

Connector Reliability for Offshore Oil and Natural Gas Operations (BOLTS Study)

Committee

Robert E. Schafrik, Sr

Chair

ROBERT SCHAFRIK [NAE] is a consultant and recently retired general manager of the Materials and Process Engineering Department at GE Aviation. He received his Ph.D. in metallurgical engineering from Ohio State University in 1979, an M.S. in information systems from George Mason University in 1996, an M.S. in aerospace engineering from the Air Force Institute of Technology in 1974, and a B.S. in metallurgy from Case-Western Reserve University in 1967. As such he was responsible for developing advanced materials and processes used in GE's aeronautical turbine engines and their marine and industrial derivatives. He oversaw Materials Application Engineering activities supporting GE Aviation's global design engineering, manufacturing, and field support activities. He also operated a state-of-the-art in-house laboratory for advanced materials development, characterization, and failure analysis. Prior to joining GE in November 1997, he served in 2 concurrent positions within the National Research Council, which he joined in 1991: Staff Director, National Materials Advisory Board and Staff Director, Board on Manufacturing and Engineering Design. Under his direction, 33 final reports for studies were issued that addressed significant national issues in materials and manufacturing. Dr. Schafrik also served in the U.S. Air Force in a variety of R&D and system acquisition capacities; he retired as a Lieutenant Colonel, while recently he served as member of the Air Force Scientific Advisory Board, 2009-2013. His experience in the aviation industry and efforts for materials development will be indispensable for leading this effort as the chair.

Robert Pohanka

Vice Chair

ROBERT POHANKA was the director (retired) at National Nanotechnology Coordination Office. He received his PhD from Penn State University in 1972. He served from 2012 until 2014 as the Director of the National Nanotechnology Coordination Office (NNCO), within the National Science and Technology Council, Office of Science and Technology Policy, Executive Office of the President. From January 2009 to March 2012 he served as the Research Director for the Hybrid Complex Warfare Sciences within the Expeditionary Maneuver Warfare and Combating Terrorism Science & Technology Department, Office of Naval Research (ONR). Dr. Pohanka served as the Director of Defense Venture Catalyst Initiative (DeVenCI), on assignment from ONR to the Office of the Under Secretary of Defense, Science & Technology. He led and directed the strategy for finding private sector technologies, developed independently of DoD, and transitioned them to DoD Research, Development, and Acquisition. From June 2004 to May 2006 he was Head of the Engineering Materials and Physical Sciences Department at ONR. During this period, Dr. Pohanka also served as Director for the Materials Science and Technology Division and as Director for the Ship, Hull, Mechanical, and Electrical Division. Dr. Pohanka is a recipient of the US-Japan Electroceramic Bridge Building Award (2005), presented the E.F. Osborn Memorial Lecture (2001), selected as a Senior Executive Service Meritorious Executive (2000) and Centennial Fellow – The Pennsylvania State University (1996). He is a fellow of the American Ceramic Society, and a Life member of the American Physical Society. He has chaired international symposia for the American Ceramic Society, IEEE, SPIE, and Materials Research Society. His experience will serve him well as the vice-chair for this effort given his time in the Navy dealing with large engineering systems operating in oceanic environments, including design, failure analysis, life prediction, and material process control.

Clyde L. Briant

Member

CLYDE BRIANT [NAE] is the Otis E. Randall University Professor at Brown University. He received his Ph.D. in materials science from Columbia University in 1974 and was a post-doctoral researcher at the University of Pennsylvania from 1974 to 1976. From 2003-2006 he served as Dean of Engineering at Brown and from 2006-2013 he served as Vice President for Research. His primary research interest has been in the area of structural materials, and more recently has begun to study engineering design and the evolution of innovative technological systems. In engineering education, he seeks to provide an education for the public engineer that is an engineer who is extremely well-versed technically and who is also concerned about the societal impact and public understanding of engineering achievements. He is a member of the National Academy of Engineering. His fit in this slate relates to a great knowledge in how material requirements are linked to engineering systems.

