

## Editor-in-Chief



R. H. WOODWARD WAESCHE is a Senior Scientist at Science Applications International Corporation (SAIC) and received his B.A. in Physics from Williams College in 1952, his M.A. in 1962, and his Ph.D. in Aerospace and Mechanical Sciences from Princeton University in 1965. Before joining SAIC in 1993, he served in the U.S. Army, and held senior positions at Rohm & Haas Company (1954–1966), United Technologies Research Center (1966–1981), and Atlantic Research Corporation (1981–1992). His research interests center on propulsion-related combustion, especially on unsteady combustion in solid-propellant rockets and its suppression by additives. He has also performed extensive research on combustor flowfields; his most recent publications, one of which won the Solid Rockets Best Paper Award (1990), dealt with flow in the Space Shuttle Booster. Dr. Waesche chaired the AIAA Propellants & Combustion Technical Committee (1975–1977) and is currently Director-Technical of the AIAA Propulsion & Energy Group, a long-time member (since 1978) of the Technical Activities Committee, and a member of the AIAA Finance Committee. He served as Editor-in-Chief of the *Journal of Spacecraft and Rockets* from 1980 to 1986, when he assumed the post of Editor-in-Chief of this journal. Dr. Waesche is a Fellow of the AIAA, and has contributed an article on Spectroscopy to the *Dictionary of Science and Technology*, among numerous technical publications.

## Associate Editors

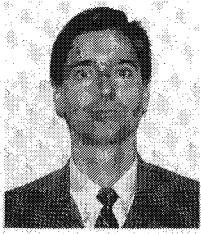
HENRY W. BRANDHORST is presently Chief of the Power Technology Division of the Aerospace Technology Directorate, National Aeronautics and Space Administration Lewis Research Center. Dr. Brandhorst earned his B.S. at the University of Oklahoma in 1957, and his Ph.D. degree in Nuclear Chemistry from Purdue University in 1961. In the same year, he joined the Lewis Research Center, where he developed the theoretical and experimental underpinnings for the cadmium sulfide-copper sulfide thin film solar cell as well as establishing the methodology for accurately determining the outer space performance of solar cells. Later he developed models for the maximum theoretical efficiency of the silicon solar cell, which have been confirmed experimentally in the last several years. In the 1970s, he also established the measurement methodology for terrestrial solar cells, working with the U.S. Department of Energy. Dr. Brandhorst has authored more than 100 technical publications in the areas of photovoltaics, solar cell measurements and advanced spacecraft technologies. Dr. Brandhorst became Chief of the Power Technology Division in 1984, and is responsible for research and technology development programs in space power and terrestrial energy. Dr. Brandhorst has been honored with the IEEE William R. Cherry Award and the NASA Exceptional Engineering Achievement Award for his work in photovoltaics. In the past he has served on the editorial board of the IEEE Transactions of Electron Devices as well as other journals. He is a member of Phi Lambda Upsilon, Alpha Chi Sigma, and the Society of Sigma XI.



JOHN BROPHY has been the supervisor of the Advanced Propulsion Technology Group at the Jet Propulsion Laboratory (JPL) since 1991, and is responsible for determining the direction and execution of NASA's advanced propulsion technology program. He has been with JPL since 1985, except for two years, from 1988 to 1990, which he spent working for a small business specializing in electric propulsion. John Brophy received a Ph.D. in 1984 in Mechanical Engineering from Colorado State University. Prior to that he worked at NASA's Marshall Space Flight Center from 1980 to 1981. In addition he received an M.S. degree in Mechanical Engineering from Colorado State University in 1980 and a B.S. degree in Mechanical Engineering from the Illinois Institute of Technology in 1978. Dr. Brophy is the author of over 50 conference papers, journal articles, and reports dealing with electric and advanced propulsion technology development, he holds three patents related to electric propulsion and has received six NASA Certificates of Recognition and one AIAA Certificate of Merit for contributions to electric propulsion.



