

Announcements and Acknowledgments

THIS editorial announces recent policy and personnel changes and acknowledges services to the *Journal of Propulsion and Power (JPP)*.

Ethical Standards. The *JPP* editors have full responsibility for maintaining the AIAA ethical standards for reviewing and accepting papers according to the AIAA definition of the journal scope and the community perception of standards and quality for scientific and engineering work and its presentation. An author's central obligation is to present a concise, accurate account of the research performed as well as an objective discussion of its significance. References that have been influential in determining the nature of the reported work must be properly cited. Information obtained privately should not be used or reported without explicit permission from the investigator with whom the information originated. Plagiarism, double submission, and unfair treatment of authorship are strictly prohibited and may be subject to penalties set forth by the AIAA Publication Ethical Standards Subcommittee. The AIAA Publications Committee and Editors-in-Chief are in the process of approving a revision to our long-standing Ethical Standards for Publication of Aeronautics and Astronautics Research. The revised document is published elsewhere in this issue. Instances of plagiarism, intentional or otherwise, have increased dramatically with the increase in the availability of documents electronically. Please take the time to read our Ethical Standards and to help to educate others on their applicability. The Editorial Policy Statement on Numerical and Experimental Accuracy published in this issue has also been revised. Authors are encouraged to read it.

Format and Editorial Review. Effective August 2004, all new submissions have been undergoing an initial format and editorial review to ensure that the AIAA manuscript preparation guidelines are closely followed, especially in terms of artwork quality, reference format, and general technical substance. Only those manuscripts that meet the basic aesthetic and technical requirements will be accepted for external peer review and consideration for publication. This extra step of review has been shown to improve overall publication efficiency by avoiding any delay resulting from the revision of artwork and formatting after the manuscript has been accepted for publication based on scientific merit. It also allows reviewers to focus on the technical content of manuscripts without being side-tracked by editorial issues.

Special Sections. In light of recent advances in several critical technologies in aerospace propulsion and power, the *JPP* plans to publish three special sections in 2006, devoted to turbine science and technology, detonations in propulsion, and emissions of aircraft particulate matters. The first one, led by Tom I. Shih, includes eleven papers covering such important subject areas as cooling, high-cycle fatigue, aerodynamics, material erosion, surface coating, superalloys, nondestructive evaluation and health monitoring. The second one, edited by Joseph M. Powers and Sergey Frolov, deals with the applications of detonation in propulsion systems. A total of sixteen papers prepared by well-known experts will address various fundamental scientific and technological implementation issues. The third one, organized by Lourdes Q. Maurice, focuses on emissions of aircraft particulate matters. This is a critical issue to aviation with the new EPA rules, and will be discussed by twelve papers in a well-rounded manner. In addition to the above three sections, the *JPP* has identified three special topics for future publication. These include weakly ionized plasmas for enhanced propulsion, nano-scale energetic materials, and SMART-1 solar-electric propulsion, led by Sergey Macheret, Steve Son, and Edgar Choueiri, respectively.

Editorial Advisory Board. We are indebted for the continuing services of the Editorial Advisory Board, whose primary functions are (1) to help define editorial policy and operation, (2) to provide

advice to the editor-in-chief, (3) to promote emerging technologies and related research and development, and (4) to help recruit associate editors. The biographies and photographs of the sixteen board members, representing most, if not all, of the important disciplines in aerospace propulsion and power, are listed in the following pages, together with those of the *JPP* Associate Editors. The contributions of these individuals in helping to improve and maintain the quality of the journal are gratefully acknowledged. I wish to express my special gratitude to our retiring member: Fred E. C. Culick of *California Institute of Technology*. The *JPP* has benefited tremendously from his advisory work. His responsibilities will be assumed by Ronald K. Hanson of *Stanford University*. We are privileged to have such a distinguished colleague join in our efforts.

Reappointed Associated Editors. Readers of the *JPP* are indeed fortunate to have a strong group of Associate Editors (AEs) processing the reviews of manuscripts. We are fortunate this year that Feng Liu, *University of California, Irvine*, Lourdes Q. Maurice, *Federal Aviation Administration*, Roger M. Myers, *Aerojet Gen-Corp.*, and Joseph M. Powers, *University of Notre Dame*, have agreed to serve another three-year term as AEs. Their continued presence will help maintain the editorial continuity of the journal. We deeply appreciate their exemplary service and on-going commitment.

Newly Appointed Associate Editors. Two names are being added to the masthead. Douglas G. Talley, *U.S. Air Force Research Laboratory*, is widely recognized for his research in multiphase combustion and heat transfer, pulse detonation engines, high-pressure sprays and combustion, and liquid rocket propulsion. Steven F. Son, *Los Alamos National Laboratory*, is a well accomplished expert in combustion of energetic materials, micro-energetics, nano-scale composite energetic materials, oscillatory combustion, and deflagration-to-detonation transition. I welcome these outstanding individuals and thank them for agreeing to serve.

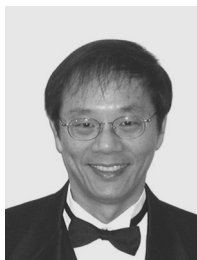
Continuing Associate Editors. Individuals who will continue their service as AEs for the coming year are: C. Thomas Avedisian, *Cornell University*; Rodney D. W. Bowersox, *Texas A&M University*; Edgar Choueiri, *Princeton University*; Alec D. Gallimore, *University of Michigan*; Ashwani K. Gupta, *University of Maryland*; Timothy C. Lieuwen, *Georgia Institute of Technology*; Joseph C. Oefelein, *Sandia National Laboratories Combustion Research Facility*; Tom I. Shih, *Iowa State University*; Gregory G. Spanjers, *U.S. Air Force Research Laboratory*; Choon S. Tan, *Massachusetts Institute of Technology*; Ten-See Wang, *NASA Marshall Flight Center*; and Liping Xu, *Cambridge University*. The dedication of these individuals to the journal is greatly appreciated.

Retiring Associate Editors. Special thanks are due to our retiring Associate Editors: Quinn Brewster, *University of Illinois*, and Winfred A. Foster, *Auburn University*. Their service has been an essential part of the review and publication process. I have been fortunate to have worked with them, and wish to acknowledge their outstanding contributions to the *JPP*.

