed to the scientific understanding of systems engineering, controls, cybernetics, and information technology. Born on 27 August 1933 in Charleston, South Carolina, Sage received his B.S. degree in electrical engineering from the Citadel in 1955. He earned his M.S. degree from MIT in 1956 and his Ph.D. from Purdue in 1960, both in electrical engineering. He then joined the faculty at the University of Arizona as an associate professor of electrical engineering. Sage then joined the Dean of Engineering, Thomas L. Martin Jr., when he left Arizona in 1964 for the University of Florida. His research at the University of Florida involved nuclear rocket engines and aerospace guidance application of optimal control theory. In 1968, he completed his first textbook, *Optimal Systems Control*, which served graduate students in this area for twenty-five years. In 1967, he was appointed Director of the Information and Control Sciences Center and, later, Chair of the Electrical Engineering Department at Southern Methodist University. In 1974, Sage joined the faculty at the University of Virginia as the Lawrence R. Quarles Professor of Engineering Science and Systems Engineering. During his tenure he served as Associate Dean for Graduate Studies and Research, Chair of the Chemical Engineering Department, and the first Chair of the Systems Engineering Department. In 1984, Sage became the First America Bank Professor of Information Technology and Engineering at George Mason University and the first Dean of the Schools of Information Technology and Engineering. In May 1996, Sage was elected Founding Dean Emeritus of the School and was also

appointed a University Professor. Sage also became editor of the Institute of Electrical and Electronics Engineers (IEEE) *Transactions on Systems, Man, and Cybernetics* in January 1972. He held this position until December 1998.

During his tenure at SMU Sage made important research contributions in various areas including simulation and modeling of large-scale systems, application of control communications, and systems engineering approaches to other than physical systems. It was at this time that Sage's interest in the information and knowledge aspects of systems began. While with the University of Virginia, he authored three texts, *Methodology of Large Scale Systems*, *Economic Systems Analysis*, and an undergraduate textbook, *Linear Systems Control*. Following his move to GMU, he did research in systems engineering and management, and in information technology. In 1990, Sage's edited volume, *Concise Encyclopedia of Information Processing in Systems and Organization,* was published in a series edited by Madan Singh, a close professional colleague. During this time he also researched engineering and management principles for the design of productive software. This resulted in a textbook, *Software Systems Engineering* that Sage co-authored with Jim Palmer. He has also written several other more recent texts: *Decision Support Systems Engineering* (1991), *Systems Engineering* (1992), *Systems Management for Information Technology and Software Engineering*, (1995), and *An Introduction to Systems Engineering* (2001, coauthored with James E. Armstrong), and has co-edited the comprehensive *Handbook of Systems Engineering and Management* with William B. Rouse in 1999.

Today Sage continues his writing and research and has also expanded his interests to include sustainable development and the application of complexity theory and complex adaptive systems to issues in systems and engineering management. Sage's work has resulted in numerous awards including the Frederick Terman Award from the American Society for Engineering Education in 1970, a Superior Public Service Award from the US Secretary of the Navy in 1994, and the Simon Ramo Medal from IEEE in 2000. In 2002 Eta Kappa Nu named him an Eminent Member. Sage also received honorary Doctor of Engineering degrees from the University of Waterloo in 1987 and

from Dalhousie University in 1997. In 2004, he was elected a member of the National Academy of Engineering. He is a Fellow of the IEEE, the AAAS, and the International Council on Systems Engineering. He and his wife LaVerne have three children, Theresa, Karen and Philip, and two grandchildren, Nathan and Evan.✦