Willard C. Capdevielle

Member

BILL CAPDEVIELLE is a semi-retired upstream oil & gas professional with over 40 years experience. Bill has served in many technical and managerial roles in Mobil, Exxon-Mobil (contractor), and Hess Corporation. He has spent approximately $\frac{1}{4}$ of his career in upstream technology centers, $\frac{1}{4}$ of his career in operations & operations support, and $\frac{1}{4}$ of his career in major capital project support. Bill has spent significant time working on offshore drilling rigs and production platforms, including 4 years as an Offshore Installation Manager on one of Mobil's North Sea platforms. Bill has been a member of the Society of Petroleum Engineers for over 45 years – having served as a Chapter officer, on Conference committees, on one of the Forum committees, and as a peer reviewer for technical papers. For the past 5 years Bill has served as a co-chair for the Oil & Gas Symposium at the TechConnect Nanotechnology Conference. Bill is also a volunteer Energy Champion at the Houston Technology Center mentoring start-up companies in the Energy industry.

Homero Castaneda

Member

HOMERO CASTANEDA is the Associate Professor and Director at the National Corrosion and Materials Reliability Center within Texas A&M University. He received his bachelors in chemical metallurgical engineering and his masters in materials science from the National Autonomous University of Mexico in 1994 and 1997 respectively. He then got his Ph.D. in materials science and engineering from Penn State University in 2001. Dr. Castaneda has 15 years of experience using electrochemical and nondestructive techniques to monitor interfacial phenomena in materials and theoretical modeling of corrosion processes for different industries. He has been the PI for multiple projects on corrosion science and engineering for DOE, DOD, DOT and several companies. Before joining TAMU, he worked for five years at The University of Akron (2011 to 2015) as an assistant professor and before that at Battelle Memorial Institute as a senior scientist (2006-2010) in the Advanced Materials and Pipelines Center in Columbus, Ohio. Before Battelle, he was the Technical Director of the Corrosion, Materials and Pipelines in the Mexican Petroleum Institute for five years. He has authored and co-authored over 70 peer-reviewed papers in the areas of corrosion science and engineering, coatings degradation and reliability, materials characterization and electrochemical impedance spectroscopy. He has nine patents and copyrights. For this slate he adds a unique mixture of corrosion knowledge in offshore or similar settings including the standards and regulations pervasive in these fields.

Nancy J. Cooke

Member

NANCY COOKE is a professor of Human Systems Engineering and the Science Director of Cognitive Engineering Research Institute at Arizona State University. Dr. Cooke received a B.A. in psychology from George Mason University and received her M.A. and Ph.D. in cognitive psychology in 1983 and 1987, respectively, from New Mexico State University. Currently, she supervises post-doctoral, graduate and undergraduate research on team cognition with applications in design and training for military command-and-control systems, emergency response, medical systems, cyber security systems, and remotely piloted aircraft systems. In particular, Dr. Cooke specializes in the development, application, and evaluation of methodologies to elicit and assess individual and team cognition. Her most recent work includes the development and validation of methods to measure team coordination, team communication, and team situation awareness and research on translating the science of teams to human-robot teaming. Dr. Cooke was editor-in-chief of Human Factors 2005-09 and is the 2006 recipient of the Human Factors and Ergonomics Society's O. Keith Hansen Outreach Award. Dr. Cooke has served as a member of from 2007-2016 and has chaired the board from 2012-2016. She served the National Research Council as a member of the panel on Human Factors Science at the Army Research Laboratory, as well as two study panels on Human-System Design Support for Changing Technology (2005-2007), the Safety and Security of Spent Nuclear Fuel Storage (2004-2005). Dr. Cooke chaired the study panel on the Science of Team Science (2013-2014). Her expertise will be valuable in determining how bolt installation, production and standards are interpreted and followed in the multi tier system that is used for offshore bolts.

Thomas W. Eagar

Member

THOMAS EAGAR [NAE] is a professor of Materials Engineering and Engineering Management at Massachusetts Institute of Technology. Eagar's past research has involved welding and joining, but an increasing amount of work involves other aspects of materials manufacturing and engineering systems such as product design and development; alternate manufacturing processes; manufacturing management; materials systems analysis; selection of materials and failure analysis. Recent research includes: fundamentals of transient liquid phase diffusion bonding; control of melting during gas metal arc welding; effects of welding fume on health of workers; stresses generated during joining of dissimilar materials; improved methods of dimensional analysis of materials processing; design, forming and assembly of automotive body components; methods for successful product design and development. His expertise in materials and manufacturing is going to be important not only for currently used fasteners but also for alternate systems like friction stir welding that will addressed by this team.