RODNEY L. BURTON received his Ph.D. in the area of Electric Propulsion from Princeton University in 1966. He has been a faculty member at the University of Illinois at Urbana-Champaign, in the Department of Aeronautical and Astronautical Engineering, since 1989. His primary research interests are electric rocket propulsion, high pressure combustion, high velocity guns, and high energy arc discharges, and he advises the thesis research of graduate and undergraduate student students in these areas. He was General Chairman of the AIAA International Electric Propulsion Conference in 1990. From 1981–1989 he was with G.T.-Devices, Inc., Alexandria, Virginia, performing basic research on electrothermal arc discharges and electromagnetic railguns. From 1979–1981 he was with the Plasma Propulsion Laboratory, Princeton University, where he measured the performance of the "benchmark" MPD thruster. He is the author of 100 journal articles and reports.



**PATRICK BARRY BUTLER** is Associate Professor of Mechanical Engineering at the University of Iowa and received B.S. and M.S. degrees in Aeronautical and Astronautical Engineering from the University of Illinois at Urbana-Champaign and a Ph.D. in Mechanical Engineering from the same university. Dr. Butler is active in a number of aerospace-related instructional and research activities at the University of Iowa, where he also serves as campus coordinator of the Iowa Space Grant Consortium. His current research interests include multi-phase reactive flows, shock initiation of energetic materials, and combustion of solid propellants and pyrotechnics. Dr. Butler has worked as a visiting research Fellow for the U.S. Navy and Sandia National Laboratories where he conducted research in the area of solid propellant and energetic materials modeling. In addition to his editorial duties with the *AIAA Journal of Propulsion and Power*, Dr. Butler is a member of the AIAA Technical Committee on Propellants and Combustion. In 1991 he was awarded the Society of Automotive Engineers' Ralph R. Teetor Educational Award from the Aerospace Division, and the American Society of Mechanical Engineers' Outstanding Professor Award from the student chapter at the University of Iowa.



**WILLIAM W. COPENHAVER** is currently director of the Compressor Aero Research Lab within the Wright Laboratory, Aero Propulsion and Power Directorate, Turbine Engine Division. He is responsible for identifying and directing compressor component basic and applied research to meet Air Force air breathing engine development requirements. Air Force research under his direction is related to the development of physics-based models that accurately represent the loss, blockage, and stability of advanced transonic fans and compressors. The models developed in the Lab are used in an advanced design system to explore innovative component designs. Prior to his current position, Dr. Copenhaver was assigned to the Air Force, Compressor Research Facility (CRF), Test Group and Data Acquisition Group. While in the test and data groups, he was responsible for the planning, development, and preparation of full scale compressor component test programs. Dr. Copenhaver holds an M.S. degree from Virginia Tech, and a Ph.D. in Mechanical Engineering from Iowa State University. He is a Senior Member of AIAA serving on the Air Breathing Propulsion Technical Committee, and a member of ASME serving on the International Gas Turbine Institute Turbomachinery Committee.



**GEORGE B. COX JR.** is a Project Engineer at Pratt & Whitney/Government Engines & Space Propulsion in West Palm Beach, Florida. He graduated in 1966 from The Johns Hopkins University with a Bachelor of Engineering Science degree, and was awarded a Master of Mechanical Engineering degree in 1968 from North Carolina State University. He has worked for 26 years at Pratt & Whitney in combustion and fluid dynamics, including rocket engine, gas dynamic and chemical laser, and gas turbine engine component design and development. His most recent activity includes analytical and CFD modeling for the Space Shuttle Engine Study program, direction of CFD support for National Aerospace Plane effort at Pratt & Whitney, and combustion and aerodynamic support for the Alternating Turbopump Development Program. Mr. Cox has 12 publications on gas turbine and rocket engine design systems, component design and development, and modeling. He also has three patents awarded, and one pending, in the fields of gas turbine, gas dynamic laser, and rocket combustion.