Communications Visionary
and Educator

Irwin M. Jacobs

2003

Eta Kappa Nu Eminent Member

IRWIN JACOBS' leadership led to the founding of two major technology corporations, Linkabit and Qualcomm. Born 18 October 1933 in New Bedford, Massachusetts, he earned his B.S. degree in electrical engineering from Cornell University in 1956, and his M.S. and Ph.D. in electrical engineering from MIT in 1957 and 1959 respectively. Following completion of his doctorate, he accepted a position as an assistant professor of electrical engineering at MIT. While at MIT Jacobs co-authored *Principles of Communication Engineering,* which helped him develop a vision of worldwide communication made possible by digital wireless communications. In 1966, he became Professor of Computer Science and Engineering at the University of California, San Diego. In 1969, he cofounded Linkabit. It became a wellspring for the telecommunications industry in San Diego. Jacobs served as Chairman, President and CEO. Under his guidance the company grew to over 1,700 employees by 1985. In 1980, Linkabit merged with M/A-COM and Jacobs remained on its board of directors. In 1985 he resigned from M/A-COM and became founder, Chairman and CEO of Qualcomm, Inc., which engaged in mobile satellite communications and digital wireless telephony. Today Jacobs maintains his position as its Chairman and CEO.

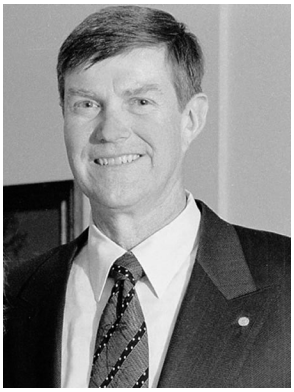
In 1973, Jacobs' innovative leadership at Linkabit led to the company's development of the first microprocessor-based, spread spectrum, satellite communication modem for military anti-jam airborne applications. Between 1980 and 1982, Jacobs guided the development and manufacture of the first Ku-band V SAT terminal.

His team at Qualcomm developed the first successful video descrambling system, the Videocypher, to descramble premium programming television transmission in C-band dishes. Under Jacobs' leadership, Qualcomm also researched mobile satellite communications, which led to one of the world's most technologically advanced two-way mobile satellite system communications and tracking systems. The system's Code Division Multiple Access (CDMA) has been adopted as one of the two digital standards for the next generation of cellular telephones in North America. CDMA has become the technology of choice for third generation wireless communications services.

Jacobs' corporate leadership revolutionized wireless communication and helped produce one of the world's most respected Fortune 500 Companies. Fortune magazine in 2003 named Qualcomm one of the best companies to work for in the United States. Jacobs has been the recipient of many awards and honors, including the Entrepreneur of the Year Award from the Institute of American Entrepreneurs in 1992, the National Medal of Technology for extraordinary achievements in the commercialization of technology, and the Institute of Electrical and Electronics Engineers (IEEE) Alexander Graham Bell Medal, for outstanding contributions to telecommunication, in 1995. Jacobs is a Fellow of IEEE. Eta Kappa Nu named him an Eminent Member in 2003. He holds seven patents in digital communication and shares in 31 others through Qualcomm. He currently resides with his wife, Joan, in California. They have fours sons. Jacobs' philanthropy, particularly in support of education, is well known. The Engineering school at UCSD is named in his and Mrs. Jacobs' honor.✦

Electrical Engineer
and Entrepreneur

Donald R. Scifres



2003

Eta Kappa Nu Eminent Member

DONALD SCIFRES'S research greatly contributed to the development of the distributed feedback semiconductor injection laser, which is used for long-distance high-speed optical fiber communications. Born in Lafayette, Indiana, he earned his B.S. degree with "highest distinction" from Purdue in 1968, and his M.S. degree and Ph.D. in electrical engineering from the University of Illinois in 1970 and 1972, respectively. Following completion of his doctorate he joined the Xerox Palo Alto Research Center to set up a new laboratory for the study of semiconductor lasers and light emitting diodes. He was named a Xerox Research Fellow in 1981. In 1983, he left Xerox and founded Spectra Diode Laboratories Inc. (SDL). He was CEO and Chairman until the company's merger with JDS Uniphase Corporation in 2000. At the time, SDL's market cap was 41 billion dollars, making the merger the largest technology deal ever. Scifres was named Co-chairman of the Board of JDS Uniphase Corporation and Chief Strategy Officer. He retired in 2003 and is currently Managing Director of SDL Ventures, LLC, an investment company based in Menlo Park, California.