Brun L. Hilbert, Jr.

Member

BRUN HILBERT is a principal engineer at Exponent. He received his bachelors in mathematics and his masters in mechanical engineering from the University of New Orleans in 1979 and 1981 respectively; he received his Ph.D. in materials science and mineral engineering from the University of California, Berkeley in 1995. Dr. Hilbert has been consulting at Exponent since 1996 in the fields of mechanical and petroleum engineering, with special applications to engineering mechanics and geomechanics. He has worked in the petroleum exploration and production industry for 30 years. Dr. Hilbert has expertise in stress analysis, solid mechanics, fluid mechanics, heat transfer, and structural component design. In the area of petroleum engineering, he has expertise in oil and gas well design and integrity, hydraulic fracturing, well production and wellhead equipment, well stability and sand production, well stimulation, drilling mechanics, petroleum rock mechanics, reservoir geomechanics, fixed and floating offshore platforms, and gas and liquid hydrocarbon storage in solution-mined salt caverns and hydrocarbon formations. In the area of geomechanics, Dr. Hilbert has expertise in evaluating the structural integrity of oil and gas wells in compacting or deforming reservoir rocks, in the stability of underground storage structures and nuclear waste repositories and he assists clients in failure analysis involving soil-structure interaction, including pipelines. Dr. Hilbert has highly specialized expertise in the structural integrity and leak resistance of the threaded connections used to join high-pressure pipe. He has conducted failure analyses of steel, rubber, and plastic structures. Prior to joining Exponent, Dr. Hilbert was employed as an engineering specialist for Exxon Production Research Company, where he performed research and taught courses in Well Completions and Workers in the Middle East, Southeast Asia, Australia, and North America. Dr. Hilbert has been selected as a Society of Petroleum Engineers Distinguished Lecturer for 2015-2016. His nomination here adds valuable international knowledge of the offshore field in combination with materials expertise.

Derek J. Horton

Member

DEREK HORTON is a materials research engineer at the Navy Research Lab. He has worked with Naval materials compatibility programs for subsea applications covering nickel-based, cobalt-based superalloys, titanium, stainless steels and other materials for use as high strength fasteners and structural materials. Dr. Horton also has additional experience with fracture mechanics based investigation of high strength fasteners materials, greater than 175 KSI yield, for subsea applications. He also served on the Railgun Corrosion Working Group whose purpose was to provide guidance for high strength material use in novel marine atmospheric and alternate immersion environments as well as a basic research study of optimizing the composition of titanium fastener materials to reduce galvanic corrosion in airframe aluminum alloys. Prior to being a materials research engineer Dr. Horton was a research engineer in the Navy's Vision Point Systems group, there he studied environmental effects on fracture including hydrogen embrittlement on a series of alloy systems including stainless steels, Ni-based superalloys, and Ti including several forensic analyses of material failures, including high strength environmental fracture induced failures. As a research associate at University of Virginia he conducted a hydrogen embrittlement based failure analysis of line pipe steel used in ocean water including electrochemical measurements of hydrogen diffusion, hydrogen concentration and in- situ measurements of hydrogen embrittlement and studied Cu-based antimicrobial alloys including: E. coli kill rate, cation release and resistance to tarnishing. For this effort he adds current knowledge in the field of fasteners for the Navy in combination with corrosion protection knowledge of in the field operations.

David W. Johnson, Jr.

Member

DAVID JOHNSON [NAE] is a senior advisor at Stevens Institute of Technology and an Editor-in-Chief of the Journal of the American Ceramic Society. He earned a B.S. in ceramic technology and a Ph.D. in ceramic science from the Pennsylvania State University in 1964 and 1968 respectively. Dr. Johnson is retired from Bell Laboratories where he served as director of the applied materials research department. Johnson is an ACerS Fellow, a past chair and member of the Electronics Division, a member of the Basic Science and Glass & Optical Materials divisions and the National Institute of Ceramic Engineers. Johnson served as president of ACerS in 1994-1995 and is the recipient of numerous awards, including Distinguished Life Membership in ACerS. His experience of systems engineering and materials for coatings and protection will suite this effort well. He is also nominated as alternate vice-chair.

