JOURNAL OF PROPULSION AND POWER
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Announcements and Acknowledgments

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

Length Limitations. The *JPP* will continue to implement a policy of no length limitations for Full-Length Papers, although all manuscripts should be as *brief and concise* as proper presentation of the ideas will allow. Length limitations on Technical Notes (maximum of nine double-spaced manuscript pages) and Technical Comments (maximum of four double-spaced manuscript pages) continue since these short manuscripts are intended for prompt disclosure of information having relatively limited scope. The detailed requirements for all types of manuscripts can be found in the Information for Contributors to Journals of the AIAA, which appears on the inside back-cover of each issue of the journal.

Publication Delay and Paper Submission. Thanks to our high efficiency and special allocation of journal pages, the former backlog has been resolved, with the time delay from paper acceptance to publication reduced to an average of two months. The total number of submittals in 2002 has increased by twenty percent as compared with that in the prior year. While this number meets our publication needs, we will further enhance the paper influx by actively soliciting quality contributions in emerging areas, such that a broader service can be provided to the propulsion and power community worldwide.

Special Issues and Sections. It is a general policy of AIAA that a focused journal issue dedicated to a specific topic will be considered only if 1) the theme represents a milestone contribution to aerospace science and technology, and 2) a well-rounded publication plan in terms of quality and quantity can be implemented. Furthermore, any special issue must be approved by AIAA's Vice President of Publications. If important scientific and technical subjects deserve in-depth treatment, but do not fulfill the above-mentioned requirements, a special section encompassing a small number of high quality papers will be considered in the place of a special issue.

The *JPP* published a special section on the electric propulsion space experiment (ESEX) program in July 2002. ESEX is not only the highest power electric propulsion system in orbit, but also one of the highest power spacecraft of any type. Roger Myers did a superb job by putting together an ensemble of nine papers, each addressing different aspects of ESEX. With the success of the ESEX special section, the electric propulsion (EP) editors of the *JPP*, Alec Gallimore and Greg Spanjers, are currently exploring the possibility of publishing special sections on the NASA Deep Space DS-1 and Earth Orbit EO-1 PPT projects. History may well view the former as the start of a new paradigm in space exploration and the latter as another milestone accomplishment in EP.

In addition to the EP topics, Ken Yu is working with two guest editors, Tim Lieuwen and Keith McManus, on a special section on lean premixed, prevaporized (LPP) gas-turbine combustion dynamics. This is a timely contribution since combustion dynamics is one of the two most important issues in developing gas turbine combustors today (the other is emissions). The section will include 10 papers contributed by well-known experts from around the world. Another topic currently under consideration is micropropulsion systems for aerospace applications. Juergen Mueller of the NASA Jet Propulsion Laboratory is charged with this task.

Celebration of the 100th Anniversary of Flight. In recognition of the Evolution of Flight, the *JPP* will publish several feature articles in November 2003, covering the histories of key technologies in all aspects of aerospace propulsion and power. Fifteen individuals who have made extraordinary contributions to the field are preparing these specially invited papers. The topics include propeller-driven propulsion, gas-turbine engines, ramjet and scramjet engines, supersonic civil transport, solid-propellant rockets, liquid-propellant rockets, electric propulsion, advanced and futuristic propulsion, propellants and fuels, and aerospace power generation, conversion, and storage. The *JPP* will take this opportunity to lead the way in consideration of the future and review of the past.

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 14 board members are listed in the following pages, together with those of the *JPP* Associate Editors. The contribution of these individuals in helping to develop the quality of the journal is gratefully acknowledged.

Reappointed Associate 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 Winfred A. Foster Jr., Auburn University; Hans Immich, Astrium GmbH; Lourdes Q. Maurice, Federal Aviation Administration; and Roger M. Myers, General Dynamics Space Propulsion, have agreed to serve another three-year term as AE. All of them have been very professional in their service and will help maintain the editorial continuity of the journal. Their exemplary work is greatly appreciated.

Newly Appointed Associate Editors. Two names are being added to the masthead. Feng Liu, University of California, is widely recognized for his research in computational turbomachinery, general computational fluid dynamics, transonic and supersonic flows, and gas-turbine cycle innovation. Joseph M. Powers, University of Notre Dame, is an acknowledged expert in detonation, high-speed propulsion, energetic material combustion, and multi-scale phenomena. I welcome these outstanding individuals and thank them for agreeing to serve.

Continuing Associate Editors. Individuals who will continue their service as AE for the coming year are: C. Thomas Avedisian, Cornell University; M. Quinn Brewster, University of Illinois; Edgar Choueiri, Princeton University; Daniel J. Dorney, NASA Marshall Space Flight Center; Alec D. Gallimore, University of Michigan; Ashwani K. Gupta, University of Maryland; Gavin J. Hendricks, Pratt & Whitney; Jan Lepicovsky, NASA Glenn Research Center; Carlson C. Pian, Alfred University; Tom I.-P. Shih, Michigan State University; Gregory G. Spanjers, Air Force Research Laboratory; and Kenneth H. Yu, University of Maryland. The dedication of these individuals to the journal is greatly appreciated.

