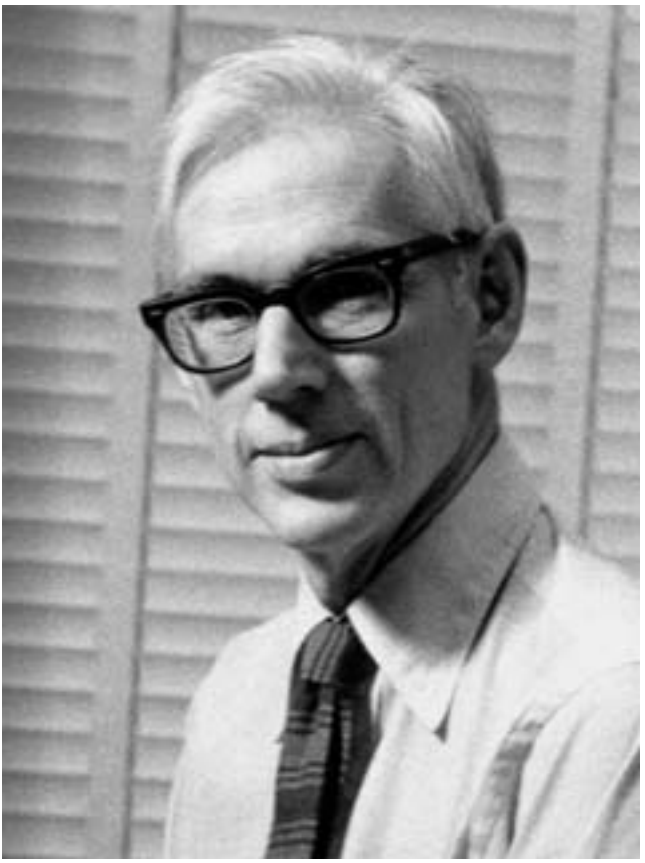

JOHN (JACK) P. LONGWELL

1918–2004

Elected in 1976

"For contributions to the basic knowledge of combustion, particularly the design basis for gas turbines, rockets, and ramjets."

BY WALTER MAY AND ADEL SAROFIM

JACK LONGWELL died on October 6, 2004, at the age of 86 after a distinguished career at Exxon and the Massachusetts Institute of Technology (MIT). He was born April 27, 1918, in a medical facility in Denver, Colorado, the nearest to his parents' home in Wyoming. His father was a civil engineer who helped build dams for the U.S. Reclamation Service. Jack spent his first 11 years in Wyoming, where he developed his lifelong interests in the outdoors—fishing, hunting, skiing, and hiking. Then in 1929 he moved with his family to Oakland, California. He attended the University of California, Berkeley, where he obtained an S.B. in mechanical engineering before continuing his studies at MIT as a doctoral student with Professor H. C. Hottel (deceased, NAE, 1974) as his advisor. His doctoral thesis research on pressure-atomized nozzles provided the detailed size distribution of droplets in the resulting sprays. He developed the first size characterization of the drop size distribution by capturing the sprays in a dry ice/acetone bath and then sieving the frozen droplets. His method for characterizing sprays had a major impact on the development of both commercial burners and gas turbines. Will Hawthorne (NAE, 1976), while working with Whittle to develop the combustor for the first British jet aircraft, told Hottel that his team had copied Jack's atomization method and classified their report on the work!

On graduation in 1943, Longwell joined Exxon, then Standard Oil of New Jersey or Esso, in the Process Research Division in Bayway, New Jersey. In 1945 he was assigned to work on government-supported research on high-output combustion. The mission was to design a propulsion system, on the Bumblebee project directed by John Hopkins, which ultimately led to the development of the long-range Talos naval surface-to-air missile. He would later take satisfaction in the successful use of the Talos missile in the Vietnam War. His research on high-output combustion—in application to gas turbines, rockets, and ramjets—led to the invention, with Malcolm Weiss, of the well-stirred reactor, which is now widely used by the combustion community for studying high-temperature kinetics. The well-stirred reactor uses sonic feed-jets to induce recirculation in the reactor to minimize mass transfer limitations. It is of great value in determining the maximum throughput achievable by a combustor without flame blowout.

"Jack showed an unusual ability and delight in taking a piece of science and showing where it could be applied, along with a singular ability to analyze all dimensions of a problem." These attributes led to his being assigned a series of management positions of increasing responsibilities, including setting up the predecessor of the Government Research Laboratory, serving as the first head of the Exploratory Division of the Process Research Division, heading up the Chemical Research Division in 1960, serving as director of the Central Basic Research Laboratory in 1965, and becoming manager of corporate research in 1968. His breadth of experience and his penetrating technical insight were recognized in his appointment as senior scientific advisor, the company's highest technical rank. Jack's responsibilities went beyond combustion to include development of a wide range of technologies for fuel conversion and utilization, as well as helping younger researchers convert their ideas into products and processes.

Jack retired from Exxon to join the MIT faculty in 1976, where he pursued his interests in combustion, pollution abatement, and the health effects of combustion-generated pollutants.