David K. Matlock

Member

DAVID MATLOCK [NAE] is a university emeritus professor at Colorado School of Mines. He received his bachelors in engineering science from the University of Texas Austin in 1968 and his masters and PhD in materials science and in engineering from Stanford University in 1970 and 1972 respectively. He joined the CSM faculty in 1972 as a member of the physical and mechanical metallurgy program. He is a registered professional engineer in Colorado. From 1981 until his retirement in 2013, he held the Armco Foundation Fogarty Professorship at CSM. He is one of the co-founders of the Advanced Steel Processing and Products Research Center, an industry-university cooperative research center established at CSM in 1984 (<http://asprrc.mines.edu/>). The Center continues active with 29 corporate sponsors. He served as Center Director from 1993 until his retirement in May 2013. In retirement he continues to be an active participant in all Center operations. At CSM he has taught courses in mechanical properties of materials, fracture and fatigue, metallurgical failure analysis, and strengthening mechanisms in metals. He continues active in research in a variety of metallurgy programs which emphasize both fundamental and applied studies. Some of his current programs include deformation behavior and formability of steel, including coated sheet products; evaluation of the deformation behavior at interfaces in forming operations; and the analysis of fracture toughness in new bar and forging steels. In addition to his continuing activities at CSM, he is currently a member of the technical management team of LIFT (<http://lift.technology/about/>) and is a co-leader of the Thermo-Mechanical Processing (TMP) Pillar, one of the six technology pillars on which LIFT is based. LIFT, Lightweight Innovations for Tomorrow, is a public-private partnership operated by the American Lightweight Materials Manufacturing Innovation Institute (ALMMII) is one of the National Network of Manufacturing Institutes established by the US Government (<https://www.manufacturing.gov/nnmi/>). His materials and manufacturing expertise will be well utilized in this study.

Jyotirmoy Mazumder

Member

JYOTIRMOY MAZUMDER [NAE] is the Robert H. Lurie Professor of Engineering at University of Michigan. He has a D.I.C. in Process Metallurgy from Imperial College, 1978 and a Ph.D. in Process Metallurgy from Imperial College, 1978, and a B.E. in Metallurgical Engineering from Calcutta University, 1972. He is interested in transforming the field of materials processing by laser from a technological art to scientifically based engineering; laser aided manufacturing; atom to application; technical approach including on-line optical diagnostics, transport phenomena modeling, non-equilibrium synthesis of materials with tailored properties, and their evaluation and characterization. Some of his honors and awards are: Distinguished University Innovator, Office of the Vice President for Research, 2012; member, National Academy of Engineering, 2012; Thomas A. Edison Patent Award, American Society of Mechanical Engineers, 2010; fellow, American Society of Mechanical Engineers, 2008; 22nd Arthur L. Schawlow Award, Laser Institute of America, 2003; 2001 Inventor Recognition, UM Technology Transfer, Celebrate Invention, 2001.

Roger L. McCarthy

Member

ROGER MCCARTHY [NAE] is a consultant at McCarthy Engineering. He received his bachelors in mechanical engineering from the University of Michigan in 1972, and his Ph.D. in mechanical engineering from the Massachusetts Institute of Technology in 1977. Dr. McCarthy specializes in mechanical, machine, and mechanism design analysis, including issues related to fabrication, manufacturing, fire and explosion, warnings, risk analysis, and hazards evaluation. His research has focused on the safety and risk analysis of mechanical designs, and the engineering of the man/machine interface, particularly on issues related to information transfer, such as on-product warnings. He also has experience in the intellectual property issues associates with these areas. Dr. McCarthy has investigated some of the major disasters in modern times that were precipitated by the failure of a bolted connection, so as the collapse of the Hyatt Walkways in Kansas City that killed 116, or the steering gear failure on the Amoco Cadiz that ultimately led to its grounding and loss. Dr. McCarthy is the founder and owner of McCarthy Engineering. Dr. McCarthy serves on the Board of Shui on Land (SOL), Ltd., which is publicly traded (stock code 0272) on the Hong Kong Exchange. SOL won the Hong Kong Corporate Governance Excellence Award in 2007. He is uniquely suited to participate in this effort based on the engineering risk analysis expertise needed by the committee.

