MARTIN SUMMERFIELD

1916–1996

Elected in 1979

"For contributions to the development of rocketry, combustion research, and the international literature in aeronautics and astronautics."

BY YVONNE C. BRILL AND LEONARD H. CAVENY

MARTIN SUMMERFIELD, pioneer in rocket propulsion and combustion research who transformed the American Rocket Society into a leading professional organization and precursor of the American Institute of Aeronautics and Astronautics, died in Hightstown, New Jersey, on July 18, 1996.

Martin Summerfield was born in Brooklyn on October 20, 1916. He graduated from Brooklyn College with a B.S. in physics at the age of 20. In 1936, the middle of the Great Depression, with no prospects for employment in science or technology, he immersed himself in the NYC neutral-accent speech-training program in hopes of qualifying as a teacher. An assistantship to the California Institute of Technology (Caltech) involving optical physics laboratory work enabled him to extend both his studies and associations. Even then he had no illusions about gaining employment as a scientist after graduation. His associations with Professor Theodore von Kármán and the technological buildup accompanying World War II changed everything and immersed him into a lifelong whirlwind of activity.

He received an M.S. in 1937 and a Ph.D. in 1941, both in physics from the Caltech. He was Professor John Donavan Strong's first Ph.D. student. Martin began his pioneering career in rocket research while he was a graduate student. In the 1940s he worked closely with Professor von Kármán on

the Air Corps Jet Propulsion Project, serving as assistant chief engineer. He made early discoveries enabling modern high-thrust liquid rocket engines. He guided the development of liquid propellant rocket engines leading to the first practical U.S. jet-assisted takeoff (JATO) of aircraft.

By 1942 development of the JATO units was so successful that the Army Air Corps asked the Caltech researchers to go into production, by producing 2,000 units by the end of 1943. That entailed von Kármán, Edward S. Forman, Andrew G. Haley, Frank J. Malina, John W. Parsons, and Martin Summerfield forming the start-up company that they named the Aerojet Engineering Company. In 1944, Aerojet, located 15 miles east of Pasadena in Azusa, was bought out by General Tire & Rubber of Akron, Ohio, which could provide the expansion of the products desired by the U.S. Department of Defense. The company was accordingly renamed Aerojet General. During the hectic JATO development, Martin worked with the colorful John W. Parson, credited with the key invention of case bonding solid propellants. From 1945 to 1949, he continued his research at the Jet Propulsion Laboratory of Caltech, as chief of the Rocket Research Division. Martin rarely commented on his Caltech and early rocketry experiences. His focus was on the future.

In 1949 he accepted an invitation to move to Princeton University to become general editor of the new Princeton Series on High Speed Aerodynamics and Jet Propulsion, whose purpose was to provide the literature for these rapidly developing fields. In 1952 he turned over the editorship to Joseph V. Charyk and continued full time as a professor.

Martin Summerfield and Eileen Budin were married on August 31, 1945; their daughter Jacqueline is a musician in California. His two grandchildren are pursuing careers in materials science and astronomy. The Summerfields maintained ties to California and always found time to spend a month or so at their beachfront second home at Capistrano Beach.

From the mid-1950s to the mid-1970s, Professor Summerfield established a world-class combustion and solid

propulsion laboratory at Princeton University for student research. The propellant processing, motor fabrication, motor testing, combustion, and diagnostic capabilities were full featured and among its distinguishing physical features. He recruited and trained professional staff and technicians to work with forefront high-energy solid propellants and high-pressure systems. The 30 years of operation with no injuries or accidents is a testimony to his exacting leadership. Martin's activities were part of the Princeton University Mechanical and Aerospace Engineering Propulsion Sciences Center in the Guggenheim Laboratories, which included Luigi Crocco and David T. Harrje (liquid propulsion), Irvin Glassman (ramjets and monopropellants), Robert G. Jahn (electric propulsion), and Jerry Grey (nuclear propulsion).

His collegial ties to the basic research leaders in the U.S. Department of Defense, National Aeronautics and Space Administration (NASA), and U.S. Department of Energy helped shape national technology policy. He enjoyed continuous funding from those agencies. Of the 47 dissertations and theses he supervised, all dealt with some aspect of combustion.

He maintained a dynamic stability in his staff and continuity in his students. From this base he ventured into new challenges, including the 1970s focus on airliner fire safety, understanding tobacco combustion in the pursuit of a safer cigarette, coal gasification, and jet engine noise reduction. His laboratories, on the sprawling Forrestal Campus, occupied about a third of the New Guggenheim Laboratory Building, a 1964 three-story office and high-bay laboratory complex partially funded by a NASA construction grant. His unique propellant processing and high-pressure test stands were in adjacent specially constructed buildings.

Martin was tireless. His staff members were certain his stamina and drive would outlast them all. He looked forward to the holidays and breaks between classes, the time all the graduate students could spend full time in his laboratories.

Premier laboratories often have a leader who sets high standards and pursues excellence at the expense of immediate popularity and personal time. Martin was such a leader.

He set difficult and deliberate agendas for his graduate students. He stressed thinking beyond the immediate problem so their Ph.D. research would not be the intellectual high point of their careers. He led his students by a dynamic process of adjusting their research goals to topics that made a difference. His list of publications reflect how quickly he moved on to the next challenge rather than engage his students in projects that might have been variations on a theme. Where plausible, he insisted his students get the full research experience ranging from designing an apparatus, checking it out, and taking the data, while being enmeshed in the development of a theory to interpret the results. This process was always uncertain and often caused his talented students to reach for another level of resilience. Enthusiastically, he added topics to a graduate student's thesis requirements. Many of his students entered the propulsion community, on graduation, fully up to speed and well connected, in part the result of multitopic dissertation research.