Retiring Associate Editors. Special thanks are due to our retiring Associate Editors: P. Barry Butler, University of Iowa, and James L. Mace, Boeing Company. Their service is an essential part of the review and publication process. I have been fortunate to have worked with them, and wish to acknowledge their valuable efforts and outstanding contributions.

Acknowledgments. I wish to express my sincere thanks to the editorial staff of the AIAA for their invaluable assistance and effective management, as follows: Roger L. Simpson (Vice President-Publications), Norma J. Brennan (Director of Publications), and Jennifer Samuels (Managing Editor, *JPP*). The publication staff at Techbooks, coordinated by Angela Weaver, is gratefully acknowledged. Special thanks are due to Roger Myers for his great effort in preparing the special section on the ESEX program in July 2002. Finally, we owe a large debt of gratitude to all of the authors in preparing the fine papers presented here. The individuals who provided their time and expertise toward reviewing the manuscripts also deserve special recognition. Their names appear in the following pages.

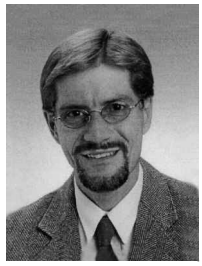
V. Yang
Editor-in-Chief

Editor-in-Chief

VIGOR YANG, Professor of Mechanical Engineering at the Pennsylvania State University, received his B.S. from the National Tsing Hua University in 1976 and his Ph.D. from the California Institute of Technology in 1984. His research interests include combustion instabilities in propulsion systems, chemically reacting flows in airbreathing and rocket engines, combustion of energetic materials, high-pressure thermodynamics and transport, and active combustion control for gas-turbine engines. He has supervised 34 Ph.D. and 15 M.S. theses. He is the author or coauthor of more than 150 technical papers in the areas of propulsion and combustion, and has published five comprehensive volumes on solid and liquid rocket propulsion. He was the recipient of the Penn State Engineering Society Outstanding Teaching and Research Awards in 1989 and 1992, respectively, and the AIAA Best Paper Award in 1995 for research on supercritical combustion. Dr. Yang also serves on the editorial advisory boards of the *AIAA Progress in Astronautics and Aeronautics* and the Russian *Journal of Combustion, Explosion, and Shock Waves*. He has been a consultant to many U.S. rocket and gas-turbine engine companies as well as various 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.

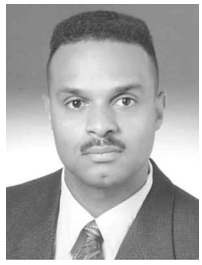


QUINN BREWSTER, Hermia G. Soo Professor of Mechanical Engineering at the University of Illinois at Urbana–Champaign (UIUC), received his Ph.D. in mechanical engineering at the University of California at Berkeley in 1979. Before joining the Mechanical Engineering department at Illinois, he conducted research at Kyoto University, the Air Force Rocket Propulsion Laboratory, and the University of Utah. His research in radiative heat transfer and solid propellant combustion has been recognized by a 1984 National Science Foundation Presidential Young Investigator Award, a 1987 Office of Naval Research Young Investigator Award, and a 1993 UIUC University Scholar Award. He is the author of a graduate textbook, *Thermal Radiative Transfer and Properties*, and currently serves as Group Leader for Combustion and Energetic Materials at the UIUC Center for Simulation of Advanced Rockets, a U.S. Department of Energy Accelerated Strategic Computing Initiative center.

EDGAR CHOUEIRI is Director of the Engineering Physics Program at Princeton University and Director of Princeton's Electric Propulsion and Plasma Dynamics Laboratory. He is Associate Professor in Applied Physics at the Mechanical and Aerospace Engineering Department at Princeton 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 the AIAA and is Chair of the AIAA Electric Propulsion Technical Committee for 2002–2004.

DANIEL J. DORNEY, Aerospace Engineer at NASA Marshall Space Flight Center in Huntsville, Alabama, received his B.S. and M.S. in aeronautical and astronautical engineering from the University of Illinois at Urbana–Champaign, and his Ph.D. in aerospace engineering from the Pennsylvania State University. His current research interests include unsteady flows in turbomachinery, aerodynamics, and computational fluid dynamics. Dr. Dorney has seven years academic experience, including two years as Associate Professor (with tenure) at Virginia Commonwealth University, one year as Assistant Professor at GMI Engineering and Management Institute, and three years as Assistant Professor at Western Michigan University. Dr. Dorney has also spent six years in industry, including five years at United Technologies Research Center as Associate Research Engineer and one year at Pratt & Whitney as Project Engineer. Dr. Dorney's research has led to three Best Paper Awards, a NASA Space Act Award, and more than 50 journal articles. He is an Associate Fellow of AIAA.

