Space Radiation Effects Testing Infrastructure for the U.S. Space Program

Committee

Bhavya Lal

Co-Chair

BHAVYA LAL is a research staff member at the IDA Science and Technology Policy Institute. Her research and analysis focuses on space technology and policy and is frequently incorporated in national policy documents. Recent and ongoing projects include supporting the Office of Science and Technology Policy and other Federal agencies in developing a national space technology strategy, improving detection of near Earth objects, evaluating a civilian space situational awareness capability, documenting global trends in space, and examining recent commercial activities in space including their legal ramifications related to the Outer Space Treaty. She has previously served on the NRC Committee on Space-Based Additive Manufacturing and the Committee on Achieving Science Goals with CubeSats. Before joining STPI, Dr. Lal was president of C-STPS, LLC, a science and technology policy research and consulting firm in Waltham, Massachusetts. Prior to that, she was a researcher and the Director of the Center for Science and Technology Policy Studies at Abt Associates, Inc., in Cambridge, Massachusetts. Dr. Lal holds B.S. and M.S. degrees in nuclear engineering from the Massachusetts Institute of Technology (MIT), an M.S. from MIT’s Technology and Policy Program, and a Ph.D. from the Trachtenberg School of Public Policy and Public Administration (concentration in science and technology policy) at George Washington University.

Paul D. Nielsen

Co-Chair

PAUL D. NIELSEN (NAE) is the director and chief executive officer of the Software Engineering Institute (SEI), a global leader in advancing software and cybersecurity to solve the nation's toughest problems through focused research, development, and transition to the broad software engineering community. The SEI is a key innovator in areas central to U.S. Department of Defense and civilian government operation in the cyberspace domain, including software architecture, software product lines, interoperability, the integration of software-intensive systems, network and system resilience, and the increasing overlap of software and systems engineering. The SEI also provides direct support to more than 50 U.S. government entities in their efforts to efficiently and effectively acquire and sustain new software and systems. Nielsen has overseen the development and expansion of CERT, which is responsible for the SEI's network/cybersecurity efforts, and the growth of the SEI to an organization with more than 700 employees and operating revenues of $145 million annually. In addition, he has overseen an increase in research activities related to software architecture, complex systems, and cybersecurity to address both present and future challenges. In 2012, Nielsen oversaw the successful spinout of the CMMI product suite and its partner network to the CMMI Institute, a subsidiary of Carnegie Innovations, Carnegie Mellon University's technology commercialization enterprise. Prior to joining the SEI in 2004, Nielsen served in the U.S. Air Force, retiring as a major general and commander of the Air Force Research Laboratory after 32 years of distinguished service. Nielsen is a member of the U.S. National Academy of Engineering (NAE) and a fellow of both the American Institute of Aeronautics and Astronautics (AIAA) and the Institute for Electrical and Electronics Engineers (IEEE). In 2011, he received the Aerospace Software Engineering Award from AIAA, and in 2004, AIAA awarded him the Hap Arnold Award for Excellence in Aeronautical Program Management. In 2014, he was recognized by the Pittsburgh Business Times with a Diamond Award as one of the region's top CEOs. And in 2016, AFCEA awarded him their Distinguished Award for Excellence in Engineering. Nielsen earned a BS in physics from the U.S. Air Force Academy, an MBA from the University of New Mexico, and an MS and a Ph.D. in applied science from the University of California, Davis.

Arden L. Bement, Jr.