Scifres began his pioneering work at Xerox where he and his coworkers patented the distributed feedback semiconductor injection laser. This technology became a light source for high-speed, long distance optical fiber communications essential for carrying Internet signals around the world. Scifres and his colleagues' founding of SDL led to widely known advances in semiconductor and electro-optic technology. SDL became the first company to commercialize

the integration of multiple lasers on a single semiconductor device. This technology is widely used in industrial, medical and military markets. These innovations opened the door for future commercial possibilities for semiconductor laser technology.

Scifres is an active Fellow of the Institute of Electrical and Electronics Engineers (IEEE), and has been president, board member and technical committee chair of the IEEE Lasers and Electro-Optics Society. In addition, he has served as Director of the Optical Society of America and as President and Director of the Lasers and Electro Optics Manufacturers Association. Scifres has earned several awards and honors including the IEEE Jack A. Morton Medal, the IEEE Third Millennium Medal and the IEEE LEOS Award for Engineering Achievement. He is a member of the International Society for Photonics and Optical Engineering, the American Physical Society and the National Academy of Engineering, and he is a Fellow of the OSA. Scifres holds 133 patents and has authored 304 technical articles. In 2001 he and his wife, Carol, donated ten million dollars to Purdue's Birck Nanotechnology Center, scheduled for completion in July 2004.✦

Engineer, Educator,
and Corporate Executive

Jerome Suran

2003

Eta Kappa Nu Eminent Member

JEROME SURAN'S research at General Electric helped pioneer the development of transistor and integrated circuit technology including the implantable cardiac pacemaker. Born 11 January 1926 in New York, NY, he received his B.S. degree in electrical engineering in 1949 and pursued graduate work at Columbia and the Illinois Institute of Technology. In 1951, he joined Motorola, working in the Communications and Electronics Division in Chicago, Illinois. One year later he began a 30-year career with General Electric. Suran held several positions including Project Engineer, Manager of Advanced Circuits, Manager of the Applications and Devices Laboratory, and Manager of the Electronics Laboratory in Syracuse, NY. In 1979, he was promoted to Staff Executive, Technical Systems and Material Sector of GE in Fairfield, Connecticut. This was an eight billion dollar high technology business, which included medical systems, aerospace, aircraft engines, communications, information, and engineered materials. Suran was also responsible for integrating technology trends and market requirements into a strategic business plan. In 1982, he left GE and accepted a position with the University of California at Davis (UCD). He held joint appointments in the College of Engineering and the Graduate School of Management. Suran is Senior Lecturer Emeritus at UCD.

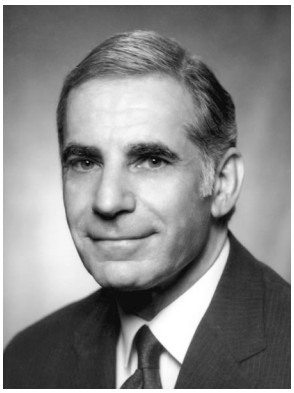
Suran's early research with Motorola led to the first internal Motorola report on the use of transistors in radio applications. Suran was a contributor to an early influential text, which dealt with practical applications of the transistor. He made one of his most widely known

contributions while working with GE. Between 1958 and 1961, he led the team that developed the GE Implantable Cardiac Pacemaker. Although Medtronics and Pemco were the first companies to bring the pacemaker to market, beating GE by a few months, GE's pacemaker was the first to be frequency controllable from an outside source. Suran's work as a leader and researcher for GE greatly contributed to the knowledge he shared with his students at UCD. As a professor, he established and taught the first management policy and strategy course in the Graduate School of Management and collaborated in creating new courses in technology management, innovation management, and computers and information systems in business applications. In the College of Engineering he developed and taught courses in microelectronic analog and digital systems.

