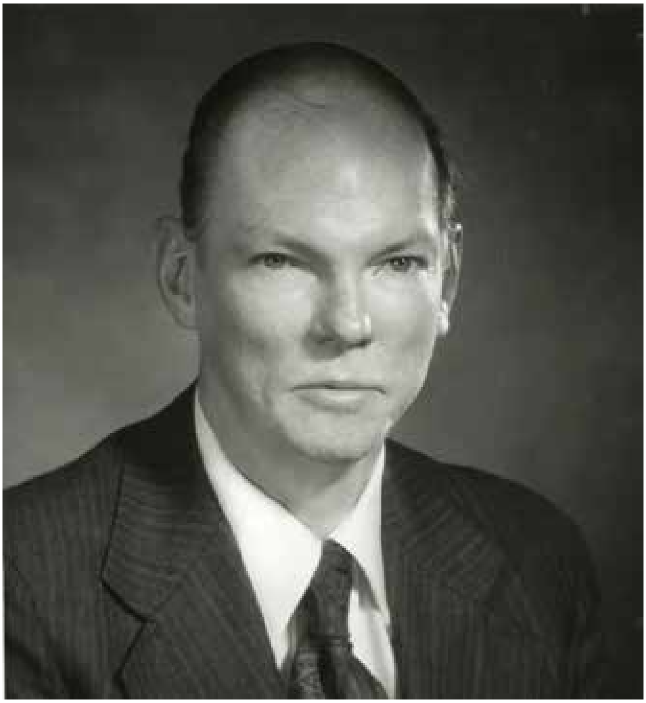

Walter E. Morrow Jr.

WALTER E. MORROW JR.

1928–2017

Elected in 1978

"Contributions to ionospheric, tropospheric, and orbital scatter communications, and to military communication satellite technology."

BY WILLIAM P. DELANEY

WALTER EDWIN MORROW JR., a pioneer in national defense technology, died February 12, 2017, at the age of 88.

He was born July 24, 1928, to Walter E. Morrow Sr. and Mary "Molly" (née Ganley) in Springfield, Massachusetts, and received his early education there. He was a science enthusiast as a child, with a hobby of building hopeful perpetual motion machines. He entered the Massachusetts Institute of Technology in 1945 and received his BS degree in 1949 and MS degree in 1951, both in electrical engineering.

He joined the newly formed MIT Lincoln Laboratory in September 1951 as the laboratory began its initial mission, the development of a prototype of an air defense network for the entire North American continent. One of the many challenges in this heroic undertaking was communication systems that could link hundreds of sites (radars, air bases, command centers), from the Arctic to the Caribbean. Walter joined the Long-Range Communications Group and immediately became active in beyond-the-horizon long-range communication techniques involving both ionospheric and tropospheric scattering. He became leader of the Communications Systems Group in 1955.

Walter's genius for innovation led to a proposal to do the equivalent of ionospheric forward scatter communications by building an orbital belt of reflectors (thin-wire dipoles) in space and using this belt as a medium to send communication signals between Earth stations located an intercontinental distance apart. Project West Ford conducted by Lincoln Laboratory provided an experimental confirmation of this technique, which achieved a data rate of 20 kilobits per second in 1963. Putting a belt of half a billion small wires in orbit caused considerable scientific controversy, but Lincoln Laboratory had calculated and later the experiment proved that the dipoles would deorbit relatively quickly because of solar pressure. This use of passive reflectors in space for long-distance communication was soon overtaken by progress in active satellites in orbit.

Walter proceeded to lead an active communication satellite program for practical military use in 1963. A series of Lincoln Experimental Satellites, LES 1–9, were developed and orbited in 1965–76. The satellites featured SHF, UHF, and EHF communications, and several continue to operate and serve a variety of users, including researchers in Antarctica.

In 1966 Walter was appointed head of the Communications Division and continued his leadership of satellite communication techniques with advances in multiple-beam antennas, signal processing techniques, and antijam techniques. In 1968 he was appointed assistant director of the laboratory; in 1972 he became associate director and in 1977 director as well as professor of electrical engineering at MIT.

Walter's leadership of Lincoln Laboratory spanned 21 event-filled years. He guided the laboratory into new challenging areas of interest and importance to national security.

For example, a concern about the possibility of chemical and biological weapons led him to establish a chemical/biological defense initiative in 1995. This was a brave undertaking because the laboratory had little experience in chemical or biological effects. Walter foresaw the important role of microelectronics technology in addressing defensive measures for these threats. The laboratory was able to build micrometer-sized electronic sensing elements that were the same size as biological molecules, which allowed the development of miniature biological sensors that could sense and identify biological attacks very quickly. This biological defense work continues to this day, with sensors being tested in government buildings and public transportation facilities.

Walter was a strong believer in the national strategic value of space systems. Under his leadership, the laboratory became a world leader in surveillance of space, with an emphasis on deep space and the identification of space objects. World-class long-range radar sensors and passive optical sensors have been deployed to keep track of the increasing population of space objects. Through Walter's leadership and guidance, staff members at Lincoln Laboratory developed and transferred to the Air Force electro-optical (EO) sensor and processor technologies and proof-of-concept surveillance systems that have successfully led to the acquisition and use of the Ground-based Electro-Optical Deep Space Surveillance System and the Transportable Optical System. These systems are located at several sites to provide worldwide coverage for space surveillance, and they continue to be upgraded with Lincoln Laboratory advanced EO sensor technologies.

Lincoln Laboratory's infrastructure of buildings and facilities was aging during Walter's directorship, and he initiated several new building efforts. His long-range view of future research needs led to his initiation of a modern microelectronic fabrication facility, which was completed in 1993. This facility enabled laboratory researchers to lead the nation in the development of 193-nanometer lithography and the successful transfer of this technology to industry by 1999.