WINFRED A. FOSTER JR., Professor in the Department of Aerospace Engineering at Auburn University, received his B.S. (1967), M.S. (1969), and Ph.D. (1974) from Auburn University. He has been a member of the Aerospace Engineering faculty since 1974. His research has been primarily in the area of solid rocket motor performance prediction and finite element structural analysis. He has published over 60 technical documents and has made numerous presentations in these and related areas. He is an Associate Fellow of AIAA and is currently a member of the AIAA Solid Rocket Technical Committee. He also serves as Chair of the History Subcommittee.



ALEC D. GALLIMORE is an Associate Professor of Aerospace Engineering and of Applied Physics at the University of Michigan where he directs the Plasmadynamics and Electric Propulsion Laboratory. Professor Gallimore is also 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, space plasma simulation, electrode physics, and hypersonics. 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, electron beam, and optical/laser plasma diagnostics. The author of more than 100 journal and conference papers on electric propulsion and plasma physics, Professor Gallimore was the recipient of the University of Michigan Aerospace Engineering Award for Outstanding Accomplishment in 2002; the University of Michigan Faculty Career Development Award in 2000; the Class of '38E Prize for teaching, service, and research in 1996; and teaching awards in 1996 and 1994 from Sigma Gamma Tau. In 1994 he was awarded the Crystal Image Award for Technical Achievement by the National Technical Association for science educator of the year, and he received the AIAA Best Paper on Electric Propulsion Award for work presented at the 1998 Joint Propulsion Conference. Professor Gallimore serves on the AIAA Electric Propulsion Technical Committee and the U.S. Air Force Scientific Advisory Board. He is an Associate Fellow of AIAA.

ASHWANI GUPTA is a Professor of Mechanical Engineering at the University of Maryland. His academic experience includes six years as member of the research staff at MIT in the Energy Laboratory and Department of Chemical Engineering, three years as senior research associate and independent research worker at Sheffield University in the Department of Chemical Engineering and Fuel Technology, and seventeen years at the University of Maryland. He spent four months in Japan as a consultant to several companies. Presently 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.

GAVIN J. HENDRICKS, Technical Fellow at Pratt & Whitney, is interested in combustor stability, compressor aerodynamics and stability, and fluid mechanics within mechanical systems of gas turbine engines. He received his B.S. in mechanical engineering at the University of Cape Town in South Africa in 1981, and he conducted his graduate studies in mechanical engineering at the California Institute of Technology, where he received his M.S. and Ph.D. in 1983 and 1986, respectively. Prior to joining Pratt & Whitney, Dr. Hendricks spent two years on the Faculty of the University of Cape Town, two years as a Research Fellow at the Massachusetts Institute of Technology, and seven years at the United Technologies Research Center. He was awarded the American Society of Mechanical Engineers (ASME) IGTI Gas Turbine Award in 1993 and the ASME IGTI Diagnostics and Controls Committee Best Paper Award in 1994 for his work on modeling and control of compressor instabilities.

HANS IMMICH, currently Manager of New Rocket Propulsion Programs and Technologies at the Propulsion Business Unit of the Space Infrastructure Division of Astrium (formerly DaimlerChrysler Aerospace), is responsible for new technology developments in the field of launch vehicle rocket propulsion. Before joining DaimlerChrysler Aerospace in 1985 he was with Asea Brown Boveri Company, Baden, Switzerland from 1979 to 1985. There, he was responsible for fluid mechanical development of large steam turbines and for development of combustion chambers for large gas turbines. Dr. Immich received his Ph.D. in the area of fluid mechanics from the Technical University in Munich in 1979. In addition, he received the "Habilitation" (lectureship qualification) in fluid mechanics from the Technical University in Munich in 1986. Dr. Immich is a Member of the AIAA Space Transportation Technical Committee. He is the author of 32 journal articles and conference papers.

JAN LEPICOVSKY is a Senior Project Manager and Head of the Turbomachinery Analysis Section at QSS Group, Inc., an onsite contractor at the NASA Lewis Research Center (LeRC) in Cleveland, Ohio. He has 30 years of experience in fluid dynamics and turbomachinery experimental research. He received his Ph.D. and M.S. from the Czech Technical University in Prague, Czech Republic. He worked as a Researcher and as the Thermodynamic Lab Leader at the Propulsion Division of the Aeronautical Research and Test Institute in Prague until 1979. He was in charge of development testing on components of a small turboprop engine. After his move to the U.S., he worked as a Scientist in the Aeroacoustic group of the Lockheed–Georgia Company in Marrieta, Georgia, from 1980 to 1988. His major involvement there was with experimental research of mixing enhancement of free jets and propeller flows. In 1988 he worked for Textron–Lycoming in Stratford, Connecticut, where he was responsible for experimental studies in turbine cooling. Since 1989 he has been associated with the Propulsion Division at NASA LeRC. His major engagement is application of nonintrusive measurement techniques to fan and turbine experimental research. His expertise involves laser velocimetry, pressure and temperature sensitive paints, and thin-film thermocouples. He has authored more than 40 technical papers. He is an Associate Fellow of AIAA and a former Member of the AIAA Ground Testing Technical Committee. He served as an Associate Editor of the *AIAA Journal*, and served on several AIAA Technical Committees. He is a Member of the American Society of Mechanical Engineers.