Member

ARDEN L. BEMENT JR. (NAE) is the former inaugural director of the Global Policy Research Institute (2010¬-2012) at Purdue. Prior to this last position, he was the director of the National Science Foundation (2004-¬2010), director of the National Institute of Standards and Technology (2001-2004), Deputy Under Secretary of Defense (1979), and director of the DARPA Office of Materials Science (1976-¬-1979). He served in the U.S. Army Corps of Engineers (Reserve)(1954-1992) and retired as a Lieutenant Colonel. He served as a member of the U.S. National Commission for UNESCO and as the vice--chair of the Commission's Natural Sciences and Engineering Committee. He is a member of the U.S. National Academy of Engineering, the European Academy of Science, the Pan American Academy of Engineering, a fellow of the American Academy of Arts and Sciences, and a fellow of the American Association for the Advancement of Science. He joined NIST from Purdue University, where he was the David A. Ross Distinguished Professor of Nuclear Engineering and head of the School of Nuclear Engineering. He has held appointments at Purdue University in the schools of Nuclear Engineering, Materials Engineering, and Electrical and Computer Engineering, as well as courtesy appointments in the Krannert School of Management and School of Industrial Engineering. Bement joined the Purdue faculty in 1992 after a 39-¬year career in industry, government, and academia. His positions included: vice president of technical resources and of science and technology for TRW Inc. (1980-1992); deputy under secretary of defense for research and engineering (1979-1980); director, Office of Materials Science, DARPA (1976-¬1979); professor of nuclear materials, MIT (1970-1976); manager, Fuels and Materials Department and the Metallurgy Research Department, Battelle Northwest Laboratories (1965-1970); and senior research associate, General Electric Co. (1954-1965). He has also been a director of Keithley Instruments Inc. and the Lord Corp. and a member of the Science and Technology Advisory Committee for the Howmet Corp., a division of ALCOA. He currently serves on the science advisory committee for the Skolkovo Foundation and the board of directors for the Skolkovo Council for the Korean Advanced Institute of Science and Technology, and the board of directors of Radian Research, Inc. Bement holds an engineer of metallurgy degree from the Colorado School of Mines, a master's degree in metallurgical engineering from the University of Idaho, a doctorate in metallurgical engineering from the University of Michigan, and honorary doctorates from Cleveland State University, Case Western Reserve University, Colorado School of Mines, University of Idaho, Michigan Technological University, Korean Advanced Institute of Science and Technology, and University of Macau and is an Honorary Professor of the Chinese Academy of Sciences Graduate School. He is a recipient of the Distinguished Civilian Service Medal of the Department of Defense. He has been awarded the Order of the Rising Sun, Gold and Silver Star from the Empire of Japan and the Chevalier dans l'Ordre National de la Légion d'Honneur from the President of the French Republic.

James L. Burch

Member

JAMES L. BURCH is the vice president of Southwest Research Institute Space Science and Engineering Division. He was the principal investigator for the NASA Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) mission, which provided the first global images of key regions of the Earth's magnetosphere as they respond to variations in the solar wind. He was elected a Fellow of the AGU in 1995 and was awarded its Fleming Medal in 2010. Dr. Burch is currently principal investigator for the Ion and Electron Sensor for the ESA Rosetta comet mission and principal investigator for the NASA Magnetospheric Multiscale mission.

Henry B. Garrett

Member

HENRY B. GARRETT is a principal scientist at the Jet Propulsion Laboratory (JPL) at the California Institute of Technology. He received his bachelors in physics from Rice University in 1970 and his Ph.D. in space physics and astronomy from Rice University in 1974. He has a wide variety of experience and over 135 publications on the space environment and its effects with specific emphasis in the areas of atmospheric physics, the low earth ionosphere, radiation, micrometeoroids, space plasma environments, and effects on materials and systems in space. While on active duty in the Air Force he served as project scientist for the highly successful SCATHA program which studied the effects of charging and radiation on spacecraft for which he was awarded the Harold Brown Award (top Air Force scientist), Air Force Systems Command Officer of the Year, and the AF R&D Award. He retired in 2002 as a full Colonel in the Air Force Reserves and received the Air Force Legion of Merit. He has been at JPL since 1980 and has been responsible for defining the space environment and its effects on reliability for many NASA missions. He has published several textbooks on the space environment and its impact on spacecraft design and reliability and served as an associate editor of the Journal of Spacecraft and Rockets. From 1992-1995, he was a JPL IPA to the Ballistic Missile Defense Organization where he acted as the deputy program manager for the DoD/NASA Clementine Lunar Mission and program manager for the Clementine InterStage Adapter Satellite (ISAS) for which he was awarded NASA's Medal for Exceptional Engineering Achievement. From 1985 to 2011, he served as the chief technologist for the Office of Safety and Mission Success. In 2006 Dr. Garrett received NASA’s Exceptional Service Medal for “his achievements in advancing the understanding of space environments and effects.” Recently, Dr. Garrett co-authored with Mr. Albert Whittlesey the primary NASA standard on spacecraft surface and internal charging for earth missions. Dr. Garrett is an international consultant on the terrestrial and interplanetary space environments and spacecraft reliability having worked for INTELSAT, L’Garde, NASDA, Boeing, Loral, CNES, and other organizations. He has no prior National Academies experience.

