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June 8-11, 2009
NUWC
Newport, RI

Sonar 101

4 Day Course

Summary:

Provide an introduction to environmental acoustics and basic sonar design to junior NUWCDIVNPT professionals with degrees in science or engineering. The attendees will learn the how and why sound propagates via different paths in the ocean and how its amplitude and phase are changed by attenuation, and interactions with the surface, near surface and bottom boundaries. They will learn the origins of ocean noise, its dependence and variability on environmental and anthropogenic conditions. They will learn how sound can be generated and focused with harmonic and explosive sources and the difference between sound energy levels and sound pressure level. They will learn how received signals are enhanced using beam formers and understand the common nomenclature associated with spatial filters. They will learn the basic concepts of acoustic scattering which give rise to reverberation and its dependence and variability on environmental conditions. They will learn the basic concepts of scattering from man-made objects and the concept of target strength. They will learn the causes for loss in system performance arising from design restrictions such as scalloping, signal mismatch array shape and energy splitting losses. They will learn how to use the active and passive sonar equations to predict and assess system performance and evaluate the impact of design and environmental parameters on system performance.

Instuctor:

Peter G. Cable received the B.A. degree in physics and mathematics from Haverford College, Haverford, PA, in 1958, the M.A. degree in physics from Columbia University, New York, NY, in 1960, and the Ph.D. degree in physics from the University of Maryland, College Park, MD, in 1966. He subsequently joined the staff of the Naval Underwater Sound Laboratory (now the Naval Undersea Warfare Center) and remained there until 1985, except for the academic years 1969 and 1970 when he held a faculty appointment at the Institute for Fluid Dynamics and Applied Mathematics, University of Maryland. In 1985, he joined BBN Systems and Technologies, New London, CT, where he was engaged in acoustic signal processing and sonar system studies. He was a Principal Scientist at BBN Technologies and is currently a Consultant to the Applied Physical Systems in Groton, Ct. His specific research interests include the areas of stochastic effects in underwater sound transmission, statistical communication and detection theory, and the modeling of self and radiated noise and reverberation.

Dr. Cable was a NASA Pre-Doctoral Fellow at the University of Maryland, and is a Fellow of the Acoustical Society of America and of the Connecticut Academy for Education is Mathematics, Science and Technology, and Treasurer of the Connecticut Academy of Science and Engineering.

William Carey received the B.S. degree in Mechanical Engineering, the M.S. degree in Physics, and the Ph.D. degree in Nuclear Science from The Catholic University of America, Washington, DC, in 1965, 1968, and 1974, respectively. He was the Editor and currently serves as an Associate Editor of the Journal of Oceanic Engineering. He is also an Associate Editor for Underwater Acoustics, the Journal of the Acoustical Society of America. Currently he is a Professor of Mechanical Engineering at Boston University, an Adjunct Professor of Applied Mathematics at the Rensselaer Polytechnic Institute, and an Adjunct Scientist at the Woods Hole Oceanographic Institution. Previously, he was a Physicist with the Naval Undersea Warfare Center and the Advanced Research Projects Agency assigned to the MIT Department of Ocean Engineering, where he taught graduate courses in Acoustics. He has also been a Research Physicist and Engineer at the Naval Underwater Systems Center, The Naval Oceanographic Research and Development Activity, and the Naval Research Laboratory. At the University of Chicago's Argonne National Laboratory, he was an Associate Scientist and Section Manager of acoustic surveillance. He has been a consultant to both industry and government in the areas of nondestructive testing, nuclear science/environmental measurements, and applied ocean acoustics.

Dr. Carey is an Institute of Electrical and Electronics Engineering (IEEE)-Oceanic Engineering Society Fellow and has received the IEEE-Oceanic of Engineering Society's Distinguished Technical Achievement Award, Distinguished Service Award, and an IEEE Millennium Award. He recently received the Pioneers of Underwater Acoustics Medal from the Acoustical Society of America and is Fellow of that society. He is also a full member of Sigma Xi, a member of the Connecticut Academy of Science and Engineering, and a member of the Cosmos Club.

Dr. Richard Evans has contributed to the development of numerical solutions to calculate underwater sound propagation using complex oceanographic variables for the range-dependent problem of acoustic and seismic wave propagation. He developed the stepwise-coupled normal mode computational method, a benchmark solutions for range-dependent problems in underwater acoustics. Dr. Evans has conducted workshops that led to the standardization of Navy models for underwater sound propagation and geophysical inversion. Dr. Evans has worked with in the Naval R&D establishment for 31 years. He is a Fellow of the Acoustical Society of America, a member of the American Mathematical Society and the Society for Industrial and Applied Mathematics.