



ROBERT A. FROSCH

1928–2020

Elected in 1971

“Contributions toward the improved application of engineering resources to large-scale engineering developments with special emphasis on underwater acoustics.”

BY LAWRENCE D. BURNS

ROBERT ALAN FROSCH, one of the nation’s foremost R&D leaders, died December 30, 2020, in South Hadley, Massachusetts, at the age of 92.

Bob was born in New York City to Herman and Rose (née Bernfeld) Frosch on May 22, 1928, and grew up in the Bronx, where he attended public schools. Blessed with deep intellect and curiosity, he attended Columbia College, where he earned a bachelor of arts degree in 1947, and Columbia University, where he earned his doctorate degree in theoretical physics in 1952 when he was just 23 years old.

After graduation Bob embarked on an extraordinary research and development career in government, industry, and academia. His formidable contributions spanned oceans, skies, outer space, and land, and enhanced this country’s defense systems, exploration capabilities, automobile transportation, and environmental quality. Few people have accomplished so much in so many areas. And even fewer have been so successful while also being a model of kindness, integrity, and service.

Bob’s first job was at Hudson Laboratories of Columbia University in Dobbs Ferry, NY, an organization under contract to the Office of Naval Research. He worked on problems in underwater sound, sonar, oceanography, marine geology, and

marine geophysics. In addition to his research, he was associate director and then director of the laboratories and managed 300 employees and two ocean-going research vessels. He was also technical director of Project Artemis, a large experimental active sonar system development program.

In 1963 Bob moved to Washington, DC, to become director for nuclear test detection in the Defense Department's Advanced Research Projects Agency (ARPA), where he led the design and building of the computer-controlled Large Aperture Seismic Array (LASA). He was appointed deputy director of ARPA in 1965 and in 1966 assistant secretary of the Navy (research and development), responsible for all Navy research, development, engineering, and test and evaluation programs, averaging \$2.5 billion annually. These programs included the Aegis anti-air system, new submarine and anti-submarine systems, and early "smart" weapons and systems.

He took on global responsibilities in 1973 when he became the first assistant executive director of the United Nations Environment Program (UNEP), with the rank of assistant secretary general. Two years later he became associate director for applied oceanography and director of research at the Woods Hole Oceanographic Institution.

Bob transitioned from oceans to outer space when he became NASA's fifth administrator in 1977. During his tenure the first space shuttle was built and ground-tested, and spacecraft projects were created to investigate Venus with radar imaging and the universe with x-rays and gamma rays.

In 1982 he transitioned again—this time from government to industry—when he became vice president of research at General Motors. With the growing proliferation of electronics and computers in automobiles in the early 1980s, vehicle design was becoming more complicated. Bob brought the concept of systems engineering (used at NASA) into the design of cars and trucks. This led to the creation of the GM Systems Engineering Center, and all future GM vehicles were designed and engineered using concepts stemming from Bob's initiative and experience.

Also at GM, Bob created the field of *industrial ecology*, the systematic study of material and energy flows through industrial

systems. The articles he wrote with his GM colleague Nicholas E. Gallopoulos in the late 1980s and early 1990s, including one in *Scientific American* titled "Strategies for Manufacturing," drew attention to the importance of managing industrial processes and waste in an environmentally acceptable manner. He became internationally recognized for his contributions to the development of environmentally friendly technologies.

After retiring from GM in 1992, Bob joined the John F. Kennedy School of Government at Harvard University as a senior research fellow. For the next 28 years he remained active at Harvard in scientific and technical policy activities related to energy, innovation, space security, industrial ecology, and globalization. He also engaged as a guest investigator and mentor at Woods Hole Oceanographic Institution.

In addition to his research and leadership accomplishments, Bob was exemplary in his professional service. He gave generously of his time and talents, serving on governing or advisory bodies for a dizzying array of professional organizations, educational and research institutions, government entities, and philanthropic and health organizations. In 1981 he became the first president of the American Association of Engineering Societies (AAES). He was a member of Phi Beta Kappa, member and president of Sigma Xi, fellow of the American Academy of Arts and Sciences, foreign member of the Royal Academy of Engineering, and a fellow of at least seven other technical societies.

He also served on numerous NAE and National Academies committees and studies and chaired quite a few, including the committee that produced the 1989 NAE consensus study *Technology and Environment*.

As the first NAE member to cochair the Academies' Report Review Committee (RRC), Bob signed off on close to 200 report reviews monitored by the RRC, and during his 23 years on the RRC he served as review monitor or coordinator for nearly 150 reports. During his term as cochair, the RRC instituted refinements in policies and procedures such as a streamlined approach for responding to reviews that made the review process more effective and efficient. In addition, RRC

meeting discussions were opened to the participation of the NAS, NAE, and IOM presidents, staff from the NRC Executive Office and six division executive offices, and select project staff. Bob approached the job with his characteristic diligence and humor and had a way of making even the most mundane tasks interesting.

For his innumerable contributions, Bob was awarded the Navy Distinguished Public Service Award, NASA Distinguished Service Medal, IEEE Founder's Medal, Defense Meritorious Civilian Service Medal, Neptune Award of the American Oceanic Organization, and IRI Medal of the Industrial Research Institute for his leadership at GM. In 2003 he received the NAE's prestigious Arthur M. Bueche Award, which honors an engineer who has shown dedication in science and technology as well as active involvement in determining US science and technology policy, promoting technological development, and contributing to the enhancement of the relationship between industries, government, and universities.

Bob was married to Jessica Rachael Denerstein of Brooklyn, NY, for 59 years, until she passed in 2016. They are survived by daughters Elizabeth Frosch-Dratfield (Paul Dratfield) and Dr. Margery Frosch (Dr. Meryle Weinstein) and two grandchildren.

Robert Alan Frosch had a beautiful mind and was an outstanding leader and person. We are all blessed by his life.

