

Mainstreaming Unmanned Undersea Vehicles into Future U.S. Naval Operations

Committee

Heidi C. Perry

Co-Chair

Ms. Heidi C. Perry is director, System Engineering, at the Charles S. Draper Laboratory, Incorporated. Her expertise includes guidance, navigation, and control; global position system antijam and ground control; precision weapons delivery command and control; autonomous systems, mission-critical software; and command, control, communications, computers, intelligence, surveillance, and reconnaissance systems. Ms. Perry began her career with General Electric as a systems engineer working on the AN/BSY-2 Sonar System before moving to IBM, also as a systems engineer. From IBM she moved to Draper Laboratory as task leader for the Dolphin Navigation System Upgrade and remains with Draper after nearly 20 years. In these years at the laboratory, she has served as technical director for various research and development programs involving autonomous spacecraft, aircraft, robotics systems, and underwater vehicles. She is a member of the Institute of Electrical and Electronic Engineers and the American Institute of Aeronautics and Astronautics (AIAA) and was named AIAA Software Engineer of the Year 2004—New England Sector. She was also listed in the Mass High Tech Women to Watch in 2005. A former member of the Naval Studies Board, Ms. Perry also served on the NRC's Committee on Capability Surprise for U.S. Naval Forces, Committee on National Security Implications of Climate Change on U.S. Naval Forces, and Committee on the "1,000 Ship Navy"—A Distributed and Global Maritime Network. She received a B.S.E.E. in electrical engineering from Cornell University and an M.S. in computer engineering from the National Technical University.

Paul A. Schneider

Co-Chair

The Honorable Paul A. Schneider is an independent consultant with specific interest in defense and aerospace issues. He was previously a Principal of The Chertoff Group—an organization aimed at providing security, risk management, and merger/ acquisition advisory services for U.S. government and corporate clients around the world. Previously, Mr. Schneider served first as the under secretary for management and subsequently as the deputy secretary and chief operating officer of the Department of Homeland Security (DHS). Prior to joining DHS, Mr. Schneider served in a number of U.S. government capacities, to include as senior acquisition executive of the National Security Agency, where he was responsible for oversight and execution of signals intelligence and information security development and acquisition programs; principal deputy assistant secretary of the Navy for research, development and acquisition, where he was responsible for the oversight and execution of Navy and Marine Corps research, development and acquisition programs; and executive director and senior civilian of the Naval Sea Systems Command, the Navy's largest ashore organization, where he was responsible for the day-to-day operations of shipyards, laboratories, and engineering and test facilities. Mr. Schneider serves on numerous scientific boards and advisory committees including as the current chair of the Armed Forces Communications and Electronics Association's Homeland Security Committee, and is the chair of the Naval Studies Board. Mr. Schneider recently served on the NRC's Committee for a Review of U.S. Navy Cyber Defense Capabilities. He received a B.S. in nuclear engineering from the University of Massachusetts at Lowell.

Julie A. Adams

Member

Dr. Julie A. Adams is associate professor of computer science and computer engineering at Vanderbilt University. Dr. Adams develops human-robot interaction (HRI) and distributed artificial intelligence methods resulting in robot systems for real-time mission deployment in dynamic environments. Her research in artificial intelligence develops distributed coalition formation algorithms that allocate task assignments autonomously to distributed robots and focuses on capabilities for humans to supervise and task large, heterogeneous robot teams and understand robot-provided information (supporting human decision making and situation awareness). She previously served on the NRC's NASA Technology Roadmap: Robotics, Communication and Navigation Panel and on the Panel on Soldier Systems. She received a B.S. in computer science from Siena College and a Ph.D. in computer and information systems from the University of Pennsylvania.

James G. Bellingham

Member

Dr. James G. Bellingham is the newly appointed director of the Woods Hole Oceanographic Institution Center for Marine Robotics. He comes from the Monterey Bay Aquarium Research Institute where he was director of engineering and most recently chief technologist. He was founder and manager of the Autonomous Underwater Vehicle Laboratory at the Massachusetts Institute of Technology and co-founder of Bluefin Robotics, a Massachusetts-based company that develops, builds, and operates autonomous underwater vehicles (since acquired by Battelle). His previous NRC experience includes the Committee on An Ocean Infrastructure Strategy for U.S. Ocean Research in 2030, the Committee on Distributed Remote Sensing for Naval Undersea Warfare, and the Committee on Seafloor Observations: Challenges and Opportunities. He received an S.B., S.M., and Ph.D. in physics from the Massachusetts Institute of Technology.