FENG LIU, Associate Professor of Mechanical and Aerospace Engineering at the University of California (UC), Irvine, received his B.S. (1982) from Northwestern Polytechnic University in Xi'an, China; his M.S. (1984) from Beijing University of Aeronautics and Astronautics; and his 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 coauthor of more than 50 journal and conference papers. He was the recipient of the Outstanding Engineering Professor Award from the class of 2000 at UC Irvine. Dr. Liu is a Senior Member of the AIAA and a Member of the American Society of Mechanical Engineers. He serves on the AIAA Airbreathing 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, with responsibility for a ~$450 million investment. 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.S. in chemical engineering and M.S. 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, U.K. She is also a Distinguished Graduate of National Defense University's Industrial College of the Armed Forces, where she earned her M.S. in National Resource Strategy. Lourdes is serving her second term on the AIAA Propellants and Combustion Technical Committee and is the U.S. Chair for the AIAA/ICAS International Conference in Celebration of the Centennial of Flight. She has authored over 80 publications and is a 2003 Fellow of AIAA.

ROGER M. MYERS is the Director of Systems and Technology Development at Aerojet–Redmond Rocket Center (RRC), where he leads 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 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 of spacecraft and missions, from small LEO communications satellites to large interplanetary spacecraft. He has authored over 70 publications on spacecraft propulsion, was Chair of the AIAA Electric Propulsion Technical Committee from 1998 to 2000, has been an Associate Editor of the *Journal of Propulsion and Power* since 1992, and co-teaches the AIAA Electric Propulsion short course.

CARLSON C. P. PIAN received his B.S., M.S., and Ph.D. in aerospace engineering from the University of Michigan. He is currently Professor and Chair of the Mechanical Engineering Division at Alfred University. Previously, he was Researcher at Molten Metals Technologies, and he later served on the Faculty of the Diagnostic Instrumentation and Analysis Laboratory at the Mississippi State University. There, he was involved in research and development of plasma torches and remediation technologies for hazardous waste treatment. At Textron Defense Systems' Everett Laboratory (formerly the Avco Everett Research Laboratory), Dr. Pian was Director of Commercial MHD Component Development, responsible for programs involving the research and development of MHD power generators. Prior to joining Avco, Dr. Pian was Research Engineer at the NASA Lewis Research Center. Dr. Pian is an Associate Fellow of AIAA and a Member of the Plasmadynamics and Lasers Technical Committee.

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, Professor of Mechanical Engineering at Michigan State University, was previously Professor at Carnegie Mellon University (1988–1998), Associate Professor at the University of Florida (1982–1988), and Research Engineer at NASA Lewis Research Center (1981–1982). He received his B.S. (1976) from the National Cheng Kung University, and his M.S. (1977) and Ph.D. (1981) from the University of Michigan at Ann Arbor. Dr. Shih is a Fellow of the American Society of Mechanical Engineers and an Associate Fellow of AIAA. Dr. Shih's research focuses 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 and the study of compressible and incompressible flows. Current focus is on grid-quality measures, error estimation, and knowledge extraction. In using CFD, he and his students have studied shockwave/boundary-layer interactions with bleed and blowing, internal and film cooling of turbine components, gas-turbine combustors, particle-particle/particle-fluid interactions, spray forming, and piston and rotary engine flow fields.

GREGORY G. SPANJERS is currently Program Manager for PowerSail at the Air Force Research Laboratory (AFRL) Space Vehicles Directorate, Kirtland Air Force Base, New Mexico. The PowerSail program is researching structures to accommodate high-power photovoltaic arrays while minimizing dynamic interactions with the spacecraft. Dr. Spanjers received his B.S. in physics and his B.S. in mathematics from the University of Minnesota in 1986. He received his M.S in 1990 and his Ph.D. in 1992 from the University of Washington, where he performed plasma physics research for magnetic fusion. After working in industry and academia, he joined the AFRL Electric Propulsion Laboratory, Edwards Air Force Base, as Principle Scientist in 1995, becoming Group Leader in 1998, and Branch Technical Advisor in 1999. He is the author of over 50 journal and conference papers and has nine patents pending for advanced spacecraft thrusters. He is a Member of the AIAA Electric Propulsion Technical Committee and is serving on National Academy of Sciences NRC Review Panels.

