UC San Diego Jacobs School of Engineering Faculty Elected to National Academy of Engineering

February 9, 2012 — Three faculty members in the Department of Mechanical and Aerospace Engineering at the University of California, San Diego Jacobs School of Engineering have been elected to the National Academy of Engineering. Peter C. Farrell, founder, chairman and CEO of ResMed, and a member of the Council of Advisors of the Dean of the Jacobs School, also was elected to the academy.

"Election to the National Academy of Engineering is one of the highest professional honors accorded an engineer. I am very pleased that the research contributions of four engineers affiliated with the Jacobs School have been recognized by the academy this year," said Frieder Seible, Dean of the Jacobs School of Engineering at UC San Diego.

Juan C. Lasheras has been elected for "studies of atomization, turbulent mixing, and heat transfer and for the development of medical devices." Lasheras is an international expert working at the intersection of mechanics, biology and medicine. He has made pioneering contributions to the design of novel medical devices; the mechanics of cell migration and invasion; the study of turbulent and two-phase flows; and the efficiency of jet engine propulsion.

Robert Skelton has been elected "for contributions to robust control, system identification, and methodology for control-structure interaction." Skelton is a leading theorist, whose work combines the disciplines of structures and controls. He has been involved with Skylab and the Hubble Space Telescope as well as a variety of projects here on Earth, from robots to red blood cells.

Mike Baskes has been elected "for contributions to the embedded atom method for predicting the structure and properties of metals and alloys." Baskes uses computational methods to investigate material properties and has developed models that predict the behavior of helium in metals as well as a model that explains hydrogen isotope recombination.

The National Academy of Engineering elected 66 new members and 10 foreign associates this year. Academy members are among the world's most accomplished engineers. They provide the leadership and expertise for numerous projects focused on the relationships between engineering, technology and quality of life.

"I am delighted that Professors Lasheras, Skelton and Baskes have been recognized for their outstanding research contributions," said Sutanu Sarkar, Blasker Professor and Chair of the Department of Mechanical and Aerospace Engineering at the Jacobs School. "They join seven other professors in our department who are NAE members. This award reflects the excellence of our research faculty, which was recognized as one of the top 10 departments in the 2010 National Research Council survey of all mechanical engineering programs in the United States."

Juan C. Lasheras: at the Interface of Mechanics, Biology and Medicine

Trained as an aeronautical engineer, Lasheras' original contributions to the field of mechanics have led to major advances in the efficiency of jet engine propulsion; 44 patents in medical device technology; and increased understanding of some of the biological processes that contribute to diseases. Lasheras' work exemplifies an increasingly interdisciplinary approach in engineering.

"I am attracted by problems that are at the interface of traditional disciplines," said Lasheras, who is the director of the Center for Medical Devices and Instrumentation at the Institute of Engineering in Medicine at UC San Diego. Lasheras also is the Stanford and Beverly Penner Professor of Applied Sciences at the Jacobs School and a distinguished professor in the departments of mechanical and aerospace engineering and bioengineering.

Earlier in his career, Lasheras explained the mechanisms of explosive (disruptive) burning of multicomponent and emulsified fuel droplets and clarified the structure and stability of turbulent mixing layers and jets, contributing to improvements in the efficiency of jet engines. He also identified and explained the regimes of liquid atomization relevant to the design of liquid-propellant rocket engines and chemical reactors.

For the last 10 years, Lasheras has been working at the interface of mechanics, biology and medicine. His recent studies have led to advances in biomechanics at both the macroscopic and cellular levels. He evaluated the effects of unsteady blood flows in the risk of rupture of aortic and intracranial arterial aneurysms and clarified some of the biochemical pathways for generation of the traction forces exerted by cells during migration. He currently works on several aspects of mechanobiology, including how cancer cells invade and move through the body.

Lasheras led the mechanical and aerospace engineering department's foray into non-traditional medical and biological applications, explained Sarkar. Lasheras has also helped create the new Masters of Advanced Study (MAS) program in Medical Device Engineering, a joint effort between the Jacobs School's bioengineering and mechanical and aerospace engineering departments.

Lasheras received the F.N. Frenkiel Award for Fluid Dynamics from the American Physical Society (APS) in 1990. He is a corresponding member of the Royal Academy of Engineering of Spain (Real Academia de Ingenieria de Espana) and a Fellow of the American Physical Society (APS). He has been awarded Doctor Honoris Causa degrees by the Universidad Carlos III de Madrid and the Universidad Politecnica de Madrid, Spain.

Robert Skelton: Skylab, Hubble and Deployable Structures

Inter-disciplinary research had been at the core of Skelton's work. Engineering's traditional disciplines should not be handled as separate research problems, he said. "The enabler of technology as we round the corner of the new millennium will be systems design," he said. "That is, finding more fundamental ways to integrate traditional disciplines of structures, fluids and controls."

Skelton's research has focused on unifying the fields of structures and controls through a discipline called tensegrity. The term, derived from tension and integrity, describes combinations of strings and rods of various materials and sizes, assembled to create deformable bridges, buildings and other alternatives to current structural technologies.

Skelton's work in the field has led to the design of a deployable wing that uses nickel-titanium wires, which change shape when exposed to electrical current. Ultimately, this technology will make rudders and ailerons in airplanes obsolete, Skelton said. "We will just change the shape of the wing, which is what birds do," he said.

Similar designs can be used for telescope antennas and bridges. Skelton also is currently investigating the possibility of designing deployable buildings that could be airlifted in remote areas affected by natural disasters, such as hurricanes, earthquakes and tsunamis.

Before working on tensegrity, Skelton worked as a controls specialist on Skylab and the Hubble space telescope. He designed control systems for Skylab's solar observatory, essentially a telescope pointed at the sun. "To take a good picture, you need a good lens and a steady hand," Skelton said. "The steady hand is what I provided." On Hubble, Skelton worked on the redesign of the control system. The original design hadn't foreseen that the metal tubes that extend to support the telescope's solar panels would present unacceptable and unforeseen dynamic disturbances to the telescope, due to the large thermal gradients from temperature extremes when exposed to heat from the sun and the deep cold of outer space.

Skelton came to the Jacobs School of Engineering in 1996, after 22 years at Purdue University and 12 years at the Marshall Space Flight Center in Huntsville, Ala., where he worked with

Lockheed Missiles and Space Company and then Sperry Rand. He became a professor emeritus in summer 2009, but he is still a constant presence in his office and lab. “I still play in the sandbox,” he said.

Mike Baskes: Advancing Materials Science

Baskes has made significant contributions, through research and teaching, to UC San Diego’s vigorous, interdisciplinary Materials Science and Engineering program.
Now an adjunct professor in the Department of Mechanical and Aerospace Engineering, he is also a laboratory associate-fellow at Los Alamos National Laboratory.

He was a staff member at Sandia National Laboratories for 29 years. At Sandia, Baskes and researcher Murray Daw developed the embedded atom method, which allows researchers to describe the cohesive energy of solids and liquids. This method has now become the standard used for calculating complex applications in materials science, especially for fission, fusion and nuclear weapons materials. Baskes also developed models to predict the behavior of helium in metals and a model to explain hydrogen isotope recombination.

He co-authored more than 190 technical publications that have been cited more than 13,670 times—three have more than 1,000 citations. He has received two awards from the Department of Energy for outstanding research, and he has been inducted in the DOE’s Basic Energy Science Hall of Fame.