

The National Academies of **SCIENCES • ENGINEERING • MEDICINE**

Division on Engineering and Physical Sciences
Army Research Laboratory Technical Assessment Board
Panel on Ballistics Science and Engineering at the Army Research Laboratory

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Biographical Sketches

Chair

GEORGE T. (Rusty) GRAY III (NAE) is a Laboratory Fellow and staff member in the dynamic properties and constitutive modeling team within the Materials Science Division of Los Alamos National Laboratory (LANL). He came to LANL following a three-year visiting scholar position at the Technical University of Hamburg-Harburg in Hamburg, Germany. As a staff member (1985-1987) and later team leader (1987-2003) in the Dynamic Materials Properties and Constitutive Modeling Section within the Structure / Property Relations Group (MST-8) at LANL, he has directed a research team working on investigations of the dynamic response of materials. He conducts fundamental, applied, and focused programmatic research on materials and structures, in particular in response to high-strain-rate and shock deformation. His research is focused on experimental and modeling studies of substructure evolution and mechanical response of materials. These constitutive and damage models are utilized in engineering computer codes to support large-scale finite element modeling simulations of structures ranging from national defense (DOE, DoD, DARPA), industry (GM, Ford, Chrysler, and Bettis), foreign object damage, and manufacturing. He is a Life Member of Clare Hall, University of Cambridge in the UK where he was on sabbatical in the summer of 1998. He co-chaired the Physical Metallurgy Gordon Conference in 2000. He is a Fellow of the American Physical Society (APS), a Fellow of ASM International (ASM), and a Fellow of the Minerals, Metals, and Materials Society (TMS). He is a member of APS, ASM, TMS, and serves on the International Scientific Advisory Board of the European DYMAT Association. In 2010, he served as the president of the Minerals, Metals, and Materials Society. Starting in 2012 he became the chair of the Acta Materialia Board of Governors which oversees the publication of the journals Acta Materialia, Scripta Materialia, and Acta Biomaterialia. He has authored or co-authored over 430 technical publications. In 2017, he was elected to the National Academy of Engineering. He received his Ph.D. in materials science in 1981 from Carnegie-Mellon University.

Members

ELLEN M. ARRUDA (NAE) is the Maria Comninou Collegiate Professor of Mechanical Engineering and a professor biomedical engineering and of macromolecular science and engineering at the University of Michigan. She conducts research in the areas of theoretical and experimental mechanics of macromolecular materials, including polymers, elastomers, composites, soft tissues and proteins, and in tissue engineering of soft tissues and tissue interfaces. Her research programs include experimental characterization and analytical and computational modeling of soft materials, including native and engineered tissues. Her interests in tissue engineering include scaffoldless methods using primary and mesenchymal cell sources, tissue engineering of tissue interfaces such as the myotendinous junction, and enthesis and multi-phasic tissue engineering. Her polymer mechanics work has focused on the mechanics of these highly strain rate and temperature dependent materials with emphasis on the relationships among the structures at various length scales to the deformation mechanisms of those structures to predict the mechanical responses. She obtained her B.S. in engineering science from Pennsylvania State University (1985); an M.S. in engineering mechanics from Pennsylvania State University

(1988); and a Ph.D. in mechanical engineering from Massachusetts Institute of Technology (1992).

MELVIN R. BAER, retired, was a senior scientist in engineering sciences at Sandia National Laboratories. Over the past 35 years, he has published fundamental and basic research in the field of energetic materials involving the initiation, deflagration, and detonation processes in propellants, explosives, intermetallics, and pyrotechnics. He has served as a consultant in energetic materials for several government agencies and has participated in numerous explosives review and investigation programs, such as the Advanced Energetics Integrated Process Team (IPT) group, the U.S. Navy reinvestigation of the USS Iowa incident, and the National Transportation Safety Board investigation of the TWA 800 accident. Dr. Baer received his Ph.D. in mechanical engineering from Colorado State University.

