HANS W. LIEPMANN

1914–2009

Elected in 1965

"Fundamental contributor to the field of fluid mechanics."

BY HANS HORNUNG AND ANATOL ROSHKO

HANS WOLFGANG LIEPMANN, Theodore von Kármán Professor of Aeronautics emeritus at the California Institute of Technology and a pioneering researcher and passionate educator in fluid mechanics, passed away at the age of 94 on June 24, 2009, at his home in La Cañada Flintridge, California.

Widely honored for his contributions to aeronautics, Liepmann came to Caltech in 1939 and from 1972 to 1985 was the third director of its Graduate Aeronautical Laboratories (GALCIT). Through his students and colleagues, he was highly influential in spreading GALCIT's fundamental research approach and rigorous curriculum. Known for his sharp wit and distinctive accent, he was a noted teacher who mentored more than 60 PhD students and hundreds of undergraduates, many of whom became leaders in the aerospace industry and at universities around the world.

Liepmann was born in Berlin on July 3, 1914, and grew up surrounded by the political turmoil and liberal Berlin society of the 1920s. His father, a well-known physician and hospital director, had a passion for the humanities and an abhorrence of mathematics. Insisting that Hans have a classical education despite the boy's interest in physics, he nearly ended his son's scientific career before it began. Looking back, Liepmann observed that, "Of my 10 years in school, I can remember

no more than maybe three teachers who were more than drillmasters." Those experiences likely contributed to his passion for teaching.

His time in Berlin came to an end shortly after his graduation from high school and a stint in the Siemens factory as an apprentice. His father decided to emigrate after the rise of the Nazi government and the infamous Reichstag fire in 1933. Liepmann joined his family in Turkey in 1934 where his father was invited to head the gynecology department at the University of Istanbul. The young man enrolled at the university to study physics, mathematics, astrophysics, and mechanics. The classes were taught in a mix of German, French, and Turkish, by the numerous German expatriates who found Turkey more welcoming than Germany under Hitler.

After a year in Istanbul and an unproductive term in Prague, Liepmann traveled to Switzerland and found academic success in the physics department at the University of Zürich. His talent as an experimenter was immediately recognized, leading to an invitation to pursue his doctoral studies on low-temperature physics under Richard Bär. Liepmann's scientific temperament was strongly influenced by the exciting physics scene of 1930s Zürich and the teaching style of Gregor Wentzel, a student of Arnold Sommerfeld, whom many consider the father of modern physics. Throughout his life, Liepmann maintained the perspective of a physicist and emphasized to his students the importance of a scientific approach.

He came to the United States in 1939 after impulsively expressing an interest in hydrodynamics during a drinking party at the successful conclusion of his PhD defense. An offer from Theodore von Kármán led to a research position in experimental fluid mechanics at GALCIT, where von Kármán was the first director. Liepmann's early experiments, on boundary layer instability and transition to turbulence, were followed by investigations of various turbulent flows that are relevant to engineering application—a recurring theme throughout his career.

With the entry of the United States into World War II, he began research on problems associated with high-speed flight,

including transonic flight phenomena and interaction of shock waves with boundary layers on aerodynamic surfaces. This marked the beginning of a longtime interaction with the Southern California aircraft industry.

In addition to his research, Liepmann worked with Allen Puckett to organize short wartime courses on high-speed aerodynamics for working engineers, resulting in their pioneering textbook *The Aerodynamics of Compressible Flow* (1947, John Wiley). It was followed in 1956 by *Elements of Gasdynamics* (1957, John Wiley, republished by Dover in 2001), coauthored with Anatol Roshko; this text influenced a broader, mainly graduate student following and was translated into Russian, Spanish, and Japanese.

In the rapid expansion of scientific and applied research that followed World War II, Liepmann emerged as a respected and influential contributor to aeronautics and to the physics of fluid flow. By 1949 he had advanced to professor of aeronautics at Caltech and had developed a vigorous program of research around his group of PhD students and visiting postdoctoral fellows as well as senior scientists, many of them seeking a change from their work in postwar Europe.

Believing strongly that experimental research must relate to theoretical foundations and questions, Liepmann sought association for his group with applied mathematicians among visitors and Caltech faculty. An outgrowth of this was the establishment, in 1967, of the applied mathematics option at Caltech. As if tying up loose ends, he was also instrumental, along with Caltech colleagues Amnon Yariv and Roy W. Gould, in the establishment of the applied physics option in 1974.

The work of Liepmann's group was distinguished by its innovation in experimental apparatus and instrumentation, often designed for the specific needs of particular problems. Pioneering contributions were made to a wide range of topics that frequently anticipated future technology. These include flow instability and transition, turbulent shear flow, transonic flow, shock wave–boundary layer interaction, turbulent skin friction at supersonic speeds, aircraft buffeting, rarefied gas flow, magnetohydrodynamics, plasma physics, fluid

mechanics of liquid helium, chemistry of turbulent mixing, and flow control.

Another of Liepmann's strongly held principles was that teaching is vital, even at a research-oriented institution such as Caltech. Throughout his career, up to retirement, he was devoted to teaching both graduate and undergraduate courses. The enthusiasm, clarity, and teaching effectiveness of his lectures are legendary.

In recognition of his accomplishments, Liepmann was elected to both the National Academy of Engineering (1965) and the National Academy of Sciences (1971). In 1968 he was selected to receive the Ludwig Prandtl Ring, the highest honor conferred by the German Society for Aeronautics and Astronautics. In 1986 President Ronald Reagan awarded him the National Medal of Science, and he received the National Medal of Technology in 1993.

Liepmann leaves behind sons Dorian, Till, Christopher, and Paul and two grandchildren. His wife, Dietlind, passed away in 1990.