Acknowledgments. I wish to express my sincere thanks to the editorial staff of the AIAA for their invaluable assistance and effective management, as follows: David S. Dolling (Vice President-Publications); Norma J. Brennan (Director of Publications); and Amanda Maguire (Managing Editor, *JPP*). The publication staff at TechBooks, coordinated by Angela Weaver, is gratefully acknowledged. The individuals who have provided their time and expertise in reviewing the manuscripts also deserve special recognition. Their names appear in the following pages. Finally, we owe a large debt of gratitude to all of the authors in preparing the fine papers presented here.

V. Yang
Editor-in-Chief

Editor-in-Chief



VIGOR YANG, Distinguished Professor of Mechanical Engineering at the Pennsylvania State University, received his B.S. from the National Tsing Hua University and Ph.D. from the California Institute of Technology. His research interests include combustion instabilities in propulsion systems, chemically reacting flows in air-breathing and rocket engines, combustion of energetic materials, and high-pressure thermodynamics and transport. He has supervised 39 Ph.D. and 15 M.S. theses. He is the author or co-author of more than 250 technical papers in the areas of propulsion and combustion, and has published 9 comprehensive volumes on rocket and air-breathing propulsion. He was the recipient of the Penn State Engineering Society Premier Research Award, and several publication and technical awards from AIAA. Dr. Yang also serves on the editorial advisory boards of *Combustion and Flame*, *Progress in Energy and Combustion Science*, *Journal of Combustion, Explosion, and Shock Waves*, and *Journal of the Chinese Institute of Engineers*. He has been a consultant to many U.S. rocket and gas-turbine engine companies as well as government organizations. Dr. Yang is a Fellow of the AIAA and American Society of Mechanical Engineers.

Associate Editors



C. THOMAS AVEDISIAN, Professor in the Sibley School of Mechanical and Aerospace Engineering at Cornell University, is currently interested in research including droplet and spray combustion, particulate emissions and control during combustion of fuel droplets, impingement of droplets and fluid jets, thermal analysis of composite materials, and rapid evaporation of liquids. He was previously a member of the technical staff at AT&T Bell Laboratories (Holmdel, New Jersey), a Visiting Scientist at the National Institute of Standards and Technology (Gaithersburg, Maryland), and a Visiting Professor at Brown University. He is the recipient of three AIAA Best Paper Awards for research on droplets and sprays, and the James Harry Potter Gold Medal (1999) from the American Society of Mechanical Engineers (ASME) for eminent scientific achievements in the thermal sciences. He received his B.S. (1972) from Tufts University, his S.M. (1974) from Massachusetts Institute of Technology, and his M.A. (1977) and Ph.D. (1980) from Princeton University. He has been at Cornell since 1980. He is a Fellow of ASME and was Chair of the ASME Heat Transfer Visualization Committee from 1993 to 1997. He is a member of the Combustion Institute and is a Fellow of AIAA, where he is a member of the AIAA Terrestrial Energy Committee.



RODNEY D. W. BOWERSOX is an Associate Professor of Aerospace Engineering Department at Texas A&M University. He received his Ph.D. (1992), M.S. (1990) and B.S. (1988) all in aerospace engineering from Virginia Polytechnic Institute & State University. His research interests include theoretical and experimental analyses of high-speed and unsteady flow fields with applications in aerodynamics and aerospace propulsion. He is experienced in gasdynamics, laser/optical experimental methods, flow control and turbulence modeling. His research program has produced over 90 technical articles. He was awarded five Air Force Scientific Achievement Awards (1996–1997) and the Col. Charles A. Stone Award (1995) for leadership for his research program. He received the Lockheed Martin Excellence in Engineering Teaching Award in 2004. Dr. Bowersox is an Associate Fellow of the AIAA, and he serves on the HyTASP Committee. He also serves as an U.S. National Committee Member of the International Society for Air Breathing Engines.



EDGAR CHOEIRI is Director of the Engineering Physics Program at Princeton University, where he also heads the Electric Propulsion and Plasma Dynamics Laboratory. He is Associate Professor in Applied Physics at Princeton's Mechanical and Aerospace Engineering Department and Associated Faculty at the Department of Astrophysical Sciences (Program in Plasma Physics). He holds a Ph.D. from Princeton University and is the author of numerous analytical, experimental, and numerical papers on electric and plasma propulsion, plasma physics and dynamics, instabilities and turbulence in collisional plasmas, plasma thruster numerical modeling, and applied mathematics. He is an Associate Fellow of AIAA and is the Chairman of the AIAA Electric Propulsion Technical Committee for 2002–2004.



ALEC D. GALLIMORE is Professor of Aerospace Engineering and of Applied Physics at the University of Michigan, where he directs the Plasmadynamics and Electric Propulsion Laboratory, and Associate Dean at the Horace H. Rackham School of Graduate Studies. Professor Gallimore is also the Director of the NASA-funded Michigan Space Grant Consortium. He received his B.S. in aeronautical engineering from the Rensselaer Polytechnic Institute in 1986, and his M.A. and Ph.D. in aerospace engineering from Princeton University in 1988 and 1992, respectively. His primary research interests include electric propulsion, plasma diagnostics, and space plasma simulation. He has experience with a wide array of electric propulsion technologies including Hall thrusters, ion engines, arcjets, and MPD thrusters, and has implemented a variety of probe, microwave, and optical/laser plasma diagnostics. Professor Gallimore is the author of more than 170 journal and conference papers on electric propulsion and plasma physics. He has been the recipient of a number of University of Michigan prizes including the Trudy Huebner Service Excellence Award in 2005, the Harold R. Johnson Diversity Service Award in 2005, and the Outstanding Accomplishment Award in Aerospace Engineering in 2002. He received the Best Paper in Electric Propulsion Award for work presented at the 1998 Joint Propulsion Conference. Professor Gallimore serves on the AIAA Electric Propulsion Technical Committee and is an Associate Fellow of AIAA.