MARCIA A. COOPER is a distinguished member of the technical staff at the Sandia National Laboratories. Her expertise is in gaseous and condensed phase detonations, explosives, shock waves, and compressible flow. She runs Sandia's Light Gas Gun Facility at the Explosive Components Facility and a unique diagnostic, the optically recording velocity interferometer system (ORVIS), which is an important variant of the more familiar velocity interferometer system for any reflector (VISAR), both of which were invented at Sandia. She has served as Technical Committee Member and as Poster Session Co-Chair of the American Physical Society Shock Compression of Condensed Matter (APS-SCCM) Conference (June 14-19, 2015, Tampa, FL); Organizing Committee Member for the International Detonation Symposium and Poster Session Chair (2018, 2014, 2010); Technical Committee Member for the Energetic Materials topical area of the American Physical Society Shock Compression of Condensed Matter/International Association for the Advancement of High Pressure Science and Technology (APS-SCCM/AIRAPT-24) Joint Conference (July 7-12, 2013, Seattle, WA); and Chair of Sessions: Society of Experimental Mechanics Annual Conference (2015), American Physical Society Shock Compression of Condensed Matter (2013), Joint Army-NASA-Air Force (JANNAF) Subcommittee Meeting (2012, 2011, 2008). Dr. Cooper has a B.S. (1999, mechanical engineering) from Purdue University, an M.S. (2000, mechanical engineering) and a Ph.D. (2004, mechanical engineering) from the California Institute of Technology.

ROGER GHANEM is the Gordon S. Marshall Professor of Engineering Technology and professor in the Aerospace and Mechanical Engineering Department and the Civil and Environmental Engineering Department at the University of Southern California. Prior to joining USC in 2005, he served on the faculty of Johns Hopkins University and SUNY-Buffalo. Dr. Ghanem is an expert in stochastic analysis and stochastic computational science. He has developed the functional analytic approach to stochastic mechanics as a relevant tool in computational science and engineering. He has worked for the past twenty years to clarify scientific, mathematical, and algorithmic foundations for the application of these methods to problems critical to national competitiveness and security. Dr. Ghanem has co-authored over 300 technical articles related to stochastic systems and predictive science. He has supervised the research of over 20 postdoctoral associates, 30 Ph.D. students, and numerous masters and undergraduate students. Dr. Ghanem serves on the executive council of the US Association for Computational Mechanics (USACM) and on the US National Committee for Theoretical and Applied Mechanics, and as the Chair of the Uncertainty Quantification SIAG of SIAM. He is fellow of AAAS, USACM, and EMI. He received his Ph.D. in civil engineering from Rice University in 1989.

ZELDA GILLS is a physicist working in the aerospace and defense industry as a technical project manager at Lockheed Martin Aeronautics Company. Dr. Gills' career at Lockheed began in 2003 with engineering, prototyping and testing solutions for airborne communications, radar and defensive systems. She currently leverages expertise in systems engineering and avionics to conceptualize and mature solutions for mission system modification contracts valued at over \$100 million each and aircraft recapitalization

programs valued at over \$1.5 billion long term. Over the course of her career, she has led multisite/multidisciplinary technical teams in a variety of industries including optics/photonics, telecommunications, electronics, and avionics. She is a graduate of Southern University and A&M College in Baton Rouge, Louisiana, where she received her undergraduate degree in physics, supported in part by an American Physical Society (APS) scholarship. With the support of a Bell Labs fellowship, she completed her Ph.D. in optics and laser physics at Georgia Institute of Technology. Dr. Gills credits hunger for continuous improvement and support from strong mentors for her success. Consequently, she values opportunities to tutor and mentor students and intentionally looks for people in whom she can sow and cause to grow.