**DANIEL B. FANT** was selected as the new program manager for the Advanced Gas Turbine Systems Research (AGTSR) program and started working at the South Carolina Energy R&D Center at Clemson University on August 29, 1994. The AGTSR program is a university-industry research consortium dedicated to advancing stationary gas turbine engine design for the next generation of land-based power generation systems. Dan recently retired from the U.S. Air Force after 15 years of service, and during his career he served in various engineering capacities: as project officer for advanced space transportation concepts at the Space Division in Los Angeles, CA; laboratory research associate at MIT-Draper Laboratory in Cambridge, MA; assistant professor of aerospace engineering at the Air Force Institute of Technology in Wright Patterson AFB, Dayton, OH; and in his last assignment, at Bolling AFB in Washington, D.C. as program manager of basic research in turbomachinery flows and high angle-of-attack unsteady aerodynamics. He received his B.S. in Mechanical Engineering from the University of Connecticut, his M.S. in Aeronautical Engineering from the Air Force Institute of Technology, and his Ph.D. from Iowa State University in Mechanical Engineering. Dan is also a licensed professional engineer in the State of Ohio.



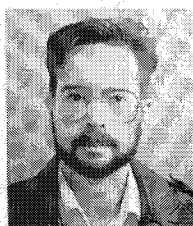
**ROBERT FREDERICK** received a B.S.M.E. from Purdue University in 1980 and later completed his Ph.D. at Purdue University in Aeronautics and Astronautics in 1988. His industrial experience comes from two years at Phillips Laboratory in propellant development and three years at Arnold Engineering Development Center in solid motor diagnostics and analysis. He is currently an Assistant Professor of Mechanical and Aerospace Engineering at the University of Alabama in Huntsville and a member of the UAH Propulsion Research Center. His work at the university involves research in hybrid combustion, plume diagnostics, and solid propellant development. Professor Frederick has also been active in developing design courses and advised the winning team in the 1994 AIAA Graduate Team Missile Design Competition. Professor Frederick is a Senior Member of the AIAA and the vice-chairman of the Hybrid Rocket Technical Committee.



LAWRENCE A. KENNEDY is currently the Ralph W. Kurtz Distinguished Professor of Mechanical Engineering at Ohio State University. Beginning in January 1995 he will be Dean, College of Engineering at the University of Illinois at Chicago. At OSU he served as Chairman of Mechanical Engineering for the period 1983–1993. He also served as Acting Director of the Center for Automotive Research and is a Professor at the Ohio Aerospace Institute at NASA Lewis Research Center. Prior to joining Ohio State he was on the faculty of the State University of New York at Buffalo. He has been a Visiting Professor at Princeton University, the University of Michigan, the von Karman Institute of Fluid Dynamics, and the University of California/San Diego. Professor Kennedy received his Ph.D. and M.S. degrees from Northwestern University in 1964 and 1962, respectively, and his B.S. degree in 1960 from the University of Detroit. His technical interests include the broad areas of combustion, fluid mechanics, and heat transfer. Professor Kennedy is a Fellow of ASME, an Associate Fellow of AIAA and a member of the Combustion Institute, SAE, APS, and ASEE. He is a registered Professional Engineer in New York. He has been a NATO Senior Fellow in Science, a U.S. Consultant to AGARD, NSF Senior Science Fellow, and a Goebel Visiting Professor at Michigan. In 1993 he received the Ralph Coats Roe Award.