ASHWANI GUPTA is a Professor of Mechanical Engineering at the University of Maryland. His academic experience includes 6 years as member of the research staff at MIT in the Energy Laboratory and Department of Chemical Engineering, 3 years as senior research associate and independent research worker at Sheffield University in the Department of Chemical Engineering and Fuel Technology, and 17 years at the University of Maryland. He spent four months in Japan as a consultant to several companies. At present he serves as an international consultant on a major project sponsored by the Japanese Government. He is the author of over 150 publications in the areas of combustion, swirl flows, diagnostics, fuel sprays, hazardous waste thermal destruction, pollution, and alternative fuels. He has coauthored two books and edited seven books. Presently he is co-editor of the Energy and Environmental Series of books published by CRC Press. He has been the recipient of the AIAA Propellants and Combustion Award and Energy System Award, George Westinghouse Gold Medal of American Society of Mechanical Engineers (ASME), and four Best Paper Awards from AIAA and ASME. Dr. Gupta received his Ph.D. from Sheffield University in 1973. He was awarded his D.Sc. from Sheffield University in 1986 for international recognition and publication of high-quality original research. Dr. Gupta is the AIAA Deputy Director of Energy and was previously the Chair of the AIAA Terrestrial Energy and Propellants and Combustion Technical Committees. Dr. Gupta is a Fellow of AIAA, ASME, and the Institute of Energy, U.K., and a Member of Society of Automotive Engineers and the Combustion Institute.



TIM LIEUWEN is Associate Professor in the School of Aerospace Engineering at Georgia Institute of Technology. His research interests include combustion instabilities, combustion of alternative fuels, control of combustion phenomenon, flame-acoustic wave interactions, combustion noise and engine health monitoring. He was awarded the National Science Foundation Career Award in 2000, the Sigma XI Young Faculty Award in 2004, and the AIAA Lawrence Sperry Award in 2005. Dr. Lieuwen is on the Air Breathing Propulsion Technical Committee of the AIAA, where he serves as the Joint Propulsion Conference Planning Subcommittee Chair. He is also a member of the Combustion and Fuels Committee of the ASME, where he serves as point contact. He is a member of AIAA, ASME, The Acoustical Society of America, the American Society for Engineering Education, and the Combustion Institute. He received his Ph.D. from Georgia Institute of Technology.



FENG LIU, Professor of Mechanical and Aerospace Engineering at the University of California, Irvine, received his B.S. (1982) from Northwestern Polytechnic University in Xi'an, China; M.S. (1984) from Beijing University of Aeronautics and Astronautics; and Ph.D. (1991) from Princeton University. His research interests include computational fluid dynamics, transonic, reactive, and two-phase flows, turbomachinery aerodynamics, aeroelasticity, and gas-turbine engine cycle innovation. He is the author or co-author of more than 100 journal and conference papers. He was the recipient of the Outstanding Engineering Professor Award from the students of Class 2000 at UC Irvine. Dr. Liu is an Associate Fellow of the AIAA and a Member of the American Society of Mechanical Engineers. He serves on the AIAA Air-breathing Propulsion Technical Committee.



LOURDES Q. MAURICE is the Chief Scientific and Technical Advisor for Environment in the Federal Aviation Administration's Office of Environment and Energy. She serves as the agency technical expert for basic and exploratory research, and advanced technology development focused on aircraft environmental impacts and its application to noise and emissions certification. She previously served as the Air Force Deputy, Basic Research Sciences and Propulsion Science and Technology in the office of the Deputy Associate Secretary of the Air Force for Science and Technology. She also worked at the Air Force Research Laboratory's Propulsion and Power Directorate from 1983 to 1999 planning and executing basic, exploratory, and advanced development propulsion science and technology programs, focusing on state-of-the-art aviation fuels and propulsion systems. Her areas of expertise include pollutant formation chemistry, combustion kinetics, hypersonic propulsion, and aviation fuels. She received her B.Sc. in chemical engineering and M.Sc. in aerospace engineering from the University of Dayton in Dayton, Ohio and her Ph.D. in mechanical engineering from the University of London's Imperial College at London, United Kingdom. She is also a Distinguished Graduate of National Defense University's Industrial College of the Armed Forces, where she earned a M.Sc. in National Resource Strategy. Lourdes has served as an advisor to the United Nation's Intergovernmental Panel on Climate Change and the National Academies of Science National Research Council. She is an Associate Editor for AIAA's *Journal of Propulsion and Power* and serves on the Editorial Board of the *International Journal of Aeroacoustics*. She has authored over 90 publications and is 2003 Fellow of AIAA.



ROGER M. MYERS is the Executive Director of Systems and Technology Development at Aerojet-Redmond Rocket Center, leading development, qualification, and first-article production efforts in chemical and electric propulsion systems. He received his B.S. in aerospace engineering from the University of Michigan in 1984 and his Ph.D. in mechanical and aerospace engineering from Princeton University in 1989. 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 continued to serve in this capacity with Nyma, Inc., becoming Deputy Director of Aerospace Technology in early 1996. He left Nyma for Primex Aerospace (now Aerojet-RRC) later that year, serving as Director, Electric Propulsion until 2000, when he assumed the broader role as the leader for Systems and Technology Development. He has worked on a wide range of propulsion technologies, spacecraft integration assessments, and missions/systems analyses. The propulsion systems include Hall thrusters, arcjets, ion thrusters, pulsed plasma thrusters, magnetoplasmadynamic thrusters, and both conventional and advanced monopropellant and bipropellant chemical rockets. The spacecraft integration assessments and mission analyses have included a wide range spacecraft and missions, from small LEO communications satellites to large interplanetary spacecraft. He has authored over 70 publications on spacecraft propulsion, was Chairman of the AIAA Electric Propulsion Technical committee from 1998–2000, has been an Associate Editor of the *Journal of Propulsion and Power* since 1992, and co-teaches the AIAA Electric Propulsion Short course.



JOSEPH C. OEFELEIN received a Doctorate in mechanical engineering from The Pennsylvania State University in May 1997, an M.S. in mechanical engineering from The Pennsylvania State University in December 1992, and a B.S. in mechanical engineering (with highest honors) from Rutgers University in May 1989. He is currently employed as a Principal Member of Technical Staff at the Sandia National Laboratories Combustion Research Facility. His research interests are interdisciplinary, with focus on the theory, numerical modeling and analysis of complex fluid flows where turbulence, combustion, high-pressure phenomena and (or) multiphase phenomena play a controlling role. Concurrent interests are focused in the general area of numerical methods for partial differential equations, with emphasis placed on computational fluid dynamics (CFD), applied numerical analysis, large-scale scientific computing and parallel processing. He has extensive experience in the development and application of the large-eddy-simulation (LES) technique and the related subgrid-scale models to both fundamental flows and device-scale components such as liquid-rocket injectors, gas-turbine combustors and internal combustion engines.