JERRY A. KRILL is the assistant director for science and technology and chief technology officer at the Johns Hopkins University (JHU) Applied Physics Laboratory (APL), leading APL's innovation initiatives and providing oversight of the Research and Exploratory Development Department. Previously he served as the JHU/APL assistant director for programs and chief quality officer. In that position, Dr. Krill was responsible for all of APL's programs and co-led NASA design and mission reviews for APL-built NASA science missions and instruments, including New Horizons and the Van Allen Probes. Previous positions at JHU/APL include the executive for air and missile defense programs and head of the Power Projection Systems Department. He was a principal in conceiving, and developing the U.S. Navy's Cooperative Engagement Capability that networks air defense sensor and weapon systems and serves as a foundational system for the Naval Integrated Fire Control-Counter Air (NIFC-CA) capability. In 2000, he led the Navy/Ballistic Missile Defense Organization Concept Formulation Working Group in a presidentially directed study of the Navy's role in ballistic missile defense. Several concepts are presently fielded or in development for the Aegis Ballistic Missile Defense program. He holds 22 patents, has authored over 100 papers and major technical documents and serves on the Johns Hopkins University's Whiting School of Engineering's Advisory Board. He received the Maryland Daily Record Innovator of the Year, was awarded the American Society of Naval Engineers "Jimmie" Hamilton Award, and was inducted into the Clark School of Engineering Innovation Hall of Fame at the University of Maryland, College Park. He co-authored the book *Infusing Innovation into Organizations* (CRC Press). A member of the National Academies Naval Studies Board from 2006 to 2012, he co-led the study "Responding to Capability Surprise: A Strategy for US Naval Forces". He holds a Ph.D. in electrical engineering from the University of Maryland.

RICHARD B. MILES (NAE) is the TEES Distinguished Research Professor in the Aerospace Engineering Department at the Texas A&M University and the Robert Porter Patterson Professor Emeritus in the Department of Mechanical and Aerospace Engineering at Princeton University. His expertise focuses on the use of lasers, electron beams, microwaves and magnetic devices to control, accelerate, extract power and precondition gas flows for supersonic and hypersonic fluid dynamics, molecular detection and propulsion applications. Research on these applications areas is facilitated by advanced linear and nonlinear laser diagnostics he has developed for the study of high speed gas phenomena as well as for use in other application areas including liquid flows and the detection of hazardous material. He is currently examining microwave control of flame propagation, the stand-off detection of molecules by laser/microwave techniques, the role of high-power microwaves, electron beams and lasers in driving and controlling aerodynamic phenomena, new methods for flow diagnostics based on picosecond and femtosecond lasers, backward lasing methods in air, and plasma flow control and drag reduction of hypersonic vehicles. He obtained his B.S., M.S., and Ph.D. in electrical engineering from Stanford University.

MICHELLE PANTOYA is the J. W. Wright Regents Endowed Chair in Mechanical Engineering and professor at the Texas Tech University. Dr. Pantoya is the founder and director of the Combustion Lab and Texas Tech that supports 15 graduate and undergraduate research assistants. She currently has over \$1M in federally funded research projects that focus on synthesizing energetic material formulations and characterizing their ignition and combustion

behaviors. She has over 150 archival journal publications on these topics, 4 books, 5 book chapters, and 4 patents with an H-index of 31. Her previous positions include being a visiting scholar at the Los Alamos National Laboratory, Combustion and Energetic Materials Division; and as a gas turbine research and development program manager at the California Energy Commission, Sacramento, California. Her honors and awards include the Presidential Early Career Award for Scientists and Engineers (PECASE) (2004), the Department of Defense Young Investigator Award (2002); Barnie E. Rushing Research Award, Texas Tech University (2017); the Creativity Garden Grant by Disney – for development of informal engineering education at the Science Spectrum, Lubbock, TX, (2016); the YWCA Women of Excellence Award (2015); and the Outstanding Research, Texas Tech University (2012-2013). She earned a B.S., M.S., and Ph.D. in mechanical engineering from the University of California, Davis.