Suran's generosity has also augmented the development of UCD's Graduate School of Management. In 1999, Suran and his wife, Elsie, endowed the School's first faculty chair by contributing over $500,000, which enabled the school to recruit and retain top experts in the field of technology management. His leadership and valuable research have led to several awards and honors including the Magnar Ronning Award for teaching excellence in electrical engineering in 1986, the Teacher of the Year Award from the Graduate School of Management in 1990, and the Excellence in Teaching award from the UCD University Extension in 1993. Suran received an honorary doctorate from Syracuse University in 1976 for his research in transistor and integrated circuit technology and for his development of the implantable pacemaker. In 2003 the Surans endowed an undergraduate scholarship fund in the College of Engineering at Syracuse University. Suran has co-authored two books on transistor circuits, has written more than 50 papers in professional journals, and holds 19 patents. He is a Fellow of the American Association for the Advancement of Science and served as President of the Institute of Electrical and Electronics Engineers (IEEE) in 1979. He is a veteran of World War II, having served in combat with the U.S. Infantry in the European Theater of Operations. Eta Kappa Nu named him an Eminent Member in 2003. He currently resides in El Macero California. His wife, Elsie, passed away on 25 September 2003.✦

Electrical Engineer
and Corporate Executive

Henry Lee Bachman



Eta Kappa Nu Eminent Member-Elect

HENRY L. BACHMAN'S technical and management skills helped make Wheeler Laboratories, Hazeltine Corporation, and BAE Systems CNIR strong factors in the electronics and aerospace industries. Bachman was born 29 April 1930, in Brooklyn, New York. He earned his B.E.E. from the Brooklyn Polytechnic Institute (now Polytechnic University) in 1951, and his M.S.E.E. in 1954. He completed Harvard University's Advanced Management Program in 1972. Bachman began his engineering career as a development engineer at Wheeler Laboratories and rose successively through technical and managerial positions to Assistant Chief Engineer and Vice President. In 1968 he became President. When Wheeler Laboratories merged with Hazeltine in 1970, he became Vice President of the merged organization, a position he retained when Hazeltine was acquired by BAE Systems. During his tenure with Hazeltine and BAE Systems his responsibilities included engineering, logistics engineering, manufacturing, quality control, business development, and customer service. He retired in 1995, but continues as a consultant to BAE Systems. He is also a consultant to the Center for Advanced Technology for Sensor Systems at the State University of New York, Stony Brook, and a member of the Electrical Engineering Industrial Advisory Committee at SUNY, Stony Brook, as well as a member of the Electrical Technologies Industrial Advisory Committee of Farmingdale State University.

Bachman is active in community service. He is an Advisory Trustee of Polytechnic University. He is a member of the board of directors

of the Long Island Forum for Technology and served as chairman in 1985-86. He was president of the Long Island Museum of Science and Technology in 1994-96. He was a member of the board of directors of the Huntington Arts Council in 1994-96. Bachman has received many honors and awards, including the Institute of Electrical and Electronics Engineers (IEEE) Centennial Medal, its Third Millennium Medal, and its Haraden Pratt Award. In 1985, he was recipient of the Engineering Manager of the Year Award from IEEE's Engineering Management Society. He was elected a Fellow of the IEEE for "leadership in the effective design and economical manufacture of electronic products for government and industry." He served as president of IEEE in 1987, and as president of the IEEE Foundation from 1994-99. He is also a Fellow of the American Association for the Advancement of Science.

Bachman married Doris Engelhardt in 1951. They have a son, Steven, and two daughters, Dianne and Lorraine.✦

Computer Engineer, Educator,
and Entrepreneur

Chester Gordon Bell

Eta Kappa Nu Eminent Member-Elect

C. GORDON BELL is equally well known for his prowess in computer design and his entrepreneurial skills. Bell was born 19 August 1934, in Kirksville, Missouri. He earned his BSEE and MSEE from the Massachusetts Institute of Technology (1956, 1957), and was subsequently a Fulbright Scholar (1957-58). Worcester Polytechnic Institute awarded him an honorary Doctorate of Engineering in 1993. He got an early exposure to technology when, in high school, he worked in his father's electric appliance and contracting business and became an electrician. At MIT, he was an engineering co-op student with General Electric and American Electric Power. Returning from the Fulbright he joined MIT's Speech Research Laboratory, and wrote the first speech analysis-by-synthesis program. In 1960, joining the Digital Equipment Corporation, he directed the development of the first minicomputer (PDP-5) and served as architect, designer, and project leader for the PDP-6, the first commercial time-shared computer. In 1966 he became a professor of electrical and computer engineering at Carnegie Mellon University. He wrote *Computer Structures,* with Allen Newell, that posited notations for describing and analyzing computers. Returning to DEC in 1972 as vice president of research and development, he led the development of VAX computer architecture that was introduced in 1978.