His strong sense of international involvement was reflected in his selection of graduate students. Most of his international students were a direct result of one of their professors or mentors visiting his laboratories and subsequent recommendations. The students who returned to their home countries maintained strong ties to him and their U.S. colleagues.

He relished the broad international nature of the aerospace research. The parties he and his wife Eileen had at their home on Lake Carnegie in Princeton were memorable for the broad cross section of staff, students, colleagues, and friends. They were truly international affairs, often prompted by visiting foreign scientists. He recognized the benefits of international scientific exchanges as a precursor to better world relationships. For example, the ties he helped maintain with the Russians in the 1960s and 1970s are the basis for the present-day interactions by his students and staff. He relished assigning offices to visiting scientists. For example, Arie Peretz of Israel's Rafael Systems, Ltd., and his new officemate Vadim B. Librovich of Moscow's Institute of Problems in Mechanics soon became good friends,

just as the professor planned. He expertly kept in touch with his international counterparts through such activities as being vice president of the International Astronautical Federation from 1963 to 1965 and editor-in-chief of its journal, *Acta Astronautica,* from 1966 to 1973.

He loved the Joint Army, U.S. Navy, NASA, and Air Force Interagency Propulsion Committee's combustion meetings. They were his forum for *works in progress* prior to submission to peer review. He would wait out the obviously weak presentations and save his comments for his peers. The sight of Professor Summerfield entering a conference room (often to the right of the speaker, to benefit his better ear) and taking a seat near the front brought anticipation to the audience that a good presentation would be followed by pointed questions and observations. They were seldom disappointed. After carefully listening to the speakers' interpretation of their data set, he would offer his unique insights. During a session break, he was the first to approach the speakers for more discussion. He was content to let his staff and students make national presentations. They too could anticipate new observations from their coauthor following the presentation.

He was committed to the embryonic American Rocket Society (ARS) and its successor, the American Institute of Aeronautics and Astronautics (AIAA). As editor of the *ARS Journal,* he was the major force transforming ARS into a technical society to be taken seriously and ready for its leadership position in time for the late 1950s Space Race. *ARS Journal* readers were never far from the practical, since the journal included hardware and employment ads, patent summaries, book reviews, and so forth. In 1962, during the critical merger forming AIAA, he served as ARS president.

In 1960, Martin was the founding editor-in-chief of its book series ARS and later *AIAA Progress in Astronautics and Aeronautics.* These types of contributions earned him the Pendray Award for literature in 1954. He served as volume editor of and contributor to *Solid Propellant Rocket Research,* Volume 1 of the Progress Series, published in 1960. Later, he coedited with former students several additional volumes for

the series. In 1963–1964, Martin served as the AIAA's first vice president for publications. He continued to be very active on the Publications Committee as an honored emeritus member.

He always gave high priority to ARS and AIAA. Any author in his Progress Series will testify to the difficult standards he set. He found the first disclosure in the form of an AIAA preprint satisfying and would often engage the next challenge without offering his preprints for journal publications. Since the aerospace profession will never have a more effective champion of its refereed publications, this is a contradiction. Readers of his papers never have to hunt for the significance of his results, figures, and tables; he taught two generations how to highlight results.

Professor Summerfield, the rather formal leader of a laboratory, became the congenial guest when he visited a staff member's home. He could be expected to bring something to amuse his guest's children—for example, a trick way to fold a dollar bill.

Martin relished taking combustion and propulsion research into new and topical areas. He thrived on the intellectual challenge of convincing others how spinoffs of his research facilitated addressing other problems. Examples of this include jet engine noise, coal gasification, oil fires, smoldering of construction, and upholstery foams. His involvement with the National Academy of Engineering, government panels, and industry consulting were constant sources of new relevant research. In 1977 the AIAA Wyld Award commended his wide-ranging contributions to rocket propulsion.

The Princeton community debate over the Vietnam War referred to the Defense Department's funding of some of Martin's research. Threats to march on his laboratory to confiscate files were met with cordial invitations to tour all aspects of the laboratory. Martin loved to talk about his research, particularly the physics of the phenomena. The groups there to question his activities left with the knowledge that the research was being done in a "fish bowl" for all to judge.

Martin satisfied his entrepreneurial zeal by forming

Princeton Combustion Laboratory, Inc., in 1975, with two young associates. He and Neale A. Messina evolved the company into Princeton Combustion Research Laboratories (PCRL), well respected in the community and noted for its combined experimental and analytical treatment of complex high-pressure combustion systems. Around 1994 the company was acquired initially by Lockheed Martin. Shortly thereafter, Martin began to reduce his activities due to failing health and relinquished his role in PCRL. He remained active as an advisor and a vigorous campaigner for technical approaches in the national interest. In 1996 he was elevated to honorary fellow by the AIAA, our aerospace community's highest honor.

Martin Summerfield was a genius. Anyone who worked with him will testify to that. He surrounded himself with the most capable people, recruited the brightest students, and attracted colleagues who would challenge him technically. In the final analysis, Martin's insights were often the defining interpretation of difficult physical problems . . . and he loved it. He had the ability to see through the first interpretation to a more satisfying one.