In a similar fashion, Walter personally initiated and led the process to build a major new building, the South Laboratory, which houses many of Lincoln Laboratory's research teams and their laboratories since its completion in 1994.

Under Walter's leadership, MIT Lincoln Laboratory pursued an aggressive program of technology transfer to industry. Through its application of advanced technology to critical problems of national defense, Lincoln Laboratory has remained on the leading edge of technical research. Because the laboratory, as an FFRDC, purposely has no production facility, it has taken an active role in transferring technologies to the defense industry. Also from these innovative technological developments have come numerous civilian applications and products.

The laboratory has encouraged and supported the formation of more than 100 companies by former Lincoln Laboratory employees. These companies have created over a billion dollars in annual sales and employment of over 65,000, strongly supporting the national economy with employees in every state. The dual use of advanced defense technology in the commercial sector by small, high-technology startup companies is instrumental in promoting the nation's technological competitiveness.

Walter's strong personal commitment to service to the nation occasioned his participation in a number of government advisory boards and studies. He was a member of the Defense Science Board for 22 years, where he served on 35 studies and chaired 10 of them. He served on the executive panel of the Chief of Naval Operations for 32 years and was involved in 24 studies. He served on the US Air Force Scientific Advisory Board for 9 years, participating in 16 studies and chairing 5 of them.

Elected in 1966 as a fellow of the Institute of Electrical and Electronics Engineers (IEEE), he served as vice chair of the IEEE Northeast Electronics Research and Engineering Meeting (NEREM) in 1968, chaired NEREM-69 and the NEREM board of directors (1970), served on the IEEE Energy Committee (1976–79), and chaired the IEEE Technical Activities Board Technical Appraisal Committee (1977–79).

He was appointed in 1983 to the Voice of America Radio Engineering Advisory Committee, on which he served through 1989, including as chair (1984–87), and in 1984 to the American Physical Society Study on Directed Energy Weapons. As a member (1987–2002) and senior fellow (2002–09) of the Defense Science Board, he contributed to dozens of task forces in areas such as space superiority, advanced semiconductors, homeland protection, and air defense. He was a member of the Chief of Naval Operations executive panel for 37 years, the Naval War College board of advisors, the Air Force scientific advisory board, and the National Aeronautics and Space Administration's (NASA) advisory council.

He lent his technical expertise to committees of the National Research Council: on US Space Command (1987–88) and Assessment of Defense Space Technology (1989–90), both for the Air Force Studies Board; and on Science and Technology (1989–92) and Strategic Technologies for the Army (1989), both for the Board on Army Science and Technology.

Walter received many awards over his illustrious career. In 1963 he was honored with a unique outstanding achievement award from MIT for his innovative investigation of the orbiting belt of thin-wire dipoles operating as a communication signal reflector. In 1976 he received the IEEE Communications Society's Edwin Howard Armstrong Achievement Award "in recognition of innovative contributions to space communications," in 1980 the Armed Forces Communication and Electronics Association awarded him the Medal of Merit, and in 1995 he was selected by the American Association of Engineering Societies for the National Engineering Award, presented "in recognition of an engineer whose career and accomplishments have particularly benefited humanity." He also received two medals from the Department of Defense, for Distinguished Public Service in 1998 and for Outstanding Public Service in 2010, and the Navy Superior Public Service Award in 2015.

MIT leaders had high praise for Walter Morrow. Charles M. Vest, MIT president (1990–2004), summed up his contribution to the DoD: "Walter is widely valued in federal defense policy circles as an advisor of great integrity, analytical capability, and wisdom."

Joel Moses, MIT provost (1995–98), said: "Walt Morrow has a unique combination of insights and skills. He understands in a deep way the needs for future defense systems for the US. He also deeply understands the core technologies that will enable such future systems to exist."

I joined Lincoln Laboratory in 1957 and was well aware of Walt's technical leadership and innovations in my early years. I came to know him much better starting in 1987 when I became one of his assistant directors. Our congenial relationship continued as he assumed director emeritus status in 1998, and we shared an office suite until his passing in 2017. This 30-year association occasioned numerous discussions on a wide range of topics in national defense and civilian science challenges.

Walter was the quintessential engineer-scientist, with great technical depth and a very broad view of scientific challenges. He was surely an "idea man," and he welcomed hearing the ideas and opinions of others. His underlying belief was that technology could solve many major challenges, and he searched for the "silver bullets" that could help guarantee our national security. He imbued the Lincoln Laboratory staff with his high regard for new ideas and breakthrough techniques. He was quick to support the further investigations of new ideas, even the far-out ones, and this support sent a strong message to the research staff.

My assistant director colleague (1977–96), Donald MacLellan, knew Walter best. He worked closely with Walter throughout his early and mid-career at the laboratory as they built our nation's early communication satellites. In Don's view, "Walt had outstanding technical competence coupled with a complete lack of pretentiousness. He was also extremely patient and always open to discussion in the pursuit of knowledge."

In Walter's spare time, he enjoyed hiking, swimming, and Scottish country dancing. He was a loving and caring son, husband, father, grandfather, and great-grandfather. He was the beloved husband of 65 years to the late Janice (Lombard) Morrow. He is survived by his devoted children, Clifford Morrow and his wife Kathryn (Atwood) of Rhode Island, Gregory Morrow of Gloucester, and Carolyn Morrow and her husband Michael Rowen of California; his cherished grandchildren, Glenn and Keith Morrow; and his great-grandson, Nolan.

Clearly, his other enduring love was the MIT Lincoln Laboratory, and thousands of talented researchers there as well as the entire nation are the beneficiaries of that love affair.