JOSEPH M. POWERS, Associate Professor of Aerospace and Mechanical Engineering at the University of Notre Dame, received his B.S., M.S., and Ph.D. in mechanical engineering from the University of Illinois at Urbana-Champaign in 1983, 1985, and 1988, respectively. His research interests include detonation theory, pyrotechnic combustion, highspeed propulsion, transition to detonation in solid propellants, high speed flows in reactive porous media, numerical and theoretical methods for multiscale phenomena, and systematic reduction of large systems of chemical kinetics. He is the author of several papers in the archival literature and has supervised many M.S. and Ph.D. students since joining the faculty in 1989. He held summer appointments at NASA Glenn Research Center and the U.S. Air Force Wright Laboratories at Eglin AFB and at Los Alamos National Laboratory. He is the recipient of the University of Notre Dame's Amoco-College of Engineering Outstanding Teacher of the Year Award in 1994, and Department Faculty Award in 1997. He received a NASA Innovative Technology Award in 1999. Dr. Powers is a Member of Society for Industrial and Applied Mathematics, American Society of Mechanical Engineers, American Society for Engineering Education, and the Combustion Institute. He is an Associate Fellow of AIAA.



TOM I-P. SHIH is Professor and Chairperson of the Department of Aerospace Engineering at Iowa State University. Previously, he was at Michigan State University (Professor, 1998–2003), Carnegie-Mellon University (Associate Professor, 1988–93; Professor, 1993–98), University of Florida (Assistant Professor, 1983–87; Associate Professor, 1987–88), and NASA—Lewis (now Glenn) Research Center (Mechanical Engineer, 1981–82). He received his B.S.E. degree (1976) from the National Cheng Kung University, and his M.S.E. (1977) and Ph.D. (1981) degrees from The University of Michigan at Ann Arbor. Dr. Shih is a Fellow of ASME and an Associate Fellow of AIAA. Currently, he is chair of AIAA's Aerospace Department Chair Association, member of NASA's Council of Deans, and member of the Universities Space Research Association's nominating committee and Council of Institutions. Dr. Shih's research centers on computational fluid dynamics (CFD)—both in developing and improving it as a tool and in using it to study physical problems. He and his students have developed a number of algorithms and codes for grid generation, error estimation, and the study of compressible and incompressible flows. In using CFD, he and his students have studied shock-wave/boundary-layer interactions with bleed and blowing, internal and film cooling of turbine components, aerodynamics of iced airfoils, gas-turbine combustors, particle-particle/particle-fluid interactions, spray forming, automotive torque converters, thermoelectric power generation, and piston and rotary engine flow fields.



STEVEN F. SON received his Ph.D. from the University of Illinois at Urbana-Champaign, and is currently a Project Leader and Technical Staff Member at Los Alamos National Laboratory. He was a J. R. Oppenheimer Fellow at Los Alamos from 1993 to 1996. He has given numerous invited lectures at several research institutions, and at meetings of the Material Research Society (MRS), American Physical Society (APS), International Pyrotechnics Seminar, and Gordon Research Conferences. He has studied the combustion of energetic materials for over 15 years. His research interests include advanced energetic materials, microenergetics, microchannel combustion, nanoscale composite energetic materials, oscillatory combustion, instabilities, deflagration to detonation transition, and diagnostics. Steve is a member of the American Physical Society, American Society of Mechanical Engineers, and American Institute of Aeronautics and Astronautics. Steve is currently on sabbatical at Pennsylvania State University teaching a special topics course and doing research.



GREGORY G. SPANJERS is currently Program Manager for Deployable Structures Experiment (DSX) at the AFRL Space Vehicles Directorate, Kirtland AFB, NM. DSX is a basic research space flight experiment performing experiments on high-power generation in space, radiation-belt remediation, advanced structures, adaptive control of these structures, and space weather mapping in the MEO environment. Dr. Spanjers received the degrees of B.S. in physics and B.S. in mathematics from the University of Minnesota in 1986. He received his M.S. degree in 1990 and his Ph.D. in 1992, from the University of Washington performing plasma physics research for magnetic fusion. After working in industry and academia, he joined the AFRL Electric Propulsion Laboratory, Edwards AFB, as Principle Scientist in 1995, becoming Group Leader in 1998 and Branch Technical Advisor in 1999. Dr. Spanjers transferred AFRL Space Vehicles in 2002. He is the author of over 60 journal and conference papers and has 9 patents or patents pending for advanced spacecraft thrusters and structures. He is a member of the AIAA Electric Propulsion Technical Committee and serves on National Academy of Sciences NRC Review Panels and the Steering Committee for the Space Environmental Effects Working Group.



DOUGLAS TALLEY received his B.S. in engineering from Oakland University and then began his career as a naval nuclear engineer aboard a U.S. submarine in 1976. He entered graduate school following naval service, earning an M.S. and Ph.D. in mechanical engineering from Carnegie-Mellon University in 1983 and 1985, respectively. Following a teaching appointment at the University of Michigan, he accepted his present position in 1991 as a Senior Research Scientist in the Liquid Rocket Combustion Group, Propulsion Directorate, Air Force Research Laboratory (AFRL), a position that he still enjoys today. His general area of expertise is multiphase combustion and heat transfer, and he is currently engaged in basic research and exploratory development in liquid rocket propulsion. While at AFRL, he developed expertise in pulsed detonation rocket engines and pioneered an experimental program in high pressure sprays and combustion related to liquid rocket engines which has impacted several national programs. He is particularly well known for his work on injection and combustion at pressures exceeding the critical pressure of the propellants. He has over 50 publications and is winner of the W. R. Marshall best paper award (1999). He is Secretary of the Institute of Liquid Atomization and Spray Systems—Americas, sits on several advisory boards, and also serves on the editorial board of the journal *Atomization and Sprays*.