KENNETH H. YU, Associate Professor of Aerospace Engineering at the University of Maryland, College Park, received his B.S. (1985), M.S. (1988), and Ph.D. (1989) in mechanical engineering from the University of California at Berkeley. Prior to joining the faculty at the University of Maryland in 1999, he was an Aerospace Engineer at NASA Ames Research Center (1985); a Post-Doctorate/Visiting Professor at Ecole Centrale Paris, France (1989–1990); and a Physical Scientist at the Propulsion Research Laboratory, Naval Air Warfare Center in China Lake, CA (1990–1999). He is an Associate Fellow (since 2001) of AIAA and is currently serving as Chair (2002–2004) of the AIAA Propellants & Combustion Technical Committee. His current research interests include various time-dependent phenomena involving turbulent shear flow, supersonic mixing enhancement, liquid-fuel injection, passive and active combustion control, and other thermo-acoustic processes in ramjets and scramjets for improving aeropropulsion performance. He has authored or coauthored over 100 journal and conference papers, and has five patents, some of which are now pending. His work has resulted in three conference Best Paper Awards.

Editorial Advisory Board

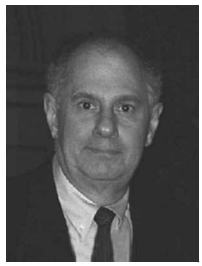
MIKE J. BENZAKEIN, General Manager, Advanced Engineering Programs at General Electric Aircraft Engines (GEAE), received his degree in mechanical engineering in 1960. He received his M.S. in mechanical engineering in 1963 and his Ph.D. in engineering mechanics in 1967. He joined General Electric in 1967 where he served in a number of positions in Advanced Technology and 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. 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 Programs. He is responsible for leading the technology development efforts and ensuring 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 and engine systems, and production hardware design.

SEBASTIEN CANDEL, Professor of Aerospace Engineering and Head of Mechanical and Aerospace Studies at Ecole Centrale Paris, received 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 Compiégne from 1975 to 1978. Since 1978 he has been a Professor at Ecole Centrale Paris, where he is Leader of the combustion group of the EM2C laboratory (CNRS). In 2001 he was appointed as a Senior Member of Institut Universitaire de France. His current research interests include aeroacoustics, turbulent combustion, combustion dynamics, combustion control, and propulsion. He is the recipient of the d'Aumale Price (1987), and of the Marcel Dassault Grand Price (2000) from the French Academy of Sciences. He was awarded the silver medal of CNRS in 1993, promoted as "Officier des Palmes Académiques" in 1998, and elected as "Chevalier de la Légion d'Honneur" in 2000. 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 is currently the Vice-President of the Combustion Institute, and the Chairman of the Supersonic Aircraft Research Network in France (2000). He has also served as a Deputy Editor of *Combustion and Flame* since 2000, and an Associate Editor of *the Comptes Rendus de l'Académie des Sciences* since 1994. He is a Member of the editorial boards of *Combustion Science and Technology* and *Progress in Energy and Combustion Science.* He is the author or coauthor of two books and more than 260 articles and papers.

JIM C. I. CHANG serves in a dual-hatted position; Deputy Director for Basic Science, Army Research Laboratory (ARL), and Director of the Army Research Office (ARO). The ARL is the Army's corporate laboratory with sites throughout the U.S. and with a budget of about $670 million. As ARL Deputy Director for Basic Science, he is the senior science and technology executive charged with oversight of the entire ARL basic research (6.1) program. As ARO Director, he leads an organization of scientists who manage a $250 million extramural research program in the physical and engineering sciences conducted mostly in universities. He entered federal service in 1978 and was appointed to the Senior Executive Service (SES) in 1990. He has served as Director of the Aerospace and Materials Sciences Directorate of the Air Force Office of Scientific Research, Chief Scientist at the Naval Air Systems Command, Program Manager with NASA, and Branch Head at the Naval Research Laboratory. Dr. Chang received his Ph.D. in theoretical and applied mechanics from Cornell University. He has published over 40 publications, served as an Associate Editor and reviewer for several professional journals, and has received recognition for his technical, science, and technology management contributions.

