JUAN C. LASHERAS

1951–2021

Elected in 2012

"For studies of atomization, turbulent mixing, and heat transfer and for the development of medical devices."

BY ALBERT P. PISANO, GENO PAWLAK, AND ANTONIO L. SÁNCHEZ

JUAN CARLOS LASHERAS, Distinguished Professor of Mechanical and Aerospace Engineering and Bioengineering at the University of California, San Diego, passed away February 1, 2021, after a brief battle with cancer. He was 69 years old.

Juan was a brilliant scholar, a visionary leader, a supportive mentor, and a dedicated educator, with a larger-than-life presence in the Department of Mechanical and Aerospace Engineering (MAE) and in the Jacobs School of Engineering. More than that, he was a beloved friend and dear colleague.

He was instrumental in founding the UCSD Aerospace Engineering Program and in forming the MAE Department. In 1999, when the Department of Applied Mechanics and Engineering Sciences (AMES) split into MAE and the Department of Structural Engineering, Juan served as the first chair of the new MAE department. He was also the founding director of the UCSD Center for Medical Devices, and served as interim dean of engineering in 2012. Beginning in 2007, he held the Stanford S. and Beverly P. Penner Endowed Chair in Engineering or Applied Sciences.

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Juan was born August 16, 1951, in Valencia, Spain, and spent most of his formative years near Murcia, where his father, a mathematician by training, was stationed as a colonel at the Air Force Academy. At age 18, Juan began his studies in aeronautical engineering at the Universidad Politécnica de Madrid. Sadly, his academic plans were disrupted at the end of his first year by his father's passing. To provide for his family, Juan moved back to Murcia and, for the next several years, worked as a teacher and director of a preparatory school for Air Force cadet candidates. Unable to attend college lectures in Madrid, 300 miles away, he prepared for course exams using class notes shared with him by his classmates. Despite these challenges, he graduated at the top of his class in 1975.

Upon graduation with his bachelor's degree in aerospace engineering in 1977, Lasheras secured a Guggenheim fellowship to continue his studies at Princeton University under the guidance of Irvin Glassman,[1] a renowned combustion scientist. He earned master's (1979) and doctoral degrees (1981) in mechanical and aerospace engineering.

It was at Princeton that Lasheras began to develop his skills as a creative experimentalist. He designed a combustion facility from scratch that, for the first time, allowed investigation of the mechanisms for explosive (disruptive) burning of multicomponent and emulsified fuel droplets. His pioneering work attracted the attention of the Research Department at the Shell Corporation, which hired him as a research scientist in 1981 to direct the combustion group at the Royal Dutch Shell Laboratory in Amsterdam.

In 1983 Lasheras returned to the United States as an assistant professor in the Department of Mechanical Engineering at the University of Southern California. There, he used his experimental skills to investigate a number of fluid dynamics problems related to aerospace propulsion applications. For example, his experiments helped clarify the structure and stability of turbulent mixing layers and jets, as well as the regimes of liquid atomization relevant to the design of rocket engines.

[1] See his tribute on pp. 129–33 in this volume.

While in Los Angeles, Juan met Alexis Hix. They were married in the Picos de Europa in Cantabria, Spain, in 1985.

Already a renowned experimentalist, Lasheras joined UC San Diego as a professor in the AMES Department in 1991. While he maintained an active research program addressing flow problems for engineering applications, he also developed an interest in biomedical applications following the deaths of two of his sisters at an early age. With initial guidance from Shu Chien, UCSD Distinguished Professor of Bioengineering and Medicine, Lasheras quickly built a brilliant career working at the interfaces between mechanics, biology, and medicine. His work laid the foundation for significant advances in biomechanics.

He addressed a wide variety of problems and applications at the macroscopic level, including endovascular techniques to induce and control mild hypothermia, unsteady blood flows, and the risk of rupture of aortic and intracranial arterial aneurysms. More recently, his work encompassed cerebrospinal flow in the central nervous system and its role in intrathecal drug delivery procedures. His contributions are equally important at the cellular level, including development of a novel three-dimensional cell-traction-force microscopy method and resolution of some of the biochemical pathways for the generation of traction forces exerted by cells during migration.