C. KUMAR N. PATEL (NAS/NAE) is Emeritus Professor of physics, chemistry, and electrical engineering at University of California, Los Angeles. He is the founder, President and CEO of Pranalytica, Inc., a Santa Monica-based company that is commercializing highly sensitive and selective trace gas sensors and high-power quantum cascade lasers for commercial, homeland security, and defense markets. He is also University Distinguished Professor at University of Central Florida. From March 1993 to December 1999, he was the Vice Chancellor of Research at UCLA. Until joining UCLA in March 1993, he was Executive Director, Research, Materials Science, Engineering and Academic Affairs Division at AT&T Bell Laboratories in Murray Hill, New Jersey. He is the inventor of the carbon dioxide laser. His work at AT&T Bell Laboratories led to the creation of the field of high-power molecular lasers, infrared nonlinear optics, ultra-small absorption measurement techniques for gases, solids, and liquids, and laser surgery. He has authored/coauthored over 270 publications and has been awarded 52 U.S. patents. He was awarded the National Medal of Science by President Clinton in 1996. He was inducted into the National Inventors Hall of Fame in 2012. In 1980, Dr. Patel was elected an honorary member of the Gynecologic Laser Surgery Society, and in 1985, he was elected an honorary member of the American Society for Laser Medicine and Surgery. He is the past president of the American Physical Society (1995) and Sigma Xi, the Scientific Research Society (1993-1995). He co-chaired (with N. Bloembergen) the American Physical Society Study of the Science and Technology of Directed Energy Weapons. Dr. Patel received his B.E. in telecommunications from the College of Engineering in Poona, India. He received M.S. and Ph.D. in electrical engineering from Stanford University.

DONALD PROSNITZ is an independent consultant and an associate senior fellow at the Center for Global Security Research at Lawrence Livermore National Laboratory (LLNL). He also serves as an adjunct senior researcher at the RAND Corporation, a visiting scholar in the Berkeley Physics Department, and holds an affiliate appointment at the Lawrence Berkeley National Laboratory. His current activities include policy analysis of the privacy implications of advanced electronic surveillance, the impact of modern biotechnologies on national security, and the implications of high performance computing (HPC) for policy and decision analysis. In 1999, Dr. Prosnitz was named the first chief science and technology advisor for the U.S. Department of Justice by Attorney General Janet Reno. He was responsible for coordinating technology policy and technology projects among the Justice Department's component agencies including the FBI, DEA, U.S. Marshals, Border Patrol and Bureau of Prisons and with state and local law enforcement entities. Dr. Prosnitz was previously the deputy associate director (programs) for nonproliferation, homeland and international security at LLNL. Prior to joining the laboratory in 1979, he spent two years as an assistant professor at Yale University. Over the next three decades, he conducted research at LLNL on lasers, particle accelerators, high-power microwaves, free-electron lasers, remote sensing, counter terrorism technology and managed the design, construction, and operation of numerous research facilities. In 1990, he was awarded the U.S. Particle Accelerator Award for Achievement in Accelerator Physics and Technology. In 2002, he was named a fellow of the American Physical Society. He is a former chair of the American Physical Society Forum on Physics and Society. Dr. Prosnitz earned a Ph.D. in physics from the Massachusetts Institute of Technology and a B.S. in engineering and

applied science from Yale University. He is a licensed amateur radio operator and an active member of his community's CERT (Community Emergency Response Team).

GHATU SUBHASH is the Newton C. Ebaugh Professor in the Department of Mechanical and Aerospace Engineering at the University of Florida. His research interests include high strain rate and shock response of materials; dynamic multiaxial response, characterization of deformation modes, and fracture behavior of structural ceramics; metallic glasses; 3D woven composites; structural foams; nanostructured materials; and refractory metals; processing-structure-property relationships in ultra-high temperature ceramics; development of novel test methods for low density materials and experimental solid mechanics. He has received numerous honors and awards: 2018 Frocht Award', Society for Experimental Mechanics (SEM) - in recognition of outstanding achievements as an educator. The award recognizes the Experimental Mechanics Educator of the Year and is in recognition of the technical stature and the high personal regard in which the awardee is held by the experimental mechanics community; Best paper ASME- J. Eng. Mater. Tech (2016), American Nuclear Society (ANS) Materials Science and Technology Division 'Significant Contribution Award' (2013), Society of Experimental Mechanics (SEM) Executive Board (2015-2017), Fellow of ASME and SEM, Society of Automotive Engineers (SAE) Ralph R. Teetor Educational Award, and American Society for Engineering Education (ASEE) Outstanding New Mechanics Educator award. He is an associate editor for Journal of the American Ceramic Society, Experimental Mechanics, Mechanics of Materials, Journal of Engineering Materials and Technology, and Journal of Dynamic Behavioral Materials. He recently appeared in a PBS documentary "Secrets of Spanish Florida" - aired nationwide on Dec 26, 2017 while discussing the impact response of Coquina, the material with which the oldest fort in USA, Castillo de San Marcos, in St. Augustine was built. He has published 165 peer-reviewed journal articles and 80 conference papers, and holds three patents (several pending). He received his Ph.D. in applied mechanics and engineering sciences from University of California, San Diego and then conducted his post-doctoral studies at Caltech.