DR. C. S. TAN is Senior Research Engineer at the MIT Gas Turbine Laboratory, he received his B.S. in engineering from Victoria Manchester University UK in 1974, M.S. in aeronautics from California Institute of Technology in 1975, and Ph.D. in aeronautics and astronautics from MIT in 1978. His research interests include unsteady, three-dimensional flow and aero-structural interactions in multistage turbomachinery/propulsion systems. He has approximately 35 publications on internal flows, turbomachinery, and fluid mechanics in archival journals. He is a co-author of the book "*Internal Flow: Concepts and Applications*," published by the Cambridge University Press in 2004.



TEN-SEE WANG, the Technical Assistant of the Thermal and Combustion Analysis Branch at the NASA Marshall Space Flight Center (MSFC), received his B.S. from National Central University, M.S. from National Taiwan University, and his Ph.D. from the Louisiana State University. Before joining NASA he was affiliated with Science Applications International Corporation, Continuum Inc., Scientific Research Associates, and Software Engineers, Consultants, Analysts Inc. Dr. Wang has over 25 years of engineering and research experiences in the field of combustion driven flows, launch vehicle flows, and advanced propulsion systems. He has authored or co-authored 97 technical papers and 81 presentations and company reports. He is a Senior Member of AIAA and reviews technical papers for six professional journals. Since joining NASA, Dr. Wang has received 25 awards, including a NASA Exceptional Service Medal for technical contributions in the area of reacting flow analysis, rocket base flows, and plume predictions using computational fluid dynamics.



LIPING XU is a University Lecturer in turbomachinery in the Department of Engineering, University of Cambridge, UK. He received his B.Sc. from Beihang University (then Beijing Institute of Aeronautics and Astronautics), Beijing, China and a Ph.D. from University of Cambridge. His major research and teaching area is three-dimensional and unsteady flows in turbomachinery, especially fan aerodynamics. Prior to the appointment at Cambridge, he had a Chair in Turbomachinery at Beihang University, where he served on the University Council as a member and deputy director from 1989–1996 and on its Academic Board as Secretary General from 1993–1996. He was the Associate Chair of the Turbomachinery Subcommittee of the Chinese Aeronautical Society. In China and U.K. he has been working very closely with the aeroengine and gas-turbine industries and is active in the Turbomachinery Committee of ASME's International Gas Turbine Institute. He received jointly with Prof. John Denton the Best Paper Award (1990) from the IGTI Turbomachinery Committee, and the Water Arbitration Prize from the Institution of Mechanical Engineers (1999). He is a specialist member of the Chinese Aeronautical Society and a member of the Chinese Society of Engineering Thermophysics. He also serves on the editorial board of the *Chinese Journal of Aerospace Power*.

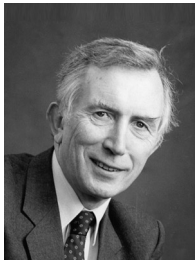
Editorial Advisory Board



MEYER J. BENZAKEIN received his Mechanical Engineering degree in 1960. He received an MSME in 1963 and a Ph.D. in engineering mechanics in 1967. In 1967, he joined General Electric, where he served in a number of positions in Advanced Technology, Project and Product Engineering. He led the CFM56 Engineering Program from 1984 to 1993 and the GE90 Engineering Program from 1993 to February 1995. In February 1995 Dr. Benzakein became General Manager for Engine Systems Design and Integration, and in this capacity he had the responsibility for engineering leadership and technical oversight of GE Evendale Commercial and Military Aircraft Engines. In January 1996, Dr. Benzakein took over the position of General Manager, Advanced Engineering. He is responsible for leading the Technology Development efforts and the Certification/Qualification of New Engine Products. His charter is to ensure that the customer expectations as well as the needs of GEAE Multigeneration Product Plans are met. Dr. Benzakein is responsible for GEAE front-end initiatives in driving technology maturation, strengthening the linkage between preliminary design, engine systems and production hardware design. Dr. Benzakein was elected as a member of the National Academy of Engineering in 2001. That year he received the Gold Medal Award from the Royal Aeronautical Society. He was elected a Fellow of the Royal Aeronautical Society in 2002.



SÉBASTIEN CANDEL, Professor of Aerospace Engineering and Head of Mechanical and Aerospace Studies at Ecole Centrale Paris, received his engineering degree from Ecole Centrale Paris in 1968, his Ph.D. from the California Institute of Technology in 1972, and the Doctorat d'Etat from U. Paris 6 in 1977. He was a research scientist at ONERA (the French Aerospace Research Office) from 1973 to 1987 and an assistant professor at University of Compiègne from 1975 to 1978. Since 1978 he has been a professor at Ecole Centrale Paris. In 2001 he was appointed as a senior member of Institut Universitaire de France. He was awarded the silver medal of CNRS in 1993, received the Marcel Dassault Grand Prize from the Academy of Sciences in 2000, the Aeroacoustics Award from the Confederation of European Aerospace Societies in 2004, the Pendray Aerospace Literature Award from AIAA in 2005. He is a Fellow of the Association Aéronautique et Astronautique de France, of the Institute of Physics, and of the AIAA. He has been a corresponding member of the French Academy of Sciences since 1994 and a member of the Academy of Technology since 2000. He was a Vice-President of the Combustion Institute, and is a member of the launchers committee of CNES. He has been an associate editor of *Combustion and Flame* since 2000, and of the *Comptes Rendus de l'Académie des Sciences* since 1994. He also serves on the editorial boards of *Combustion Science and Technology*, *Progress in Energy and Combustion Science*, and *Journal of Turbulence*. His research interests are in combustion and propulsion. He is the author or co-author of 2 books and of more than 300 articles and papers.



NICHOLAS A. CUMPSTY is Head of the Mechanical Engineering Department in Imperial College London. Until 2005 he was Chief Technologist for Rolls-Royce plc, and before 2000 he was Professor of Aerothermal Technology in the University of Cambridge and Director of the Whittle Laboratory. He received his B.Sc. from Imperial College in mechanical engineering and his Ph.D. in the University of Cambridge for work on three-dimensional boundary layers. After a period as a research fellow in Cambridge, Dr. Cumpsty worked for Rolls-Royce in the area of noise until returning to the University of Cambridge to join the teaching staff in 1972. He was the Hunsaker Visiting Professor in the Department of Aeronautics and Astronautics, Massachusetts Institute of Technology, from 1991–1992. He has received the ASME Gas Turbine Award twice as well as the George Stephenson Medal of the Institution of Mechanical Engineers. Dr. Cumpsty has written two major books: *Compressor Aerodynamics*, published in 1989 (to be reprinted in 2004), and the second edition of *Jet Propulsion*, which appeared in 2003. Dr. Cumpsty is a Fellow of the AIAA and ASME as well as a Fellow of the Royal Academy of Engineering.