FRED E. C. CULICK joined the faculty of the California Institute of Technology after receiving his Ph.D in aeronautics and astronautics from Massachusetts Institute of Technology in 1961. He is currently Richard L. and Dorothy M. Hayman Professor of Mechanical Engineering and Professor of Jet Propulsion. Dr. Culick's Ph.D. dissertation treated combustion instabilities in liquid rockets. Much of his research has been concerned with problems of unsteady motions in combustion chambers generally. He began working on solid rocket combustion instabilities in 1965; since 1979, he has been addressing the problem in air-breathing systems. Dr. Culick is a Fellow of AIAA and of the International Academy of Astronautics. In 1981, he received the AIAA Pendray Aerospace Literature Award and in 1988 the JANNAF Combustion Subcommittee Recognition Award. From 1977–1986, Dr. Culick was a member of the AGARD Propulsion and Energetics Panel, resuming that position in 1994. He has been a consultant to all of the major U.S. rocket companies as well as to various government organizations. For nine years until 1995 he was a member of the Technical Advisory Council for Sverdrup Technology, Inc., primarily concerned with operation of the propulsion test facilities at AEDC, Tullahoma, Tennessee.

EDWARD M. GREITZER, H. N. Slater Professor and Associate Head of the Department of Aeronautics and Astronautics at Massachusetts Institute of Technology (MIT), received his B.A., S.M., and Ph.D. from Harvard University. Prior to joining MIT in 1977 he was with United Technologies Corporation. More recently (1997–1998), he was on leave at United Technologies Research Center as Director, Aeromechanical, Chemical, and Fluid Systems. From 1984 to 1996, Dr. Greitzer was the Director of MIT's Gas Turbine Laboratory. He is a three-time recipient of the American Society of Mechanical Engineers (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. He was Chair of the IGTI Board of Directors from 1996 to 1997. Dr. Greitzer is a Fellow of ASME and AIAA and was elected to the National Academy of Engineering in 1995.

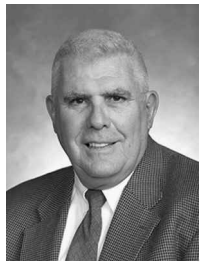


ANTHONY K. HYDER, Professor of Physics and Associate Vice President for Graduate Studies and Research at the University of Notre Dame, received his B.S. in physics from Notre Dame and his M.S. in space physics and Ph.D. in nuclear physics from the Air Force Institute of Technology. Following the award of his Doctorate, he was a Research Physicist at the Aerospace Research Laboratory in Dayton, Ohio, and then served on the physics faculty at the Air Force Academy. From 1981 to 1982, he was Scientific Advisor to the Director for Research, Office of the Secretary of Defense (Research and Advanced Technology). Then, he joined Auburn University as a faculty member in physics and aerospace engineering while serving as the Associate Vice President for research. In 1985 he became the founding Director of the Space Power Institute at Auburn, and in 1986 served as the founding Director of the Auburn University Center for Advanced Technologies. In 1991 he returned to Notre Dame to become the Associate Vice President for graduate studies and research and a Professor of physics. He is an AFIT Ph.D. Fellow and the recipient of the 1974 Air Force R&D Award. He has served on the Air Force Scientific Advisory Board and is currently serving on the Defense Intelligence Science and Technology Advisory Board, the Army Science Board, and the NATO RTO Sensors and Electronics Technology Panel.

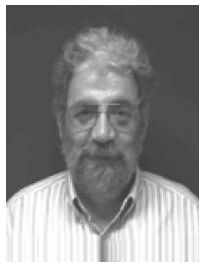
WOLFGANG W. KOSCHEL, University Professor for Jet Propulsion at the University of Technology of Aachen (RWTH Aachen) and Director of the Space Propulsion Institute of the German Aerospace Center (DLR), received his engineer degree from the Technical University of Berlin in 1964. He received his Ph.D. in mechanical engineering at the Technical University of Berlin in 1970, and received the Venia Legendi in aerospace engineering from RWTH Aachen in 1980. Since 1982 he has become University Professor at the Institute for Jet Propulsion and Turbomachinery of RWTH Aachen. In 1995, he was delegated to the rocket test center of the DLR at Lampoldshausen. His former activities covered diagnostics and health monitoring of aeroengines and life extension of turbine components. He was engaged for many years on ramjet and scramjet activities in the former German Hypersonics Technology programme. Since 1996, he has been a national delegate of the Executive Committee of the International Society of Airbreathing Engines. From 1996 to 1997, he was a member of the Advisory Board for Space Transportation Systems of the General Advisory Council of the former German Space Agency (now DLR). He currently serves on the Industry and Research Committee of the Federal German Industry and Commerce Association, the Advisory Committee for Space Infrastructure of DLR, and the Haut Conseil Scientifique of the Office National d'tudes et de Recherches Aérospatiales, France. His present research activities are linked to liquid rocket propulsion and associated space transportation topics. He is the author or coauthor of more than 120 scientific publications on turbomachinery, airbreathing, and rocket propulsion.