James S. Harris

Member

JAMES HARRIS (NAE) is the James and Ellenor Chesebrough Professor of Electrical Engineering, Applied Physics and Materials Science at Stanford University. He received his bachelors, masters, and Ph.D. in electrical engineering from Stanford in 1964, 1965, and 1969 respectively. He has 50 years experience on III-V materials, epitaxy, characterization and device physics. He spent 14 years at the Rockwell International Science Center working on the first high speed GaAs devices and circuits for satellite communications and solar cells for satellite power, including radiation hardness design and testing. At Stanford, Harris has worked on a broad range of materials and devices, including development of the dilute Nitride-Antimonide materials system that was the foundation for he and three former students co-founding Solar Junction which utilizes this material as the bottom junction of the record efficiency triple junction solar cells. He has also used this cell as the basis to set a new record solar to hydrogen conversion efficiency. He is a fellow of the IEEE, the Materials Research Society, American Physical Society and Optical Society of America. He is a member of the National Academy of Engineering and has served on several NAE/NAS panels evaluating research programs at NIST and the Army Research Labs.

Sandra L. Hyland

Member

SANDRA HYLAND is a semiconductor design engineer at the Northrop Grumman Corporation’s Advanced Technology Lab, where her principal efforts are in yield monitoring and improvement for Northrop’s silicon-based radiation-hardened and non-radiation-hardened CMOS line. She has 25 years experience as a technical lead and program manager in both for- and non-profit organizations. Prior to joining Northrop, Sandra was a product engineer for infra-red detectors at BAE Systems, etch process engineering manager for Tokyo Electron, and front-end process integration engineer for IBM Federal System’s radiation-hardened semiconductor chip line in Manassas, VA. She has also served as a staff officer at the National Research Council’s National Materials Advisory Board. Dr. Hyland has a Ph.D. in materials science and engineering from Cornell University, an M.S. in electrical engineering from Rutgers University, and a B.S. in electrical engineering from Rensselaer Polytechnic Institute. Dr. Hyland is a member of the Institute of Electrical and Electronic Engineers and a current director of the Northern Virginia section. She is a fellow of the Society of Women Engineers, and previously served as chair of the National Academies Committee on Engineering Aviation Security Environments – False Alarm Reduction.

Linda P. Katehi

Member

LINDA KATEHI (NAE) is a professor in electrical and computer engineering at University of California, Davis and the Chancellor Emerita. She has focused her research on the design of high frequency, high density planar and three-dimensional circuits for RF front ends used in atmospheric, space radars and various wireless applications. She has been the author and co-author of nine book chapters, more than 650 articles and owns 19 patents. She is a member of the National Academy of Engineering (NAE), a member of the American Academy of Arts and Sciences, a member of the National Academy of Innovators, and a fellow of the American Association for the Advancement of Science (AAAS). She served as chair of the Nominations Committee for the National Medal of Technology and Innovation and the National Medal of Science. She served as a member of the Kauffman National Panel for Entrepreneurship, a member of the NSF Advisory Committee to the Engineering Directorate, a member of the Engineering Advisory Committee for Iowa State University, a member of the NRC Army Research Lab Advisory Committee on Sensors and Electronics Division (SED), a member of the NSF Advisory Committee to CISE, a member of the NASA Aeronautics Technical Advisory Committee (ARAC), and a member of the DoD Advisory Group on Electron Devices. She has chaired the NAE report on Engineering Education (2014) and the NAS report on Pathways to Urban Sustainability (2016).