John R. Scully

Member

JOHN SCULLY is the interim department chair, Charles Henderson Chaired Professor of Materials Science and Engineering; and co-director for Center for Electrochemical Science and Engineering at University of Virginia. He received his bachelors, masters, and PhD in materials science and engineering from Johns Hopkins University in 1980, 1982, and 1987, respectively. He had appointments with the Naval Ship R&D center and Sandia National Labs prior to joining the faculty at UVa. Dr. Scully's work is closely linked to technological advancements that improve the standards of living, safety, and the quality of life. Dr. Scully's primary research interest is to understand the relationships between a material's structure and composition and properties related to environmental degradation, aging and life prediction. He is technical editor in chief of CORROSION The journal of science and engineering. Technical focus includes most forms of corrosion and environment assisted cracking in numerous environments including seawater focusing on a wide variety of materials ranging from high strength steels and precipitation aged hardened alloys to metallic glasses and high entropy alloys. He has served on numerous government review boards, and for industries concerned with materials reliability, aging, and failure including either spent nuclear fuel engineered waste canisters, aircraft, and bolt failures for 5 different countries. He has previously been a member of NRC corrosion studies and his knowledge will greatly enhance this committee.

Pol D. Spanos

Member

POL SPANOS [NAE] is the Lewis B. Ryon Professor of Mechanical Engineering and Materials Science at Rice University. He received his M.S. in civil engineering in 1974 and PhD in applied mechanics from the California Institute of Technology in 1976. Professor Spanos' research efforts focus on the dynamics and vibrations of structural and mechanical systems under a variety of loads. Professor Spanos develops primarily analytic and numerical methods that often require advanced scientific computation packages and supercomputers. He is a fellow of the American Academy of Mechanics (AAM), the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the Alexander von Humboldt Association of America. He is a member (by invitation) of the Earthquake Engineering Research Institute, the International Association for Structural Safety and Reliability, the American Society of Engineering Education, and the American Association for the Advancement of Science. He is a corresponding member of the National Academy of Greece (Academy of Athens); a member of Academia Europaea (Academy of Europe); a foreign member of the Indian National Academy of Engineering; and a member of the National Academy of Engineering (USA). He has served, both, as the chair of the ASCE Engineering Mechanics Division and as the chair of the ASME Applied Mechanics Division. He has held Distinguished Visiting Professor positions in numerous prestigious institutions, worldwide. Further, he has served in leadership/mentorship positions for a plethora of diversity enhancing initiatives and organizations. For this study his expertise will serve well for understanding the offshore environment and systems that utilize the fasteners being scrutinized.

Neil G. Thompson

Member

NEIL G. THOMPSON is senior vice president of Det Norske Veritas (USA)(DNV-GL) and head of Pipeline Services Department, including the Materials and Corrosion Technology Center (MCTC) located in Dublin, Ohio. Dr. Thompson is a graduate of University of Alabama and Vanderbilt University with a Ph.D. in Materials Science Engineering. He has worked in corrosion and materials research and forensic analysis for over 30 years. He is past president of NACE International and the NACE Foundation. He directs and oversees forensic investigations in a variety of business segments including pipelines, oil and gas, and petrochemical/chemical processing. Dr. Thompson was the Project Manager for the forensic investigation of the blowout preventer recovered from the Deep Water Horizon drilling rig failure (2010 Gulf oil spill) for the Department of the Interior (DOI) and Department of Homeland Security (DHS) Joint Investigation Team (JIT) and contracted through the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE). Dr. Thompson has directed thirty-two major research projects and numerous field studies and testing projects examining various aspects of corrosion science, corrosion monitoring and cathodic protection. He is co-author of DC Electrochemical Test Methods published by NACE Press and has co-author of over 70 technical publications. A large portion of his research has been in the area of underground corrosion and CP for the pipeline industry with numerous projects performed for the Pipeline Research Council International (PRCI), the Gas Research Institute (GRI), and the Gas Technology Institute (GTI). Naturally the committee will benefit from his experience with analyzing issues in this field.