



Chris J. Frankel

JOHN L. LUMLEY

1930–2015

Elected in 1991

*“For significant contributions to the understanding
of turbulent and non-Newtonian flows.”*

BY SIDNEY LEIBOVICH

JOHAN LEASK LUMLEY, Willis H. Carrier Professor of Mechanical and Aerospace Engineering at Cornell University, died in Ithaca on May 30, 2015, of a brain tumor. He was 84. It is widely believed that his contributions to fluid mechanical turbulence were among the most significant in the second half of the 20th century. His impact on the field was impressive and lasting.

John Lumley was born November 4, 1930, in Detroit. His parents were immigrants, his father from England and his mother from Scotland. His father, Charles Swain Lumley, was an architectural engineer and instilled in him a deep appreciation of good design. His mother, Jane Leask Lumley, was the likely source of his extensive repertoire of British aphorisms with which he occasionally sprinkled his conversation.

John enrolled in Harvard University in 1948 and received an AB in engineering sciences and applied physics in 1952. His interest in statistical physics was piqued by a course taught by Stanislaw Ulam, who was visiting Harvard.

John chose to attend Johns Hopkins University for graduate work, primarily (he said) based on the attractiveness of their recruiting brochures. After receiving an MSE in mechanical engineering in 1954, he switched to the aeronautical

engineering program to work with Stanley Corrsin on turbulence, earning his PhD in aeronautics in 1957.

While at Harvard, John had met Jane French, a student at Radcliffe. They married while he was a graduate student and their three children were born in Baltimore.

After two years as a postdoctoral fellow with Corrsin, John joined the faculty at Pennsylvania State University, initially as a research professor at the Garfield Water Tunnel of the Applied Research Laboratory and then as a professor in aeronautics. At age 44 he was appointed Evan Pugh Professor of Aerospace Engineering, the youngest person to hold this title.

In 1977 he accepted an offer from Cornell to be the Willis H. Carrier Professor of Mechanical and Aerospace Engineering. He thrived at Cornell and built a turbulence group that became recognized worldwide.

John's work covered many areas, from fundamental physics and the mathematical theory of turbulence to the very practical, like his design of very quiet water tunnels for testing full-scale torpedoes. He was an expert on undersea warfare, in which turbulence plays a central role, and he was involved in this work throughout his tenure at Penn State.

The scope of his work was remarkably broad, ranging from turbulence modeling (he insisted on models that obeyed the same invariance properties as the physics) to incisive experiments to computation. He wrote about environmental flows, technological flows, drag reduction, and buoyant plumes, among other applications.

In a seminal paper, "The Structure of Inhomogeneous Turbulent Flows," presented at the 1967 Moscow conference on "Atmospheric Turbulence and Radio Wave Propagation," he showed that a particular series representation of any turbulent flow, a "proper orthogonal decomposition," could be found. For a given number of terms, this kind of series captures more of the energy of the flow than a Fourier or any other series and is thus an optimal representation. Each term can be thought of as representing a "structure" in the turbulence.

In this way he provided a precise definition of what had been a loose notion of the coherent features observed in

turbulent flows. The paper appeared in an obscure publication and it took some time to become widely known. Proper orthogonal decomposition of turbulent flows has since developed into a cottage industry.

He (co)authored six books: *The Structure of Atmospheric Turbulence* (with Hans A. Panofsky; Interscience Publishers, 1964); *Statistical Tools in Turbulence* (Academic Press, 1970); *A First Course in Turbulence* (with Henk Tennekes; MIT Press, 1972); *Turbulence, Coherent Structures, Dynamical Systems, and Symmetry* (with Philip Holmes and Gal Berkooz; Cambridge University Press, 1998); *Engines: An Introduction* (Cambridge University Press, 1999); and *Still Life with Cars: An Automotive Memoir* (McFarland, 2005). He also wrote 229 scientific papers and produced and performed in two films in the NSF series on fluid dynamics.

In addition to his books and papers, he served the community in numerous ways, including memberships and chairmanships of many national and international committees. Among his editorial duties for several journals, he spent over 30 years with *Annual Reviews of Fluid Mechanics*, 19 of them as coeditor or editor.

He made several trips behind the Iron Curtain and met the most prominent and productive Soviet scientists working in turbulence. His work had caught their attention starting with his 1964 book with Panofsky, *The Structure of Atmospheric Turbulence*. This was recognized as an important contribution and was translated into Russian by A.S. Monin.

During the Cold War, Soviet scientists had developed turbulence theory and experiment further than their counterparts in the West. John brought their advances to the attention of Western researchers first by editing English translations of the important two-volume treatise *Statistical Fluid Mechanics: Mechanics of Turbulence* by A.S. Monin and A.M. Yaglom (MIT Press, Vol. 1, 1971; Vol. 2, 1975). These had to be smuggled out of the Soviet Union. He also edited the translation of *Variability of the Oceans*, by A.S. Monin, V.M. Kamenkovich, and V.G. Kort (John Wiley & Sons, 1977). In addition, for many years he edited the cover-to-cover English translations of *Izvestiya: Atmospheric*

and Oceanic Physics, a transaction series of the Soviet Academy of Sciences.

Among the most prominent of the many honors John received were election to the National Academy of Engineering and the American Academy of Arts and Sciences; he was a fellow of the American Physical Society (APS) and American Academy of Mechanics; he was awarded the Timoshenko Medal of the American Society of Mechanical Engineers, the Fluid and Plasmadynamics Award of the American Institute of Aeronautics and Astronautics, and the APS Fluid Dynamics Prize. He also received honorary doctorates from the University of Poitiers and the École Centrale de Lyon. He was especially proud of these.

A true child of Detroit, John developed a lifelong love of automobiles. He attended a preparatory school in Detroit alongside the children of auto company executives. In addition to a fine academic curriculum, the school offered shop courses, including ones particular to the automobile industry, which John appreciated and in which he excelled.

His lifelong avocation was the repair of family cars—mostly his family's small fleet of Volkswagen Beetles—and the restoration of six classic cars, ranging from about 50 to 80 years old. He was a self-taught craftsman, rebuilding cars that arrived at "Lumley's Good Enough Garage" in poor condition and, on one occasion, in boxes. He did all of the restorations himself—the mechanical work, body work, painting, and fabrication of the interior, even the sewing of the leather upholstery and reconstruction of the interior wood veneer. Much of this is captured in his memoir written after retirement, *Still Life with Cars*. He had an expert knowledge of the history of the automobile and enjoyed talking about it, especially the engineering solutions to various subsystems that the designers adopted, some of which he admired and some not.

His curiosity and memory were remarkable, as was the facility for language so evident in his writings. Together with his love of reading and sense of humor, these characteristics made conversation with him entertaining and rewarding. While he had strong opinions about research and rapidly

arrived at theories for controversial questions, he was always willing (though not always happy) to abandon a pet theory if experiment proved it untenable.

John and Jane were gourmets, which no doubt was why John preferred France as the destination for his sabbatical leaves. Jane taught in the School of Hotel Administration at Cornell and was a restaurant critic for *Distinguished Restaurants of North America*. The two of them loved to cook and hosted many delightful dinner parties at their home.

John was predeceased by Jane in March 2014. They are survived by their children Katherine Leask Lumley-Sapanski, Jennifer French Lumley, and John Christopher Lumley, and five grandchildren.