In 1983, Bell founded Encore Computer Corporation, and developed architectures for one of the first multiple microprocessor computers -- architectures that were subsequently adopted by all computer manufacturers. He served as the founding Assistant Director in the

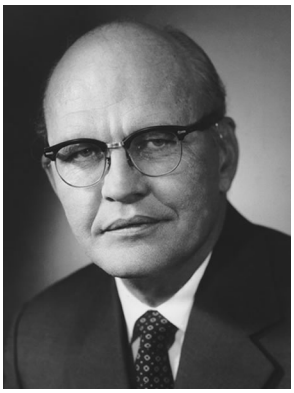
National Science Foundation Directorate for Computer Information Science and Engineering. He also led the cross-agency group that proposed the National Research and Education Network that became Internet. He was a founder of Stardent Computer in 1987, where the first graphics supercomputer was developed. He is a senior researcher at Microsoft's Bay Area Research Center and an advisor to and investor in high tech startups. He is also co-inventor of the Bell-Mason Diagnostics model for understanding high tech ventures, and a director of the Bell-Mason Group. His book *High Tech Ventures* (1991) describes the basis for successful startups.

Bell is a member of the National Academy of Engineering, the American Academy of Arts and Sciences, and a Fellow of the IEEE. In 1991 he received the National Medal of Technology. He has been awarded the ACM-IEEE Eckert-Mauchley Award, the IEEE's Computer Pioneer and McDowell Awards, and the IEEE Von Neumann Medal. He was a founder of the Computer Museum, Boston, that was to become the Computer History Museum, Moffett Field, Calif. Bell was elected to Eta Kappa Nu as an undergraduate at MIT in 1955, and received the society's major award, the Vladimir Karapetoff Award, in 2001 for his research and development in the computer industry.

He married Gwendolyn Kay Druyor in 1959. They had a son, Brigham Roy, and a daughter, Laura Louise.✦

Electrical Engineer, Inventor,
and Nobel Laureate

Jack St. Clair Kilby



Eta Kappa Nu Eminent Member-Elect

JACK KILBY will go down in history for his role in the invention of the semiconductor integrated circuit, for which he received the Nobel Prize in Physics in 2000. Kilby was born in Jefferson City, Missouri, 8 November 1923. Kilby earned the BSEE from the University of Illinois in 1947 and the MSEE from the University of Wisconsin in 1950. From 1947 to 1958 he worked on the design and development of ceramic-base silk-screen circuits at Centralab, where he was principal developer of the company's first transistorized hearing aid amplifiers. When he joined Texas Instruments in the summer of 1958, he quickly concluded that passive components could be made from the same semiconductor material as were the active devices. By September he had constructed a working integrated circuit and demonstrated it to TI executives. This first device was a phase shift oscillator. The next, demonstrated to the Institute of Radio Engineers in 1959, was a flip-flop. By 1961 TI had announced its Series 51 logic family, and delivered a computer using silicon ICs to the Air Force. Kilby is the co-inventor of the electronic hand-held calculator that helped to commercialize the integrated circuit. He holds more than 60 U.S. patents. In 1962 he became manager of semiconductor networks for TI. In cooperation with Autonetics he designed the first military system using ICs, the Improved Minuteman. Integrated circuits became the impetus for the unprecedented complexity and performance of military, industrial, and consumer systems, and the means by which the Internet and today's computer systems were made possible. Among the positions Kilby held at TI were Deputy Director of the Semiconductor R&D Laboratory, Assistant Vice

President, and Director of Engineering and Technology for the Components Group.