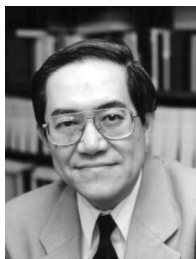
EDWARD M. GREITZER is the H. N. Slater Professor of Aeronautics and Astronautics at MIT. He received his A. B., S. M. and Ph.D. from Harvard University. Before joining MIT he was with United Technologies Corporation, and more recently, he was on leave at United Technologies Research Center as Director, Aeromechanical, Chemical, and Fluid Systems. From 1984–1996 Dr. Greitzer was the Director of MIT's Gas Turbine Laboratory. He is a three-time recipient of the ASME Gas Turbine Award for outstanding gas turbine paper of the year, an ASME Freeman Scholar in Fluids Engineering, a recipient of publication awards from AIAA and the Institution of Mechanical Engineers, and a recipient of the Aircraft Engine Technology Award from the ASME International Gas Turbine Institute (IGTI). He has been a member of the U.S. Air Force Scientific Advisory Board and the NASA Aeronautics Advisory Committee and the Chair of the IGTI Board of Directors. He is lead author of the book *Internal Flow: Concepts and Applications*, published by Cambridge University Press. Dr. Greitzer is a Fellow of AIAA and ASME and a member of the National Academy of Engineering.



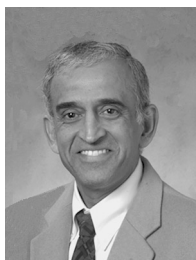
RONALD K. HANSON earned engineering degrees from Oregon State University, Arizona State University and Stanford University. He has been affiliated with Stanford University since 1972, and presently is the Woodard Chair of Mechanical Engineering. He served as the ME Department Chair at Stanford from 1993–2003, and has advised more than 50 Ph.D. students. His research has been in the fields of laser diagnostics and sensors, shock wave physics, and combustion chemistry, and he is the author or co-author of over 400 archival publications in these areas. Dr. Hanson is a Fellow of the AIAA, the American Society of Mechanical Engineers (ASME) and the Optical Society of America (OSA), and is a member of the National Academy of Engineering (NAE). He is a recipient of the Silver Medal of the Combustion Institute and multiple awards from the AIAA.



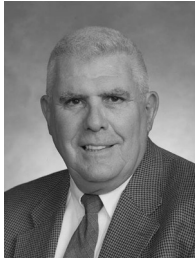
BORIS I. KATORGIN, General Designer of Research and Production Association of Power Engineering named after academician V. Glushko (Joint Stock Company “NPO ENERGOMASH”). He graduated with a first-class honor degree from Bauman High Engineering School in 1958. He made his way up from mechanical engineer and design engineer to General Director and General Designer of NPO ENERGOMASH (from 1992 to 2005), and General Designer (from 2005 to present). Under his leadership, NPO ENERGOMASH made many breakthroughs in the field of liquid propellant rocket engines (LPRE), won the competition in the USA in 1996 and delivered two RD-180 engine modifications, which provided successful launches of commercial satellites on launch vehicles Atlas III and V. Other significant innovations include developments of large LPRE for the new launch vehicle Angara, engine modernization for launch vehicles Soyuz, Proton, and Zenit. NPO ENERGOMASH under his leadership also conducted activities in the development, research, and application of chemical lasers. He is a member of the Russian Academy of Sciences (Academician), a Doctor of Engineering, and a Professor. He has practiced teaching for more than 30 years and is currently Chair of Energetic and Physical Systems of Moscow Aviation Institute. He is an author of 320 scientific papers, 160 inventor certificates and patents as well as 7 US patents. He has been awarded Orders Badge of Honor, Motherland’s Distinguished Service, Yaroslav Mudry of V degree (Ukraine) and is the Russian Government Prize and Russian State Prize Laureate and the Honored Scientist of the Russian Federation. For many years Katorgin has headed the board of industrial companies of Khimki district, Moscow region, and is a member of Presidium of Defense Companies League as well as a member of the editorial boards of the Russian scientific and technical journals *Engine* and *Flight*.



CHUNG K. LAW received a B.S. in physics from the University of Alberta in 1968, an M.A.Sc. in aerospace studies from the University of Toronto in 1970, and a Ph.D. in engineering physics from the University of California at San Diego in 1973. Since graduation he has been associated with the General Motors Research Laboratories, Princeton University, Northwestern University, and the University of California at Davis. In 1988 he returned to Princeton University, where has been the Robert H. Goddard Professor of Mechanical and Aerospace Engineering since 1975. Law’s research interests cover various physical and chemical aspects of fundamental combustion phenomena. He is a fellow of the AIAA and the American Society of Mechanical Engineers, a member of the National Academy of Engineering, a past president of the Combustion Institute, and a recipient of a number of professional and best paper awards for technical contributions. He is author or coauthor of over 300 journal publications.



JAYANT S. SABNIS earned his B.Tech. from I.I.T. Bombay and an M.S. and Ph.D. from Syracuse University. Until 1992 Dr. Sabnis worked at SRA, Inc., where he made significant contributions in the development and application of computational analyses for multi-phase reacting flows in solid and liquid rocket motors. In 1992, Dr. Sabnis joined United Technologies Research Center. At UTRC, he actively led several R&D programs in propulsion systems and turbomachinery. In 1998, Dr. Sabnis transferred to Pratt & Whitney and assumed responsibility for the Secondary Flow & Heat Transfer discipline as well as the internal air system integration in Pratt & Whitney engines. In 1999, he was appointed the Director of Mechanical Systems and was responsible for the Engineering as well as Product Delivery aspects of rotor support and lubrication systems in Pratt & Whitney engines. He led the group in developing analytical approaches to design and analysis of Mechanical Systems and implementation of novel design concepts to manage fluid flows in lubrication systems. In 2002, Dr. Sabnis was appointed the Director of Aerodynamics, where he was responsible for all aspects of aerodynamic designs of P&W engines, as well as defining technology programs related to the aerodynamics discipline and interrogating results to validate the design process. In 2004, Dr. Sabnis assumed his current responsibility as the Chief Engineer, Systems Analysis and Aerodynamics. In this capacity, he is responsible for all aspects of engine system performance and operability, as well as component aerodynamics and acoustics. Dr. Sabnis is a Fellow of the AIAA and American Society of Mechanical Engineers.



