

*At a meeting of the FACULTY OF ARTS AND SCIENCES on February 6, 2024,  
the following tribute to the life and service of the late Frederick Henry  
Abernathy was spread upon the permanent records of the Faculty.*

## **FREDERICK HENRY ABERNATHY**

BORN: June 19, 1930

DIED: February 3, 2022

With the death of Frederick H. Abernathy, Gordon McKay Professor of Mechanical Engineering and Abbott and James Lawrence Professor of Engineering, *Emeritus*, at the age of 91, Harvard lost one of her most devoted faculty members. Fred served for decades as the unofficial energy czar for the Faculty of Arts and Sciences (FAS), guiding efforts to reduce energy consumption and contributing to energy policy. He introduced a modern engineering design course, which engaged undergraduates in broad technical issues drawn from real environmental and societal problems. On the lighter side, Fred loved the pomp and circumstances of Commencement and served as caller in the Old Yard, drawing on his avuncular humor and his respect for good order while prodding alumni, faculty, and dignitaries into their proper places in the morning procession.

Born in Denver, Colorado, Fred grew up in northern New Jersey, where his father worked in paper mills. Fred's exposure to the heavy machinery in the mills seeded his interest in engineering. He paid his way through the Newark College of Engineering by working in the construction industry in the summers. Following a two-year stint at the Oak Ridge National Laboratory, where he was introduced to energy generation and nuclear power, Fred moved to Harvard to obtain a doctorate in mechanical engineering. Fred's talent for engineering principles and their application to complex technical problems was reinforced by his Ph.D. program, which comprised a broad mix of theoretical and experimental fluid mechanics, thermodynamics, and applied mathematics. During this period, Fred met the woman who would become his wife of more than 60 years, AnnaMaria Herbert, then a graduate student in history at Radcliffe College. Fred obtained his Ph.D. in 1959 and, after a brief period as a lecturer at Harvard and a consultant at Oak Ridge, began his lifelong career on the faculty in the Division of Engineering and Applied Physics, as the unit was called at the time.

Fred's early research in fluid mechanics entailed experimental studies of boundary layers and the transition of these flows from laminar to turbulent. As the terminology suggests, boundary layers are thin layers of fluid separating the surface of a solid object, such as an airplane wing or ship hull, and the liquid or gas environment in which it is immersed. The

force resistance, called drag, on a moving wing or hull depends on the characteristics of the boundary layer, most notably on whether the flow is smooth (i.e., laminar) or turbulent. A lasting contribution to this field is Fred's movie, *Fundamentals of Boundary Layers*, issued in 1968 in a series of films on fluid mechanics sponsored by the National Science Foundation. The film is standard viewing in many courses on fluid mechanics.

As a young faculty member, Fred's interests expanded year by year, and he developed a broad engineering background in energy conservation and production, manufacturing, and operations research. In the early 1970s Fred spent two years at the National Science Foundation, becoming the head of the agency's office concerned with funding energy-related research in the second year. Harvard was one of the beneficiaries of the expertise he gained during this period. Starting with the energy crisis in the 1970s and continuing until his retirement, Fred pushed for energy conservation and "green" approaches at Harvard. He developed a particularly close working relationship on energy matters with Jeremy Knowles during the latter's tenure as Dean of FAS. Fred's contributions to Harvard's energy conservation efforts were recognized by the 2012 Spengler-Vautin Special Achievement Award.

These experiences made their way into Fred's teaching. From his time as Associate Dean of Engineering and Applied Physics in the late 1960s, Fred realized that Harvard was not offering challenging engineering design courses that took advantage of Harvard's unique undergraduate environment. He and R. Victor Jones, an electrical engineer and the Robert L. Wallace Professor of Applied Physics, created a course in engineering design (which is still labeled Engineering Sciences 96) that tackled problems confronting Harvard and its neighboring communities. Projects ranged from Harvard's energy consumption and the integration of a recently purchased power plant on Memorial Drive into the Harvard power and steam grid to the complexities of campus parking. For each project, Fred established a board of clients drawn from the requisite community to which the students presented their findings. ES 96 became the backbone of the undergraduate engineering program. The topics addressed required input from across the fields of environmental, electrical, and mechanical engineering. Woodward Yang, Gordon McKay Professor of Electrical Engineering and Computer Science, co-taught this course with Fred in later years.

Fred's technical breadth led to a decades-long collaboration with John T. Dunlop, a former U.S. Secretary of Labor and Dean of FAS who became Lamont University Professor, *Emeritus*, in 1985. The background to the collaboration was the rapid decline in America's manufacturing capacity and capabilities in the textile and apparel industry that took place in the second half of the twentieth century. Much of this industry had already migrated from the northeast of the U.S. to the south and was rapidly moving abroad. In work initially supported by the Amalgamated Clothing and Textile Workers Union in 1979, Abernathy and Dunlop investigated the importance of research to advancing technology for the industry. As their activities progressed, they founded a nonprofit company, the Textile Clothing

Technology Corporation, funded by industry, labor, and government. They worked closely with selected companies, investigating the potential technological benefits of robotic tools for cutting and sewing, rapid responses to style changes, effective data gathering, and just-in-time delivery. These efforts came together in a book co-authored with Janice H. Hammond and David Weil and published by Oxford University Press in 1999, *A Stitch in Time: Lean Retailing and the Transformation of Manufacturing—Lessons from the Textile and Apparel Industries*.

Fred's warm and irreverent manner will long be remembered by the many students and colleagues who knew him at Harvard. He is survived by his wife, AnnaMaria; three daughters, Sarah, Marian, and Pauline; and three grandchildren.

Respectfully submitted,

Harry R. Lewis

Michael B. McElroy

Venkatesh Narayanamurti

James R. Rice

John W. Hutchinson, Chair