A true engineer, Juan was driven by a fundamental interest in both the underlying physical mechanisms and the ultimate applications. He held nearly 50 patents, including one for an endovascular blood-cooling catheter that served as a heat exchanger, the first device approved by the FDA to rapidly cool the body temperature after cardiac arrest to protect the brain.

He was drawn to complex problems that required an interdisciplinary approach. His research style combined an outstanding ability to identify relevant problems in need of further understanding and quantification with a deep knowledge of the key physical and biological elements involved. With mastery of the central physical phenomena and the capacity to describe them in a clear and concise manner, he

had a gift for designing insightful experiments that revealed underlying phenomena with minimum associated complexity.

An exceptional communicator, he could convey very complex ideas in simple terms. In a laboratory meeting he could explain the different roles of viscous and pressure forces in blood flow to a doctor, and then turn around and explain the physiology of a red cell to an engineer.

His success was also due to his remarkable ability to form and motivate research teams that included individuals from different disciplines who were able to contribute a wide range of research tools. His exceptional interpersonal and communication skills enabled and promoted the collaborative work of people with completely different backgrounds, facilitating harmonious interactions of biologists and medical doctors with electrical, mechanical, and aerospace engineers.

These skills also contributed to his effectiveness and popularity as a teacher. Students consistently gave him the highest evaluations, he received the MAE department's Teacher of the Year Award on multiple occasions, and he was recognized by the Tau Beta Pi Engineering Honor Society. He was often sought by campus colleagues to serve on academic senate faculty committees.

Fortunately for colleagues and students, Juan was extremely generous with his time. He somehow seemed to have endless hours available for either serious discussion or friendly conversation, and he handled both with ease. He never turned down a request when his help or advice was needed.

His generosity extended to active service to the scientific community. He was an associate editor of the *Journal of Fluid Mechanics* and a participant in activities of the American Physical Society (APS) and National Institutes of Health (NIH). Besides serving as secretary/treasurer and later chair of the APS Division of Fluid Mechanics, he was a member of the APS Executive Council and chaired the organizing committee for two annual meetings. He was also heavily involved in NIH studies and a permanent member of the Study Section on Modeling and Analysis of Biological Systems. In addition, for many years he chaired the board of advisors at Universidad

Carlos III in Spain, where, with his friend Shu Chien, he helped organize a bioengineering program that has become the leading program in the country. He contributed deep thought and time to all these activities, always trying to make sure that what was done would be best for the scientific community.

His numerous contributions were recognized with various honors. He was a member of the National Academy of Engineering, National Academy of Inventors, and Spanish Royal Academy of Engineering. In 1990 he was elected an APS fellow and shared the François Frenkiel Award for Fluid Dynamics.[2] He held honorary doctoral degrees from the Universidad Politécnica de Madrid and Universidad Carlos III de Madrid.

Beyond all his professional accomplishments and accolades, Juan was a caring and generous person who had a profound impact on many students, staff, and faculty at UC San Diego. This legacy is evident in their countless anecdotes about his career advice, his role in bringing them to UC San Diego, and the help he graciously offered to them or their relatives in the face of personal challenges.

Outside of work, Juan was an excellent golfer and a talented chef. In his cooking, he applied the same creativity he used in the laboratory, always ready to try new recipes. He and Alexis loved to entertain friends, students, and colleagues and hosted many memorable gatherings in their La Jolla home.

Juan Lasheras leaves an extraordinary academic legacy, not only in his scientific contributions but also in the innumerable graduate and undergraduate students, postdocs, and colleagues who have benefited from his teaching and mentorship.

He is survived by Alexis; his siblings, Maruja, Arsenio, and Teresa; and seven nephews and nieces.

[2] Lázaro BJ, Lasheras JC. 1989. Particle dispersion in a turbulent, plane, free shear layer. *Physics of Fluids A* 1(6):1035–44.