STEPHEN D. TSE is professor and outreach director and the Mary W. Raisler Distinguished Teaching Chair in the Department of Mechanical and Aerospace Engineering at Rutgers University. His research focus is in the thermal sciences, involving applications in nanomaterials synthesis, microgravity processes, combustion and propulsion, and advanced laser-based diagnostics. His research methodologies encompass experimentation; computational simulation of complex flows, chemistry, and molecular dynamics; and mathematical analysis. He has designed experiments and diagnostics that have flown on the Space Shuttle or are being planned for the International Space Station. He was Chair of the AIAA Microgravity and Space Processes Technical Committee, and was Chair of the Public Policy Committee on the ASME Board of Government Relations. At Rutgers, he is Co-Director of the Center for Nanomaterials Research, and executive member of the Institute for Advanced Materials, Devices, and Nanotechnology. He is currently the Technical Chair of the 2017 ASME International Mechanical Engineering Congress & Exposition.

ARLTAB Chair

JENNIE S. HWANG (NAE) is CEO of H-Technologies Group, and board trustee and distinguished adj. professor at Case Western Reserve University. Her career encompasses corporate and entrepreneurial businesses, international collaboration, research management, technology transfer and global leadership positions, as well as corporate and university governance. Among her many honors and awards are U.S. Congressional Certificates of Recognition; induction into International Hall of Fame –Women in Technology and Ohio Women Hall of Fame; named the R&D-Stars-to-Watch; Distinguished Alumni Awards; Honorary Doctoral degree; and YWCA Achievement Award. She was the CEO of International Electronic Materials Corp. and has held senior executive positions with Lockheed Martin Corp., Hanson, PLC and Sherwin-Williams Co. and co-founded entrepreneurial businesses. She is internationally recognized as a pioneer and long-standing leader in the infrastructure development of electronics

miniaturization and green manufacturing. She has served as Global President of the Surface Mount Technology Association and in other global leadership positions. An international speaker and author of 475+ publications including several internationally-used books, she has lectured to tens of thousands of managers, engineers and researchers on professional development courses. Her speeches range from university commencement addresses to keynote at DoD Federal Women's Program to tutorials at the U.S. Patent and Trademark Office. She is also a prolific author and speaker on education, workforce, and social and business issues. Additionally, Dr. Hwang has served as a board director for Fortune 500 NYSE-traded and private companies and various university and civic boards, and on the International Advisory Board of the Singapore Advanced Technology and Manufacturing Institute and a number of international industry boards. On serving the National Academies, she chairs the Technical Assessment Board of Army Research Laboratory, and has served as NAE Membership Search Executive (Materials Section), National Materials and Manufacturing Board, DoD R&D Globalization Board, Committee on Forecasting Future Disruptive Technologies and NAE Award Committee, among others. She also has served as a reviewer for National Academies Reports and other national/international publications. Her formal education include Harvard University Executive Program, Columbia University Business School Governance Program, and four academic degrees (Ph.D., M.A., M.S., B.S.) in Materials Science and Metallurgical Engineering, Chemistry, and Liquid Crystal Science. The Dr. Jennie S. Hwang Award for Faculty Excellence was established at her Alma Maters. The Dr. Jennie S. Hwang YWCA Award is established in her honor, now for 17 years running, to encourage and recognize outstanding women students in STEM, Further info: www.JennieHwang.com.