Princeton University

Honors Faculty Members
Receiving Emeritus Status

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The biographical sketches were written by colleagues in the departments of those honored, except where noted.

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Richard Bryant Miles

Dick Miles is an expert in hypersonics and advanced laser diagnostics, and his research has focused on the use of lasers, electron beams, microwaves, morphing materials, and magnetic devices to observe, control, accelerate, extract power, and precondition gas flows for supersonic and hypersonic fluid dynamics, diagnostics, and propulsion applications.

Dick was born in Washington, D.C., grew up in Orinda, California, and did his undergraduate and graduate study at Stanford University, where he received his Ph.D. in electrical engineering in 1972 under the guidance of Steve Harris. For his last three years at Stanford, he was a Hertz Foundation fellow. He joined the Princeton faculty in 1972, received tenure in 1978, and became a full professor in 1982. From 1980 until 1996, he served as chair of the engineering physics program. He has been the Robert Porter Patterson Professor of Mechanical and Aerospace Engineering since 2011. Dick's arrival at Princeton marked the establishment of the applied physics group within the department, and his career has been intimately associated with the success of that group. The applied physics group, although always small, has given the department a unique advantage over many other institutions, particularly in developing and applying advanced diagnostic techniques, new laser technologies, and plasma devices to research problems with applications relevant to mechanical and aerospace engineering.

Dick's research program includes the development of new plasma and magnetohydrodynamic (MHD) processes for hypersonic applications, new laser sources and detection methods, and the application of these technologies through linear and nonlinear optical interactions to characterize gas mixtures, plasmas, and flow phenomena. One of his most important contributions was the development of the radiatively driven hypersonic wind tunnel together with Garry Brown. This led to a large-scale, multi-institutional test program that demonstrated the potential for high-power, electron-beam-driven hypersonic ground test facilities for high Mach number testing. This concept provided for the first time a solution to the Mach 8 high-speed limit on classical air simulation test facilities. He has also been a principal proponent and innovator in the plasma aerodynamic control of reentry vehicles, and the MHD and plasma-enhanced hypersonic air breathing vehicles.

He and his research group are recognized for inventing a wide variety of new diagnostics, including planar laser-induced fluorescence (PLIF) for imaging of high-speed flows, angularly resolved coherent Raman scattering (ARCS) for species measurement, Raman excitation plus laser-induced electronic fluorescence (RELIEF) and femtosecond laser electronic excitation tagging (FLEET) for velocity imaging by molecular tagging in air, and photo-activated nonintrusive tracking of molecular motion (PHANTOMM) for velocity imaging by molecular tagging in water. They have also developed filtered Rayleigh scattering (FRS) for imaging velocity, temperature, density, and flow structure; coherent Rayleigh Brillouin scattering (CRBS) for point temperature measurements in gases and weakly ionized plasmas; Radar Resonant Enhanced Multiphoton Ionization (REMPI) for point measurements of species; and the application of atomic and molecular filters for species and temperature imaging. He has developed strong collaborations with the Boeing Company, Lockheed Martin, Sandia National Laboratories, the Air Force Research Laboratory, General Electric, Teledyne, and numerous small companies through Small Business Innovation Research and Small Business Technology Transfor efforts.

One of Dick's most recent efforts may help to revolutionize the standoff detection of land mines and other explosive devices as well as atmospheric contaminants. To find and identify such materials at a distance, Dick has proposed using a laser to sample the spectroscopic fingerprints of the trace gases emitted by the explosive material. Two complementary techniques are used to probe that volume: one involving a backward-propagating laser generated in the air sample itself, and the other a radar echo off ions and electrons from trace gas molecules that have been selectively ionized by a laser. The results are very promising, and, if successful, will have a major impact. Any device capable of sniffing explosives at a distance could also monitor all sorts of peacetime poisons and pollutants—carbon monoxide, mercury vapor, the oxides of nitrogen and of sulfur, and of course carbon dioxide and methane.

Dick is a member of the National Academy of Engineering. He serves on the Board of Directors for the Fannie and John Hertz Foundation, the Board of Directors of Precision Optics Corporation, and the Board of Trustees of Pacific University in Forest Grove, Oregon. He continues to serves as a member of the American Institute of Aeronautics and Astronautics (AIAA) Plasmadynamics and Lasers Technical Committee. He is also the Princeton Representative of the New Jersey Space Grant Consortium, and adviser to the Princeton Student Chapter of the AIAA. He serves as a representative for the AIAA on the Elmer A. Sperry Board of Award and was chair of that board from 2009 until this past December. He is the founder of Plasma TEC Inc. In recognition of his many contributions to the aerospace community, he received the AIAA Plasmadynamics and Lasers Award for 2012, and the AIAA Aerodynamic Measurement Technology Award for 2000.