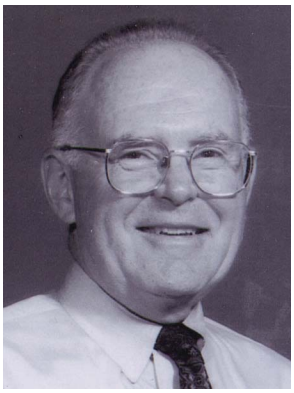
From 1978 to 1984, Kilby served as Distinguished Professor of Electrical Engineering at Texas A&M University. He was awarded honorary doctorates from the University of Illinois, the University of Wisconsin, Texas A&M, Southern Methodist University, the University of Miami, the Rochester Institute of Technology, and Rensselaer Polytechnic. In 1966, he was elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for "contributions to the field of integrated circuits through basic concepts, inventions, and development," and is a recipient of the IEEE Medal of Honor. Among his numerous other recognitions are the David Sarnoff and Cledo Brunetti Awards of the IEEE, the Holley Medal of ASME, the Stuart Ballantine Medal of the Franklin Institute, and the Zworykin Award of the National Academy of Engineering. In 1969 he received the National Medal of Science and in 1990, the National Medal of Technology. He was inducted into the National Inventors Hall of Fame in 1982, and the Engineering and Science Hall of Fame in 1988. He is a member of the National Academy of Engineering. In 1984 he received the IEEE Centennial Medal and in 1993 he was awarded the Kyoto Prize in Advanced Technology. He was named the recipient of the 1999 Vladimir Karapetoff Award, Eta Kappa Nu's most prestigious award for career contributions, for his invention of the semiconductor integrated circuit. A year later he was awarded the Nobel Prize.

The Kilby Award Foundation was founded in 1990 in Kilby's honor. By 2003, the foundation had recognized fifty Kilby Laureates for their contributions to science, technology, innovation, invention, and education. In 1997 Texas Instruments unveiled a new $150 million research and development building, naming it the Kilby Center in his honor. At the ceremony, TI's president and CEO said "Jack did more than invent the integrated circuit . . . he invented the future."

Kilby married Barbara Annegers in 1948. They had two daughters, Ann and Janet Lee.ö

Semiconductor Pioneer
and Corporate Executive

Gordon E. Moore



Eta Kappa Nu Eminent Member-Elect

GORDON MOORE is one of the very few entrepreneurs who have co-founded two major semiconductor companies, in his case, Fairchild Semiconductor and Intel. Moore was born in San Francisco 3 January 1927. He earned a B.S. in chemistry from the University of California at Berkeley in 1950, and his Ph.D. in chemistry and physics from the California Institute of Technology in 1954. He then joined the technical staff of Johns Hopkins University, where he conducted research on the structure of flames. This seemed too esoteric to him, so in 1956 he accepted an offer from William Shockley, co-inventor of the transistor, to join his staff at Shockley Semiconductor Laboratories (later Shockley Transistor Labs). In 1957, Moore and six others left Shockley to form Fairchild Semiconductor Corp. Moore became head of R&D and assumed the challenge of learning how to make commercial integrated circuits. In 1961 Fairchild sold its first logic circuits to NASA. In 1965 Moore made the prediction that device density would double every year. It became known as Moore's Law and has been proven accurate in principle over the years, with some extension of the time period in more recent years. In 1968, Moore left Fairchild along with Robert Noyce to form NM Electronics, soon to be renamed Intel. Intel became an early leader in MOS memories and microprocessors, leading inevitably to today's well-known slogan, "Intel Inside." Among the developments during Moore's early years at Intel were the standard cell and gate-array approaches to complex circuits. At Intel he served initially as executive vice president. He became president and chief operations officer in 1975, a post he held until 1979, when he was elected

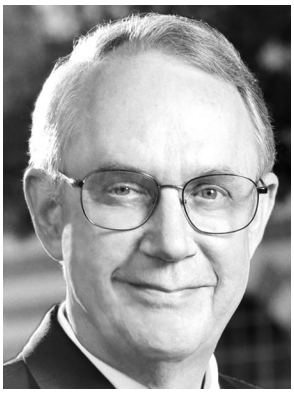
chairman and chief executive officer. He remained CEO until 1987, and was named chairman emeritus in 1997.