Archie R. Clemins

Member

ADM Archie R. Clemins, USN (Ret.) (NAE) is president of Caribou Technologies, Incorporated, an international consulting firm concentrating on the transitioning of commercial technology to government. He retired from the Navy with the rank of admiral after more than 30 years of service, concluding as commander-in-chief of the U.S. Pacific Fleet, the world's largest combined fleet command. During his Navy service, he strongly supported the establishment of the Navy's Information Technology for the 21st Century and Navy Marine Corps Intranet initiatives. Building on this experience, Admiral Clemins has remained a strong advocate for the accelerated use of information technology and the adaptation of the best commercial practices in the military and the government. A member of the National Academy of Engineering, he served on the NRC's Committee for C4ISR for Future Naval Strike Groups and the Committee on FORCEnet Implementation Strategy. He received a B.S. and M.S. in electrical engineering and an honorary Ph.D. in engineering from the University of Illinois at Urbana Champaign.

Charles R. Cushing

Member

Dr. Charles R. Cushing (NAE) is president of C.R. Cushing and Company, Incorporated, a firm of naval architects, marine engineers, and transportation consultants with offices in New York. He has been responsible for the design and/or the construction of over 250 ocean-going vessels in the United States, Europe, and the Far East. Specifically, he has directed the concept, preliminary, and contract design; strategic planning; plan approval; and supervision of construction of vessels from tankers and container ships to bulk carriers and passenger ships. His work has included new construction, conversion, repair, and refurbishment of vessels. Dr. Cushing has been directly responsible for risk analyses, safety audits, energy audits, and the preparation of the U.S. Coast Guard's Tankerman's Manual. He has worked on deep underwater surveys using remotely operated vehicles and the deployment and recovery of unmanned undersea vehicles. A member of the National Academy of Engineering, he has designed intermodal shipping containers and a myriad of container handling equipment, and he holds a number of patents in maritime and intermodal technology. Dr. Cushing has served on scientific boards and advisory committees and most recently served as a member of the NRC's Committee on Capability Surprise on U.S. Naval Forces. He is also a previous member of the Naval Studies Board. Dr. Cushing received a Ph.D. in maritime studies from the University of Wales Aberystwyth, and an honorary D.Sc. from the World Maritime University.

James N. Eagle

Member

Dr. James N. Eagle is professor emeritus at the Naval Postgraduate School. His primary areas of research and expertise are the military applications of operations research, especially in search and detection theory, applied probability, and military modeling. Dr. Eagle served as an officer in the U.S. Navy submarine force from 1969 to 1980, retiring from the U.S. Naval Reserve as a captain in 1994. At the Naval Postgraduate School, he has served as chairman of the Undersea Warfare Academic Group, chairman of the Department of Operations Research, and Associate Dean of Faculty. He is past associate editor of U.S. Naval Research Logistics, and served on the NRC's Committee on U.S. Naval Forces' Capabilities for Responding to Small Vessel Threats. He is a current member of the Naval Studies Board. Dr. Eagle received a Ph.D. in engineering-economic systems from Stanford University.

Millard S. Firebaugh

Member

RADM Millard S. Firebaugh, USN (Ret.) (NAE) is now a Glenn L. Martin Institute Professor of Practice at the University of Maryland having retired with the rank of rear admiral after more than 33 years of service with the U.S. Navy as an engineering duty officer. He became vice president innovation at General Dynamics, Electric Boat Division, from which he retired in 2005.. His area of technical interest is naval engineering, principally the design, systems engineering, naval architecture, and integration of weapons and combat systems of warships with particular emphasis on nuclear-powered submarines. His focus is on the translation of naval requirements into detailed engineering, design, and construction methodology for complex warships with specific interest in the hydrodynamics and hydroacoustics of submarines relating to powering and propulsion, quieting, sensor system performance, weapon launch, and integration of features. Admiral Firebaugh is a member of the National Academy of Engineering, and he served on the NRC's Committee on Materials Research for Defense-After-Next and the NRC's Panel on Structural and Multifunctional Materials. He received a B.S. in physics, M.S. in electrical engineering, naval engineer degree, and D.Sc. in ocean engineering from the Massachusetts Institute of Technology.