JAYESH M. MEHTA received his M.S.M.E. from the Georgia Institute of Technology, and began his professional career at Lockheed Aircraft Corporation, Marietta, Georgia. For the next four years, at Lockheed, Dr. Mehta was responsible for analytical and experimental studies on airfoil wake flows, separated boundary layers, and LDA measurements in subsonic/supersonic jets. In 1980 Dr. Mehta initiated the graduate program at Illinois Institute of Technology, Chicago, which culminated in receiving his doctorate in Mechanical Engineering in 1985. During this time, Dr. Mehta also worked as a Summer Research Fellow at Argonne National Laboratory. Between 1985 and 1993, Dr. Mehta was a lead engineer at General Electric Aircraft Engines in the combustion and emissions area. At GE he was responsible for several of the combustor/augmentor development programs including Phase I of the NASA HSCT program. In addition, he was also a program manager on two of the Navy programs on combustion instability. Between 1993 and 1994 he was employed at Allison Engine Company. At Allison he contributed to the successful completion of Phase I of the DOE Advanced Turbine Systems (ATS) program, and development of a technical proposal for the ATS Phase II program. Since November 1994 Dr. Mehta has been working with Analytic and Computational Research, Inc. (ACRI) as a senior engineer. Dr. Mehta is very active in various national AIAA and local ASME/OAI activities. He is a secretary/treasurer of the AIAA propellants and combustion technical committee, founding member of the OAI focus group on fluid and propulsive systems, and a past chairman of the Cincinnati area ASME chapter. He also has contributed to heat transfer/combustion literature with over 40 archival papers/reports and presentations in those areas. He has been recently inducted into Who's Who of Technology, 1995 edition.



MICHAEL M. MICCI is an Associate Professor of Aerospace Engineering and is associated with the Propulsion Engineering Research Center at the Pennsylvania State University. He received a B.S. and M.S. in Aeronautical and Astronautical Engineering from the University of Illinois at Urbana-Champaign, and a Ph.D. in Mechanical and Aerospace Engineering from Princeton University. He joined the faculty at Penn State in 1981, where he teaches and conducts research in rocket propulsion. He spent 1987 as a Visiting Scientist at the Air Force Office of Scientific Research and the 1990–1991 academic year on sabbatical leave at ONERA, Palaiseau, France. He is a member of the AIAA Liquid Propulsion Technical Committee.



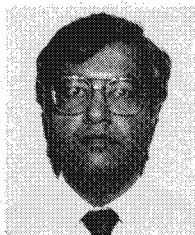
ROGER M. MYERS received his B.S. in Aerospace Engineering from the University of Michigan and his Ph.D. in Mechanical and Aerospace Engineering from Princeton University while working in the Electric Propulsion Laboratory. He joined the NASA Lewis Research Center Group of Sverdrup Technology in 1988 and became supervisor of the Space Propulsion Technology Section in 1989. He continues in this capacity at NASA Lewis, now working for Nyma, Inc. Since joining the On-Board Propulsion team at NASA Lewis, he has worked on a wide range of propulsion technologies and system/mission analyses. The propulsion systems include solid propellant pulsed plasma thrusters, pulsed and steady-state magnetoplasmadynamic thrusters, low power arcjets, electrostatic ion thrusters, Russian Hall thrusters, and small chemical rockets. The mission studies have included a range of both Earth-space and planetary missions, most recently focusing on small satellite applications. His research has also included the development of plasma diagnostics for thruster and spacecraft integration studies and fundamental research on electrode physics in plasma discharges. He has authored over 37 publications and is a member of the AIAA Electric Propulsion Technical Committee.



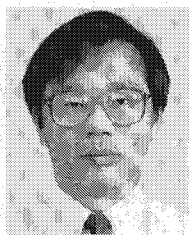
CARLSON C. P. PIAN received his B.S., M.S., and Ph.D. degrees from the University of Michigan in Aerospace Engineering. He did post-doctoral work in the field of MHD power conversion at the Eindhoven Technical University in the Netherlands. Dr. Pian is on the faculty of the Diagnostic Instrumentation and Analysis Laboratory at Mississippi State University, involved in research and development of plasma arc torches and vitrification technologies for waste treatment. Previously at Textron Defense System's Everett Laboratory (formerly the Avco Everett Research Laboratory), Dr. Pian was the Director of Commercial MHD Component Development. He also served as the Director of MHD Integrated Topping Cycle Program, was responsible for the technical direction and administration of the program, including research and development, and the design and fabrication of MHD power generators. Dr. Pian was also involved in system design studies and analyses of MHD power conversion experiments and providing theoretical support of these experiments; and worked on analytical modeling of flows in gas turbine combustors. Prior to joining Avco, Dr. Pian was a research engineer at NASA Research Center where he was engaged in research and analysis relevant to MHD power generators and systems. These included both combustion-gas and nonequilibrium MHD generators. Dr. Pian is a Senior Member of AIAA and previously served on both the Plas-madynamics and Lasers and the Terrestrial Energy Systems Technical Committees. He was also a member of the Board of Directors of the Symposium on the Engineering Aspects of MHD. Dr. Pian has authored or co-authored over 60 technical papers related to MHD power conversion and space plasma.