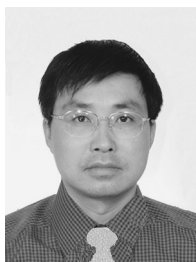
ROBERT L. SACKHEIM, the Assistant Director and Chief Engineer for Propulsion at NASA's Marshall Space Flight Center (MSFC), holds a B.S. degree from the University of Virginia and a M.S. degree from the Columbia University. He has completed all doctoral coursework in chemical engineering at the University of California in Los Angeles. He joined MSFC after 35 years in various technical and management positions with TRW Space and Electronics Group. His awards and honors include the AIAA James Wyld Award for outstanding technical contributions to the field of rocket propulsion, as well as 12 NASA Group Achievement Awards. While at TRW he received three annual Chairmen's Awards and a TRW patent of the year award. He is a Fellow of AIAA and was elected in 2000 to the National Academy of Engineering. He also received the AIAA Sustained Service Award in 2000. The Alabama/Mississippi section of the AIAA awarded him the Martin Schilling Award for outstanding service to the section, and the Herman Oberth Award from AIAA "For Outstanding Individual Scientific Achievement in the Fields of Astronautics and Space Sciences." He recently received an award from the Association of Aeronautics and Astronautics of France for "High Quality Contributions to the Propulsion Field." In 2001 he was awarded the NASA Medal for outstanding technical leadership. Mr. Sackheim was formerly the chairman of the AIAA Liquid Propulsion Technical Committee and the chairman of the Los Angeles section of the AIAA, and was recently the chairman of the Mississippi/Alabama section of the AIAA. He has served on a number of NASA boards, including the Shuttle Independent Assessment Team (SIAT), the Mars Climate Orbiter Mishap Investigation Board, and the Mars Polar Lander Mishap Board. He has authored more than 150 technical papers. He also holds 8 patents for spacecraft and/or launch vehicle propulsion and/or control systems technology.



WILLIAM A. SIRIGNANO serves as Professor of Mechanical and Aerospace Engineering and of Chemical Engineering and Materials Science and occupies the Henry Samueli Endowed Chair in Engineering at the University of California, Irvine. He received a B.S. in aerospace engineering from Rensselaer Polytechnic Institute and the M.A. and Ph.D. degrees from Princeton University. He has served as Dean, School of Engineering, University of California Irvine; George Tallman Ladd Professor and Department Head, Carnegie-Mellon University; and Professor, Princeton University. Sirignano's major forefront research accomplishments include analysis predicting periodic nonlinear oscillations with shockwaves in an unstable combustor; explanation of the nonlinear fluid dynamics associated with Helmholtz resonators; determination of admittance for oscillatory, three-dimensional nozzle flows; theory for condensed-phase behavior in flame spread above liquid and solid fuels; theory for ignition of combustible gas by a hot projectile; resolution of turbulent flame and propagation in reciprocating and rotary internal combustion engines; theory of droplet vaporization and convective heating with internal circulation; computational methods for spray flows; theory of droplet interactions in a dense spray; analysis of driving mechanisms for combustion instability in rockets and ramjets; conceptual advancements of turbine burners and miniature liquid-fuel-film combustors. Sirignano's awards and recognitions include National Academy of Engineering membership; Fellow status in AIAA, ASME, AAAS, and APS; AIAA Propellants and Combustion Award; ASME Freeman Scholar Fluids Engineering Award; AIAA Pendray Aerospace Literature Award; The Combustion Institute Alfred C. Egerton Gold Medal; Institute for the Dynamics of Explosions and Reactive Systems (IDERS) Oppenheim Award; AIAA Energy Systems Award; American Electronics Association, Orange County Council, Award; President's Award for Engineering Excellence in Service to Higher Education, Orange County Engineering Council; UC Irvine Alumni Distinguished Research Award; and United Aircraft Research Fellow. His professional service has included Chair, Microgravity Research Committee of NRC Space Studies Board; NASA Space Science and Applications Advisory Committee; AIAA Publications Committee; Chairman, AIAA Solid Rockets Technical Committee; Executive Committee, Treasurer, and Board of Directors, The Combustion Institute; and President, IDERS.



ANTHONY J. STRAZISAR is the Chief Scientist of the NASA Glenn Research Center. He earned his B.S., M.S., and Ph.D. in engineering from the Case Western Reserve University and joined NASA John H. Glenn Research Center in 1976. His early work focused on the acquisition and analysis of laser anemometer measurements in high-speed rotating machinery to advance the basic understanding of turbomachinery fluid mechanics and for turbomachinery CFD code validation. His more recent work has focused on the development of fluid injection schemes to control compressor stall and to increase the aerodynamic loading of compressor blading. He has received the NASA Exceptional Engineering Achievement Medal. He is a four-time recipient of NASA John H. Glenn Research Center Best Publication Award, and has also received publication awards from AIAA and ASME. He is a Fellow of ASME and a member of the Board of Directors of the International Gas Turbine Institute.



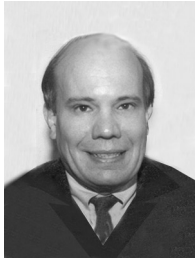
XIAOFENG SUN is a Professor of Aerospace Engineering at the Beijing University of Aeronautics and Astronautics (BUAA) where he directs the Fluid and Acoustic Engineering Laboratory. His principal fields of interest include unsteady flows in turbomachines, vortex dynamics, and aeroacoustics. The work includes experimental, theoretical, and computational investigations into vortex sound interactions, flow stabilities in compressors, control of blade flutter, and acoustic design of aeroengine nacelles as well as various strategies for fan and compressor noise reduction. Prof. Sun received his Ph.D. in aerospace engineering from BUAA in 1988, his M.S. (1985) and B.S. (1982) in mechanical engineering from the Shanghai Jiaotong University. He was a visiting research fellow of DLR at the Institute for Experimental Fluid Mechanics in Berlin from 1992 to 1994, a visiting professor at the University of Tokyo in Japan from 1997 to 1998, and a visiting professor of The Pennsylvania State University in 2001. He has published 1 book and more than 70 technical papers. He was the recipient of the National Science Funds for Distinguished Young Scholars in 1999. He is a member of the International Advisory Committee of the Gas Turbine Society of Japan and a member of the Standing Committee of the Chinese Society of Engineering Thermophysics. Currently, he is an Endowed Chair Professor sponsored by the Cheung Kong Scholarship Program and designated by the Ministry of Education of China.