He was named the first Edwin R. Gilliland Professor and served as associate director of the Center for Environmental Health Sciences. He supervised over 50 students, providing them with the stimulation of his wisdom and powers of penetrating analysis. Additionally, he catalyzed and refined their ideas, allowing them to blossom into independent researchers. The students enjoyed the frequent parties that he and his wife, Marion, hosted at their elegant home in the proximity of Harvard Square. His research contributions included the development of a new version of the jet-stirred reactor, which consists of a torus stirred with a series of tangential sonic jets discharging into a plug flow reactor. This system approximates the Bragg model of a combustor, which is comprised of two zones. The first is a well-stirred reactor representing the recirculation zone near the fuel and air injectors necessary to stabilize a flame zone; the second is a plug-flow region required to achieve high combustion efficiency. His research on pollution abatement at MIT was directed at control of the emissions of the nitrogen oxides, sulfur oxides, soot, and polycyclic aromatic hydrocarbons with special emphasis on their potential mutagenicity.

Jack was active on national committees in the combustion, environmental, and fuels areas. He served as chairman of the National Aeronautics and Space Administration's Advisory Committee on Combustion and Aeronautical Propulsion and served on the National Research Council's (NRC) Energy Engineering Board and on committees on the disposal of the U.S. Army's chemical stockpile. He headed up critical assessments of technologies for the conversion of domestic resources to liquid fuels and of the U.S. Department of Energy's coal program. As part of these efforts, he chaired NRC committees that led to the publication of "Fuels to Drive Our Future" in 1990, "Alternative Technologies for the Destruction of Chemical Agents and Munitions" in 1993, and "Coal: Energy for the Future" in 1995. His contributions on the NRC stockpile committee are particularly noteworthy. While he believed in incineration for destruction of the chemical stockpile, he also recognized the need for alternatives to incineration in the event that growing public opposition was successful.

As a result of his early efforts, several of the nine chemical depots at which chemical weapons were stored adopted alternative disposal technologies. For example, neutralization of an agent by sodium hydroxide has been successfully used to destroy the nerve agent VX at the Newport, Indiana, chemical depot and is planned to be used to destroy mustard blister agent at the chemical depots in Pueblo, Colorado, and Blue Grass, Kentucky.

Jack contributed his time freely to professional societies. He received the 1979 Award in Chemical Engineering Practice from the American Institute of Chemical Engineers in recognition of lifetime contributions. He was involved on the governing committees of the Combustion Institute since it was founded in 1954, serving on its board of directors and a term as its president, contributing to the growth of the institute into the preeminent international organization in combustion. He was the recipient of the 1974 Alfred C. Egerton Gold Medal, awarded by the institute for distinguished, continuing, and encouraging contributions in the field of combustion. He was elected to the National Academy of Engineering in 1976.

Jack brought to his hobbies of fishing, hunting, jewelry making, and woodcarving the same intensity that he applied to his professional activities. He was an enthusiastic woodcarver who produced furniture and figurines that graced his home; he often used wood from the trunks of trees downed in his neighborhood during storms. To make hunting more competitive, he used bows that he had designed and built. He was an avid fisherman; one of his favorite spots to fish was in the Henry's fork of the Snake River in Idaho, where his cabin was situated in the Yellowstone Caldera, with a distant view of the Grand Tetons. The cabin was designed by the architect husband of his daughter Ann and was built as a joint effort by Ann and his son John, along with John's college-age friends. Jack was responsible for carving the dovetail joints for the close to 400 logs used to build the three-bedroom home, joints that locked together so perfectly that the house was impermeable and beautifully insulated. The cabin continues to be a family gathering place and continues to be enjoyed by Ann and her family.

Jack shared his wife Marion's passion for classical music. Jack took up the cello at the age of 40, and as his expertise grew, he organized and played in an amateur music group in which his daughter, Martha, participated alternately as a pianist or violist. (He playfully referred to the group as the Mauvais Arts Trio, a whimsical variant of the Beaux Arts Trio.) His children remember Jack's creativity in playing with them—for example, casting their arms in plaster to pretend that they were broken and then removing the casts with a hacksaw. He joined John in his pastime of riding motorcycles and, ever a competitor, broke his collarbone in a wipeout when trying to beat John's best time. Discouraged by the family from riding motorcycles, he switched to riding mountain bikes and then broke the opposite collarbone attempting to jump a log. He instilled in his children and grandchildren his love of nature and the outdoors. In the early years his children joined him hiking, skiing, kayaking, digging for clams, and catching crabs, and in later years in Idaho he and his grandchildren canoed, rode mountain bikes, and explored for arrowheads. His importance in the lives of his children and grandchildren is reflected in their choice of careers. John is a mechanical engineer, Martha a biomedical researcher, and Ann a structural engineer. Out of eight grandchildren, six have chosen to go into some form of science or engineering. His legacy lives on with his familial and academic progeny.

This account was prepared from personal recollections by a former colleague at Exxon (W.M.), an MIT colleague (A.S.), description of his family life contributed by Jack's daughter Martha Blair, information including an excerpt (in quotation marks) from Ben Harte's "Portrait of a Pioneer" in the *Lamp* (an ExxonMobil publication), and the *Oral History of Hoyt C. Hottel* published by the Heritage Foundation.