Lee M. Hammarstrom

Member

Mr. Lee M. Hammarstrom is a special assistant to the director at the Pennsylvania State University Applied Research Laboratory. Previously, he had been the conceiver and system integrator of a National Reconnaissance Office (NRO) program that was recognized by President Reagan. He was a division head at the Naval Research Laboratory, founder and first head of the NRO Technology Office, first chief scientist at NRO, and chief scientist at the Office of the Secretary of Defense for Command, Control, Communications, and Intelligence. He has expertise in areas ranging from technology development to the testing and deploying of military and intelligence systems. He conceived and led the Global Grid/Global Information Grid initiative, which provided key elements of the Department of Defense's secure worldwide communications networks that successfully supported Operation Iraqi Freedom with more than 40 times the capacity of previous networks. Mr. Hammarstrom has served on numerous scientific boards and advisory committees, including the Naval Studies Board and committees operating under its auspices. His service to the NRC over the past decade includes membership on the NRC's Committee on U.S. Naval Forces' Capabilities for Responding to Small Vessel Threats, Committee on Operational Science and Technology Options for Defeating Improvised Explosive Devices, Committee on Persistent Surveillance: A Critical Tool for the Counter-IED Mission, Committee on C4ISR for Future Naval Strike Groups, and most recently, the Committee on Capability Surprise on U.S. Naval Forces. In 2002, he was selected as an NRO Pioneer in recognition of his concepts and developments for satellite, ground station, and processing systems to improve the accuracy, timeliness, and volume of NRO electronic intelligence products. He received a B.S. in electrical engineering from Pennsylvania State University.

Bernadette Johnson

Member

Dr. Bernadette Johnson is chief technology officer at the Massachusetts Institute of Technology Lincoln Laboratory. Her responsibilities include the development of the laboratory's long-term technology strategy and the coordination of collaborative research with the MIT campus. Prior to this position, she was assistant head of the Homeland Protection and Tactical Systems Division of the laboratory. Her technical foci include military and civilian chemical and biological defense and forensics sensing, and she led a study to develop a strategic plan for bioscience research at the laboratory. She was and remains actively involved in technology innovation initiatives. Dr. Johnson previously served on the NRC's Committee on Review of Testing and Evaluation Methodology for Biological Point Detectors. She is a current member of the Naval Studies Board. Dr. Johnson received a Ph.D. in plasma physics from Dartmouth College.

Leon A. Johnson

Member

Brig Gen Leon A. Johnson, USAFR (Ret.) retired from the U.S. Air Force Reserves with the rank of brigadier general after 33 years of service and most recently retired from United Parcel Service (UPS) after nearly 20 years of service as manager for flight operations providing expertise in logistics, flight operations, and human resources. During his Air Force career, his responsibilities ranged from command of an Air Force fighter squadron and a fighter group to the mobilization assistant to the Assistant Secretary of the Air Force for Manpower and Reserve Affairs. His UPS responsibilities range from flying the A-300 as a chief pilot in commercial logistic operations to working a variety of employee and human relations issues as a human resources manager. Prior to UPS, he worked for Trans World Airlines as a line pilot and pilot hiring manager. General Johnson is a member of several organizations, including the Air Force Association, Reserve Officers Association, League of United Latin American Citizens, Women in Aviation, and the International Black Aerospace Council. He has been elected to his third 2-year term as the national president of the Tuskegee Airmen, Incorporated. He served as a member of the NRC's Committee on Manpower and Personnel Needs for a Transformed Naval Force and more recently the Committee on Capability Surprise on U.S. Naval Forces. He is a former member of the Naval Studies Board. General Johnson received a B.S. in political science from Oregon State University and an honorary Ph.D. in humane letters from Tuskegee University.

Timothy J. Keating

Member

ADM Timothy J. Keating, USN (Ret.) is an independent consultant having retired from the U.S. Navy with the rank of admiral after 38 years of service. His last assignment was as Commander, U.S. Pacific Command. His area of responsibility included over 3.4 billion people and half the surface of the earth. While in command, Admiral Keating visited over 30 countries, meeting diplomats, military officials, and commercial leaders to emphasize active engagement with national and international partners in preserving the security and stability upon which the Asia-Pacific region's success depends. He was the first Navy officer to head Northern Command, responsible for protecting the United States homeland and providing support to federal, state and local officials in time of crisis. Simultaneously, he was Commander of the North American Aerospace Defense Command providing aerospace warning, air sovereignty and defense for the United States and Canada. He serves on numerous scientific boards and advisory committees as an international strategic advisor, including the Council on Foreign Relations. His awards include the Defense Distinguished Service Medal with three Oak Leaf Clusters and the Distinguished Service Medal with Gold Star among others. Admiral Keating received a B.S. in physics from the U.S. Naval Academy.

Annette J. Krygiel

Member

Dr. Annette J. Krygiel is an independent consultant with expertise in the management of large-scale systems, particularly in regard to software development and systems integration. She served as a distinguished visiting fellow at the Institute for National Strategic Studies at the National Defense University, where she wrote a book on large-scale system integration. Prior to that, she was director of the Central Imagery Office (CIO), a Department of Defense combat support agency, until the CIO merged into the (now)National Geospatial-Intelligence Agency. Dr. Krygiel began her career at the Defense Mapping Agency, where she held various positions including chief scientist. A former member of the Naval Studies Board, Dr. Krygiel also served as chair of the NRC's Committee on the Role of Experimentation in Building Future Naval Forces and more recently as a member of the Committee on Capability Surprise on U.S. Naval Forces. She received a D.Sc. in computer science from Washington University in St. Louis.