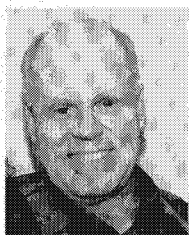
MOHAMMAD (Mo) SAMIMY received his B.S. in Mechanical Engineering from Sharif (Arya-Mehr) University of Technology in Tehran in 1978, and his M.S. and Ph.D. in Mechanical Engineering from the University of Illinois at Urbana-Champaign in 1981 and 1984. He taught and conducted research at the University of Illinois for a year as a Visiting Assistant Professor before moving to the Ohio State University where he is currently a Professor of Mechanical Engineering. He has given invited lectures in many institutions in the U.S. and abroad. Professor Samimy has conducted research at the University of Illinois, the Ohio State University, the University of Poitiers in France, NASA Lewis Research Center, the NASA Ames/Stanford University Center for Turbulence Research, and the Advanced Propulsion Division of Wright Laboratory in the areas of compressible turbulence, high and low speed flow control, particle laden flows, and advanced optical diagnostics of flows. He has published over 80 technical papers and reports. Professor Samimy is an Associate Fellow of AIAA.



SAADAT A. SYED is currently the manager of the Combustor Augmentor and Hypersonic Technology group at Pratt and Whitney, which is located in West Palm Beach, Florida. He has over 27 years of experience in teaching, research, and technology development. He received his B.S. from the University of Karachi, Pakistan, his M.S. is from the University of Ottawa, Canada, and his Ph.D. is from Imperial College, London, England. His areas of expertise are Computational Fluid Dynamics, Combustion, and Hypersonics. He has written over 32 technical papers. He is an Associate Fellow and a long time member of AIAA, and has been active in AIAA in various capacities including chairing and organizing conference sessions, reviewing journal articles, and membership of the Fluid Dynamics technical committee.



VIGOR YANG received his B.S.M.E. from National Tsing Hua University in Taiwan in 1976 and Ph.D. from the California Institute of Technology in 1984. Following one year as a Research Fellow in Jet Propulsion at Caltech, he joined the faculty at the Pennsylvania State University in 1985. He is currently a Professor of Mechanical Engineering and serves as a consultant to several industrial and government laboratories. His research mainly involves combustion instabilities in propulsion systems, high-pressure droplet/spray combustion, rocket interior ballistics, and combustion of energetic materials. He has organized several international meetings and workshops devoted to various combustion aspects of liquid and solid propellants in rocket engines. He was the recipient of the Penn State Engineering Society Outstanding Teaching and Research Awards in 1989 and 1992, respectively. Professor Yang is an Associate Fellow of AIAA.



JAMES L. YOUNGMANS is Manager of Advanced System Design and Analysis at General Electric Aircraft Engines and is located in Evendale, Ohio. He received his B.S. and M.S. from the University of Cincinnati and an M.B.A. from Xavier University. He joined the technical staff at General Electric in 1963 and has held positions of increasing responsibility in Turbine Heat Transfer, Installation Aerodynamics, Low Observables, and System Design. He is a member of the AIAA Air Breathing Propulsion Technical Committee and the ASME Aircraft Engine Committee.