Moore is a director of Gilead Sciences Inc. and serves on the board of trustees of the California Institute of Technology. His success has been recognized through many awards, including the McDowell Award of the Computer Society, 1978; the Frederik Philips Award, 1979; the IEEE Computer Pioneer Medal, 1984; and the John Fritz Medal, 1993. He was elected to the National Academy of Engineering in 1976, and was given its Foundation Award in 1988. In 1978, the American Federation of Information Processing Societies gave him the Harry Goode Memorial Award, and in 1985 he received the Medal for the Advancement of Research from the American Society of Metals. In 1990 he was presented the National Medal of Technology. He was named a Fellow of the Institute of Electrical and Electronics Engineers "for contributions and leadership in research, development, and production of silicon transistor and monolithic integrated circuits."

He married Betty Whittaker in 1950. They have two sons, Kenneth and Steven. The Gordon and Betty Moore Foundation supports research in science and health, the environment, and higher education.✦

Engineer, Educator,
and Community Leader

Steven Browning Sample



Eta Kappa Nu Eminent Member-Elect

STEVEN SAMPLE'S catholic interests have left their mark not only in academia, but on the broader community as well. Sample was born 29 November 1940 in St. Louis. He earned his B.S., M.S., and Ph.D. degrees in electrical engineering from the University of Illinois in 1962, 1963, and 1965, respectively. He was a senior scientist for Melpar from 1965 to 1966, then became an associate professor of electrical engineering at Purdue University. In 1974 he became Dean of the Graduate College and professor of electrical engineering at the University of Nebraska. Undertaking industry-sponsored research while at Purdue, he was issued patents for digital controls for commercial appliances. Successive steps up the administrative ladder of academia brought him to the presidency of the State University of New York at Buffalo, where he strengthened the school's role as an important research university, signified by its election to the Association of American Universities. In 1991, he became the 10th president of the University of Southern California, helped raise its standing in the national rankings, and instituted a building and fund-raising program that resulted in the $112.5 million Mann Institute for Biomedical Engineering and the $110 million Keck School of Medicine at USC.

Sample has served on the boards of directors of many organizations, including the Calspan-UB Research Center, Niagara Mohawk Power Corp., Dunlop Tire Corp., and 1st Interstate Bancorp. His concern for community outreach is reflected in his membership on the boards of the Los Angeles chapter of the World Affairs Council, the Rebuild

Los Angeles Committee, and the United Way of Buffalo and Erie County. He refused to move the University of Southern California out of the depressed area of Los Angeles, instead establishing community outreach programs that involved half of USC's 15,000 undergraduates and earned it *Time* magazine's "College of the Year" accolade in 2000. A patron of the arts, he was a timpanist with the St. Louis Philharmonic Orchestra from 1955 to 1958; a trustee of the Studio Arena Theatre, Buffalo, 1983-91; a trustee of the Western New York Public Broadcasting Association, 1988-91; and a member of the board of the Buffalo Philharmonic Orchestra, 1982-91. Sample also is chairman of the Pacific-10 Conference and a member of the Knight Commission on Intercollegiate Athletics. He lectures USC coaches and players to follow NCAA rules, graduate, operate within budget, and win conference and national titles, in that order.

Sample has been awarded many honors, among them the 1985 Engineer of the Year designation by the New York State Society of Professional Engineers, the Distinguished Alumnus Award of the University of Illinois (1980), and the Humanitarian Award of the National Conference of Christians and Jews (1994). He is a member of the National Academy of Engineering, the American Academy of Arts and Sciences, and the Institute of Electrical and Electronics Engineers. He was a co-founder and chairman of the Association of Pacific Rim Universities (1997-2002), and serves on numerous committees of the National Association of State Universities and Land-Grant Colleges.

Sample married Kathryn Brunkow in 1961. They have two daughters, Michelle and Elizabeth Ann.✦

Alphabetical Listing