CHUNG K. LAW received his B.S. in physics from the University of Alberta in 1968, his M.A.Sc. in aerospace studies from the University of Toronto in 1970, and his Ph.D. in engineering physics from the University of California at San Diego in 1973. He was on the faculty of Northwestern University from 1976 to 1984 and the University of California at Davis from 1984 to 1988. In 1988, he joined Princeton University where he is now the Robert H. Goddard Professor of Mechanical and Aerospace Engineering. His research interests are in combustion, propulsion, heat and mass transfer, energy, and the environment. He is a recipient of the Curtis W. McGraw Research Award of the American Society for Engineering Education (1984); a Silver Medal of the Combustion Institute (1990); the AIAA Propellants and Combustion Award (1994); the Heat Transfer Memorial Award, in Science, of the American Society of Mechanical Engineers (1997); the AIAA Energy Systems Award (1999); and an Outstanding Alumnus Award from the University of California at San Diego (2000). Presently he is a Deputy Editor of *Combustion and Flame*, the President of the Combustion Institute, and the Chair of the Disciplinary Working Group of NASA's microgravity combustion program. He is a Fellow of AIAA and American Society of Mechanical Engineers.

PONG-JEU LU, Professor of Aeronautics and Astronautics and Director of Heart Science Research Center at the National Cheng Kung University in Taiwan, received his B.S. in 1976 and M.S. in 1978 from the National Taiwan University. He earned his Ph.D. in mechanical and aerospace engineering from Princeton University in 1984. He then joined the faculty of the Institute of Aeronautics and Astronautics at the National Cheng Kung University, where he was promoted to the rank of Professor in 1992 and served as the Institute Director in 1998–2001. His current research interests include computational fluid dynamics, aeroelasticity, aeroacoustics, turbomachinery flow instability, engine condition monitoring and diagnostics, artificial neural network, and bio-engineering applied to artificial heart design. Professor Lu has been a prime mover of the aeroindustry in Taiwan and participated deeply in the National Flight Safety Improvement Program. He now serves on the Boards of Directors of the Chinese Society of Aeronautics and Astronautics, the Chinese Society of Civil Aviation, and the Aeronautical and Space Industry Development Association in Taiwan. As an advocator for international collaborations between the Pacific Rim and North America, he initiated the first Industrial Cooperation Program between the U.S. gas turbine engine manufacturers (e.g., Pratt & Whitney) and universities in Taiwan and China. Professor Lu has published more than 50 articles and papers, and was the recipient of the Best Paper Awards of the National CFD Conferences in Taiwan in 1999 and 2000.



ROBERT L. SACKHEIM, Assistant Director and Chief Engineer for Propulsion at NASA's George C. Marshall Space Flight Center (MSFC), holds a B.S. from the University of Virginia and a M.S. 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. In 2001, he was awarded the NASA Medal for outstanding technical leadership. Mr. Sackheim was formerly the Chair of the AIAA Liquid Propulsion Technical Committee and the Chair of the Los Angeles section of AIAA, and was recently the Chair of the Mississippi/Alabama section of AIAA. He has served on a number of NASA boards, including the Shuttle Independent Assessment Team, the Mars Climate Orbiter Mishap Investigation Board, and the Mars Polar Lander Mishap Board. He has authored more than 140 technical papers. He holds seven patents for spacecraft, launch vehicle propulsion, and control systems technology.



ROBERT J. SANTORO, Distinguished Professor of Mechanical Engineering and Director of the Propulsion Engineering Research Center at The Pennsylvania State University, received his Ph.D. in physics from Boston College in 1975 where he also held a one-year position as a Lecturer. He then joined the Fuels Research Laboratory in the Department of Mechanical and Aerospace Engineering at Princeton University as a Research Engineer, where his research emphasized the study of hydrocarbon oxidation and flame spread over liquids and solids. In 1978, he joined the National Bureau of Standards (NBS) in Washington, DC, where he remained until 1986. At NBS, Dr. Santoro developed research efforts in the areas of particle formation in flames, laser tomography, and spray combustion research. In 1985, he was awarded the U.S. Department of Commerce Silver Medal for his research in soot particle formation. In 1986, he joined The Pennsylvania State University as an Associate Professor of Mechanical Engineering and was promoted to Full Professor in 1990. In 1994, Dr. Santoro was appointed to the position of Director of the Propulsion Engineering Research Center, where he currently serves. In 2000, Dr. Santoro was promoted to Distinguished Professor of Mechanical Engineering. His research interests include studies of rocket propulsion, soot formation in flames, liquid spray combustion, laser diagnostics, diesel engine combustion, gas turbine combustion, combustion instability, chemical kinetics, and materials processing.

BYRON K. WOOD, with nearly 40 years of experience in the field of launch vehicle propulsion, is responsible for directing many space-related activities, including the main engines for NASA's Space Shuttle and booster engines for several Expendable Launch Vehicles. Wood joined Rocketdyne in 1963 from the Lawrence Radiation Laboratory in Berkeley, California. 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). He drove 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. He has served as Vice President and General Manager of Rocketdyne Propulsion & Power since 1998. Wood is a graduate of the University of California at Berkeley with degrees in physics and mathematics. He is a Fellow of 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 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. Currently, Wood serves on the NASA Advisory Council.