Ray Ladbury

Member

RAY L. LADBURY is a radiation physicist in the Radiation Effects and Analysis Group (REAG) at NASA Goddard Space Flight Center. He earned his bachelor of science degree in physics from Colorado State University and his PhD in experimental particle physics from the University of Colorado. He has served as lead radiation engineer for many NASA programs and missions, including the James Webb Space Telescope, SWIFT, LANDSAT8, OSIRIS-REx and the GOES and TDRS programs. Within the REAG, Dr. Ladbury’s research has centered on the radiation testing and qualification of complex devices for spacecraft applications and the use of statistical models in radiation hardness assurance. He has authored or co-authored over 70 technical papers in peer-reviewed journals and three short courses on various aspects of radiation hardness assurance. In addition, Dr. Ladbury has also authored two dozen popularized articles on cutting-edge physics research. He is the lead for the Radiation Community of Practice under the NASA Engineering and Safety Center (NESC) Avionics group and served on the recent NESC study of the use Commercial-Off-The-Shelf electrical components for Commercial Crew applications. In addition to his work in radiation physics, Dr. Ladbury has served as an editor for Physics Today Magazine, a physics professor at Pikeville College in Pikeville, KY and a science teacher trainer with the Peace Corps in the Savannah Region of Togo, West Africa.

Joe Mazur

Member

JOE MAZUR is an associate director of the Space Sciences Department at The Aerospace Corporation. He earned his bachelors in physics from the University of Chicago in 1985 and his masters and Ph.D. in physics from the University of Maryland in 1989 and 1991 respectively. He has over thirty years of experience in space science and space hazard effects, including advanced particle detectors, space physics, solar energetic particles, trapped particles in the Earth's magnetosphere, and space environment effects on space systems. He is active in the design and construction of advanced particle detectors and low-impact space radiation monitors. His scientific research interests include the composition, acceleration, and transport of solar energetic particles in interplanetary space and trapped particles in the Earth's magnetosphere. He was co-investigator on the NASA Solar, Anomalous, and Magnetospheric Particle Explorer, the NASA/ESA Ulysses mission, the NASA Lunar Reconnaissance Orbiter, and was an instrument investigator on the NASA Advanced Composition Explorer spacecraft. He is currently principal investigator of a high-energy proton spectrometer for the NASA Radiation Belt Storm Probes mission.

Leonard Rockett

Member

LEONARD ROCKETT is the president of Technology Metrics, LLC, an independent certified small business specializing in patent services and in management and engineering consulting support services. He is a registered U.S. patent agent, licensed to practice before the U.S. Patent and Trademark Office in the drafting, filing, and prosecution of patent cases. He is also a certified program management professional (PMP). For over eight years, he was the manager of the microelectronics business area within the space electronics line of business at BAE Systems. He was the program management director at BAE Systems during a successful three-year DoD-funded $125-million foundry modernization program that upgraded the semiconductor wafer fabrication capabilities of the radiation hardened microelectronics foundry. Dr. Rockett earned his doctorate in electrical engineering from Columbia University in the City of New York and he has had extensive engineering and management experience in private industry. He is a subject matter expert in microelectronics; semiconductor devices; and radiation hardening techniques. He has authored or coauthored over 80 published peer-reviewed technical final reports and journal papers, and he has 16 U.S. patents. For 12 years while at BAE Systems, Dr. Rockett was a visiting/adjunct professor of electrical engineering at Howard University in Washington DC. He is currently a member of the electrical and computer engineering advisory board at the University of the District of Columbia. He is also an ABET program evaluator.

Ronald E. Turner

Member

RON TURNER is a distinguished analyst for Analytic Services (ANSER). He received his bachelors and masters in physics from the University of Florida in 1977 and 1978 respectively, and received his Ph.D. in physics from Ohio State University in 1984. He has over 30 years experience in space systems analysis, from requirements definition to system architecture evaluation. He has expertise in the space environment, orbital mechanics, sensor design, and spacecraft design. Dr. Turner is an internationally recognized expert in radiation risk management, particularly in response to solar storms. In 2008-2009 he led an effort at NASA to understand NASA’s requirements for operational space weather support, which included a review of test facilities for component radiation hardness. He is the senior science advisor to the NASA Innovative Advanced Concepts program. His contributions to NASA were recognized with the award of the NASA Exceptional Public Service Medal in October, 2015. Dr. Turner also supports activities related to Homeland Security, including assessments of the threat posed by severe space weather to critical infrastructure. He is a member of the International Academy of Astronautics and has served on several National Academies committees.