



## **Frederick C. Gouldin**

July 4, 1943 – May 29, 2021

Professor Frederick C. Gouldin of the Sibley School of Mechanical and Aerospace Engineering died May 29, 2021, in Ithaca. Fred was a distinguished and versatile scholar of combustion, a devoted teacher and mentor, and an exemplary colleague who made innumerable contributions to the community around him. He died after more than ten years of a dignified and determined battle with dementia during which he unceasingly challenged himself to realize his greatest potential as the brilliant, kind, modest, and gentlemanly scholar, athlete, and family man he was.

Fred's research spanned many areas of combustion. He was perhaps best known for his fundamental studies of the behavior of premixed turbulent flames. Fred developed the turbulent v-flame, a versatile experimental configuration for studying the turbulent combustion that is still in use today. He pioneered the concept that flamelets in turbulent premixed combustion could be represented by fractal surfaces, and developed a new formulation of laminar flame speed corrected for this concept. The continuing use of fractals in the analysis of flame surfaces can be traced to Fred's original work on this problem. Fred organized and led international workshops on turbulent flames that led to important advances in the technology that lies at the heart of modern ultra-clean combustion systems for electricity generation.

Fred also relished applications of combustion, ranging from rocket propellants, to gas turbine combustion, to incineration of municipal waste and destruction of chemical warfare agents, to fire suppression, to carbon-sequestering household cookstoves. He combined laser diagnostics and modeling of kinetics and flow to develop systems for monitoring the behavior of waste incinerators to ensure that they are operating safely.

Fred is fondly remembered by generations of students and research advisees. He thought of ways to make lectures and talks memorable and interesting – distilling ideas into a “cartoon” that conveyed the essence of an idea, and carefully considering how to format his lecture on the blackboard for maximum clarity. Fred taught a range of graduate and undergraduate courses in the thermal sciences and combustion, including turbulent combustion and physics of fluids.

Fred's influence on both graduate and undergraduate researchers was profound – different research advisees describe Fred's positive impact on their career trajectory, his willingness to give a chance to less than stellar students, his generosity with his time and professional connections, and the impressive instrumentation that they used in his lab.

Fred was the quintessential good citizen of the department, university, research community, and greater community. At various times, he served as associate director for Graduate Affairs and associate director for Undergraduate Affairs for the Sibley School. At the University level, he served as associate dean of the faculty. His university service continued into retirement, as president of the Cornell Association of Professors Emeriti. Fred was an extremely active contributor to professional organizations, taking on leadership roles and serving on and chairing committees for the Combustion Institute, the Propellants and Combustion Technical Committee of the American Institute of Aeronautics and Astronautics, the National Research Council / Air Force Office of Scientific Research Propulsion Panel, the National Academy of Engineering, and the Society of Automotive Engineers. He was the organizer of numerous scientific meetings, technical sessions, panels and workshops. Fred's extracurricular interests included serving as commodore of the Ithaca Yacht Club and as president of the Ithaca Rotary Club, by which he was honored on several occasions. Fred even chaired the Cayuga Heights deer committee, which was tasked with examining options for keeping the deer population under control. This last assignment, which involved strongly expressed opinions, may have been the one that posed the greatest challenges to Fred's characteristic senses of civility and decorum.

Fred was born on July 4, 1943. He attended St. Stephen's School in Alexandria, and then Princeton University where in 1965 he received the B.S.E. degree with high honors in Aerospace and Mechanical Sciences. After graduation, Fred stayed at Princeton and received his Ph.D. in 1970. In 1966, Fred married his high school sweetheart, Elizabeth Fairfax (Fair) MacRae. They had two daughters, Ann and Cary.

After completing his doctorate, Fred joined the Cornell faculty. After the merger of the Graduate School of Aerospace Engineering with Mechanical Engineering in 1972, Fred spent his entire career on the faculty of the Sibley School of Mechanical and Aerospace Engineering. Fred spent sabbaticals at Cambridge University (Emmanuel College) and at CNRS, Orleans as well as at Sandia National Laboratories, Livermore.

Fred was a lifelong athlete whose many favorite sports included sailing, bicycling, running, skiing, hiking and tennis. At St. Stephens, Fred was on the football, wrestling and track teams. His senior year football team went undefeated. At Princeton, Fred was a quarterback on the Princeton football team and was a member of Princeton's famous 1964 football team which completed a perfect 9-0 season on their way to the Ivy League championship. Fred was also on the Princeton track team. At Cornell, Fred's early morning runs formed a part of his routine, and he often ran with professional colleagues. There was hardly a sport he didn't enthusiastically try, including tossing the caber and throwing the 35-pound hammer at the Scottish Highland Games on Grandfather Mountain in North Carolina. After moving to Kendal, Fred continued to find pleasure and comfort in physical activity, walking two miles a day until a few weeks before his death.

Fred is survived by Fair, his wife of 54 years, as well as his daughters Ann Kay and Cary Gouldin, son-in-law Andrew Kay, and grandsons Will and Charlie.

*Written by Elizabeth (Betta) Fisher (chair), Stephen Pope, and  
C. Tom Avedisian*