JIAN-ZHONG XU, Member of the Chinese Academy of Sciences (CAS) and Professor of the Institute of Engineering Thermophysics of CAS, received his B.S. from the University of Science and Technology of China in 1963, and finished his postgraduate study in engineering thermophysics at the Institute of Mechanics of CAS in 1967. He was on the faculty of the Institute of Mechanics in 1967–1980, before joining the Division of Propulsion and Power at the Institute of Engineering Thermophysics of CAS, where he became a Professor in 1986. His current research interests include fluid dynamics and heat transfer of turbomachinery, multiphase flows, micro engines, and space solar power. Professor Xu was awarded the second-class National Natural Science Prize, the first-class Science and Technology Achievement Prize of CAS, the second-class Natural Science Prize of CAS, and several science and technology prizes and awards. He was conferred the title "National Outstanding Scientist" in 1984 and elected as a CAS Member in 1995. He is presently Chairman of the Scientific Degree Committee of the Institute of Engineering Thermophysics, Member of the National Invention Awards Committee, Vice President and Secretary-General of the Chinese Society of Engineering Thermophysics, Deputy Editor-in-Chief of the *Chinese Journal of Engineering Thermophysics*, and Editor of the *Chinese Journal of Aeronautics and Astronautics* and the *Chinese Journal of Computational Mechanics*. Prof. Xu is the author or coauthor of more than 150 papers and articles.

BEN T. ZINN, David S. Lewis Jr., Chair of Aerospace Engineering and Regents' Professor, joint appointment with the George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, received his B.S. in mechanical engineering (cum laude) from New York University in 1961, his M.S. in mechanical engineering from Stanford University, and his 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 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 membership of the National Academy of Engineering, the AIAA Pendray and Combustion and Propellants awards, Fellow of the AIAA and American Society of Mechanical Engineers, 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 studies have won national and regional awards. Dr. Zinn is author or coauthor of 395 articles and papers.

Editorial Policy Statement on Numerical Accuracy and Experimental Uncertainty

The purpose of this statement is to reiterate the desire to have high-quality investigations with properly documented results published in the AIAA journals, and to clarify acceptable standards for presentation of numerical and experimental results. Recently there has been considerable concern with the quality of published numerical solutions. Also the practice of including error bars on experimental results is often lacking. In response to these problems, a succinct policy statement on these items is as follows:

> *The AIAA journals will not accept for publication any paper reporting (1) numerical solutions of an engineering problem that fails adequately to address accuracy of the computed results or (2) experimental results unless the accuracy of the data is adequately presented.*

The implementation of this policy will be at the discretion of the Editors and Associate Editors of the journals.

The accuracy of the computed results is concerned with how well the specified governing equations in the paper have been solved numerically. The appropriateness of the governing equations for modeling the physical phenomena and comparison with experimental data is not part of this evaluation. Accuracy of the numerical results can be judged from grid refinement studies, variation of numerical parameters that influence the results, comparison with exact solutions, and any other technique the author selects. The validity of the accuracy estimation will be judged by the reviewers of the paper. An estimate of accuracy of the numerical results must be presented when comparisons with other numerical and experimental results are given, and when new results of the author will likely become data for future comparisons. Since accuracy of various computed results obtained from a numerical solution can vary significantly, the accuracy of the result being used must be stated. Accuracy of results from a validated code must still be established to show that proper input parameters have been used with the code.

Estimates of experimental uncertainty are required for all plotted or tabulated data obtained by authors. If data from other workers are used, they require no uncertainty. Unless otherwise stated and properly referenced, it is assumed that the uncertainty of authors' output data is estimated by the small-sample method[1] with assumed odds 20:1. All reported data must show uncertainty estimates if used in text or tables; for example, $T = 642 + 8$ K. All figures reporting new data should contain uncertainty estimates either on the figure with error bars in both coordinate directions or in the caption; for example, uncertainty in $T = \pm 8$ K at 20:1 odds. Investigations with limited data should present tabulated results in the paper while extensive data should be available elsewhere in tabulated form for use by other workers.

Finally, the accepted documentation procedures for a technical investigation must be used. For computational papers, the author must provide an adequate description of the numerical solution procedure, if not documented elsewhere. In addition, the complete governing equations must be specified with sufficient detail along with the input parameters to the code so that a reader could reproduce the results of the paper. For papers concerned with experimental test, thorough documentation of the experimental conditions, instrumentation, and data reduction techniques is required.

[1] Kline, S. J., and McClintock, F. A., "Describing Uncertainties in Simple-Sample Experiments," *Mechanical Engineering*, Jan. 1953, pp. 3–8.