JUE WANG graduated from the Xian Jiao-Tong University. He joined the Beijing Aerospace Propulsion Institute in 1982, and is currently the Director of the Institute and the Vice Chief Designer of the Long March III launch vehicle. He is also a Professor of Astronautical Engineering at the Beijing University of Aeronautics and Astronautics. His earlier work involved the system design and analysis of cryogenic rocket engines for Long March III. He has been responsible for the development of key technologies of China's new generation of cryogenic rocket engines since 1995. He has served as the leader of an expert group of a national high-tech aerospace committee since 1998, managing a wide variety of research and development projects in rocket and air-breath propulsion at the national level. Mr. Wang has made substantial contributions to the field of rocket engine design and analysis. He has been active in various scientific and professional societies in China. He is a member of the Executive Council of the Chinese Society of Astronautics, and a Co-Chair of the Liquid Rocket Propulsion Committee of the Chinese Society of Astronautics.



BYRON K. WOOD has 40 years of experience in the field of launch vehicle propulsion. Byron Wood is responsible for directing many space-related activities, including the main engines for NASA's space shuttle and booster engines for Expendable Launch Vehicles (ELV's). Wood joined Rocketdyne in 1963. His initial work included development of the J-2 engine for NASA's Saturn Launch Vehicle. In 1969, he began a long association with the Space Shuttle Main Engine (SSME) as one of its primary systems architects. In 1990, he guided the Rocketdyne SSME program toward a team-oriented organization, resulting in significant cost reductions and improved product quality. Other innovations include implementing a product/process organization approach in which engineering processes support product and technology improvement and development. These efforts resulted in the first all-commercially-developed large rocket engine in the United States, the RS-68. Wood was appointed Vice President and General Manager of Rocketdyne Propulsion & Power in 1998 as part of the Boeing Company. Today he is President, Pratt and Whitney Rocketdyne as a part of Pratt and Whitney within the United Technologies Corporation. Wood is a graduate of the University of California at Berkeley with degrees in physics and mathematics. He is a fellow of the AIAA and a member of the American Astronautical Society. Wood has been honored with many awards, including NASA's Exceptional Engineering Achievement medal (1982), NASA's Public Service medal (1988 and 2003), and San Fernando Valley Engineers' Council Engineer of the Year (1994). From 1994 through 1996, he served on the Board of Directors of the Ohio Aerospace Institute. Wood served as an at-large industry member on the NASA Advisory Council from 2001 to 2003.



RICHARD A. YETTER, Professor of Mechanical Engineering at the Pennsylvania State University, received his B.S. from Syracuse University, M.S. from Cornell University, M.A. and Ph.D. from Princeton University. His current research interests include micropower and propulsion systems, propellant and nanoenergetic materials combustion, high temperature/high-pressure combustion chemistry and heterogeneous combustion. His research experience also includes the development and analysis of stratified charge internal combustion engines, alternate fuels combustion, the analysis of turbulent flames with swirl stabilization, the development and analysis of complex reaction mechanisms, the measurement of elementary reaction rate constants, absorption and laser-induced fluorescence spectroscopy, metal combustion, and the development of sensitivity analysis theory to combustion kinetics modeling. He was previously a Research Engineer at the Scientific Research Laboratories of Ford Motor Company, a Senior Research Scientist and Lecturer at Princeton University, and a Research Collaborator at the Brookhaven National Laboratory. He is currently Director of a Multidisciplinary University Research Initiative at Penn State on nano engineered energetic materials supported by the U.S. Army. He is editor-in-chief of *Combustion Science and Technology*, co-editor of the *30th Proceedings of the Combustion Institute*, and currently serves on the editorial board of *Progress in Energy and Combustion Science*. He is a member of several technical organizations including the Combustion Institute and AIAA, and is currently a member of the Advanced Power Plant Committee of the Society of Automotive Engineers and the Publications Committee of the Combustion Institute. Dr. Yetter is an author or co-author of over 170 scientific publications, 2 US patents, and the recipient of the 2000 Silver Medal of the Combustion Institute.



BEN T. ZINN is the David S. Lewis, Jr. Chair of Aerospace Engineering and Regents' Professor with a joint appointment at the George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology. Dr. Zinn received his B.S. in ME (cum laude) from New York University in 1961, M.S. in mechanical engineering from Stanford University, M.A. and Ph.D. in aerospace and mechanical sciences from Princeton University in 1963 and 1965, respectively. He joined the faculty at Georgia Institute of Technology in 1965 where he was promoted to Regents' Professor in 1973. Dr. Zinn was appointed to the Lewis Chair in 1992. Over the years, Dr. Zinn has made research contributions in the areas of combustion instabilities, pulse combustion, combustion, acoustics, fire safety, and active control of combustion processes. Dr. Zinn is presently serving as Director of the recently awarded NASA University Research, Engineering and Technology Institute at Georgia Tech (URETI) on Aeropropulsion and Power. Dr. Zinn has served on the AIAA Propellants and Combustion Technical Committee and was Associate Editor of the *AIAA Journal*. He also served on the editorial board of *Progress in Energy and Combustion Science* and currently serves on the editorial board of *Combustion Science and Technology*. Dr. Zinn's awards include the 2002 Alfred C. Egerton Gold Medal of the Combustion Institute "For Distinguished Continuing and Encouraging Contributions to the Field of Combustion." Membership of the National Academy of Engineering, the AIAA Pendray and Combustion and Propellants awards, Fellow of the AIAA and ASME, Honorary professorship at Beijing University of Aeronautics and Astronautics, and Georgia Tech's Outstanding Professor Award. He has advised the research activities of more than 35 Ph.D. students and many M.S. and undergraduate students. Some of these students have won national and regional awards. Dr. Zinn is author or coauthor of over 400 articles and papers.