Ronald R. Luman

Member

Dr. Ronald R. Luman is chief of staff of the Johns Hopkins University Applied Physics Laboratory, where he previously served as assistant director for strategy and head of the National Security Analysis Department. He is also chair of the Systems Engineering Program in the JHU Whiting School of Engineering, and has served on the Visiting Committee for Engineering Systems at Massachusetts Institute of Technology. He has a broad technical leadership experience base in undersea systems, missile and navigation systems, ballistic missile defense, and intelligence systems architectures. Dr. Luman has served on several national security advisory committees, including National Infrastructure Advisory Council panels. He is a current member of the Naval Studies Board, and he also served on the NRC's Committee on the Role of Naval Forces in the Global War on Terror and more recently on the Committee on National Security Implications of Climate Change for U.S. Naval Forces—both of which were conducted under the auspices of the Naval Studies Board. Dr. Luman received a D.Sc. in systems engineering from George Washington University.

Joseph Pedlosky

Member

Dr. Joseph Pedlosky (NAS) is scientist emeritus in the Physical Oceanography Department at the Woods Hole Oceanographic Institution. His research interests include baroclinic instability and general stability problems in fluid dynamics; nonlinear dynamics of finite amplitude waves; general circulation of the ocean, especially mid-latitude gyres; geophysical fluid dynamics; equatorial oceanic circulation; abyssal ocean circulation. Specifically, Dr. Pedlosky's research centers on the fluid dynamics of the oceans, where he has constructed theories for the wind-driven circulation of the ocean, with particular attention paid to the way in which the density stratification of the upper two kilometers of the ocean is determined by dynamic processes. Another strand of his research involves a certain type of hydrodynamic instability of particularly oceanographic and meteorological interest called baroclinic instability in which he has contributed to the basic theory of both the linear and non-linear aspects of this problem. A member of the National Academy of Sciences, he has served on scientific boards and advisory committees, including as a member of the NRC's Committee on Strengthening the Linkages between the Sciences and Mathematical Sciences. Dr. Pedlosky received a Ph.D. in meteorology from the Massachusetts Institute of Technology.

Charles E. Thorpe

Member

Dr. Charles E. Thorpe is senior vice president and provost at Clarkson University. He was formerly a White House fellow and assistant director for advanced manufacturing and robotics in the Office of Science and Technology Policy of the Executive Office of the President. He is the former head of the Robotics Institute at Carnegie Mellon University working on the development of outdoor robotic vehicles, focusing on computer vision, planning, and architectures for these machines. He has also been involved in the development of automated helicopters, walking robots, and robots that operate under water. Dr. Thorpe served on the NRC's Committee on Autonomous Vehicles in Support of Naval Operations and is a fellow of the American Association for Artificial Intelligence and the Institute for Electrical and Electronic Engineers. He received a B.S. in natural science from North Park College and a Ph.D. in computer science from Carnegie Mellon University.

Lora G. Weiss

Member

Dr. Lora G. Weiss is the chief scientist at the Georgia Tech Research Institute (GTRI). As chief scientist, she is responsible for the portfolio of Independent Research and Development at GTRI. Her personal research is on the design, development, and implementation of technologies for unmanned and autonomous systems. For more than 25 years, she has been responsible for advancing capabilities for autonomous systems spanning the domains of unmanned air, ground, sea surface, and undersea. Dr. Weiss was on the board of directors for the Association of Unmanned Vehicle Systems International (AUVSI), which is the world's largest unmanned systems organization. She was on the technical advisory board of the National Robotics Technology Consortium. She currently chairs the ASTM Committee on Unmanned Maritime Vehicle Autonomy and Control, and she is a member of the steering committee for Information Science and Technology Study Group for the Defense Advanced Research Project Agency (DARPA). In 2012, she received Georgia's Women in Technology Woman of the Year Award for Medium-Sized Businesses. She holds a patent for an unmanned underwater vehicle, she has provided testimonial to the Science and Technology Committee of the Georgia House of Representatives, and she has been principal investigator on programs sponsored by organizations such as DARPA, the Office of Naval Research, and other DoD organizations. Dr. Weiss received a B.S. in mathematics, magna cum laude, from Boston University, an M.S. in mathematics from the University of California at Los Angeles, and a Ph.D. in acoustical engineering from the Pennsylvania State University.