

Tutorial: Optical Communications Design Principles: Fiber and Free Space

(Approved for 0.8 Continuing Education Units and 8 Professional Development Hours)

Instructor: Michael Brininstool

Overview

The marine environment imposes stringent challenges for optical communications technology. For cabled systems, mechanical loads such as tension, torsion, and hydrostatic pressure dictate specialized cable and connector solutions. For free space optical connectivity, transmission impacts from reduced visibility underwater or in fog, bio-fouling, and motion must be mitigated. This efficient, two-session tutorial provides the participant with practical techniques necessary to characterize, specify, and design optical communications systems, both fiber and free space optics. It is custom tailored for the optics needs of those in the marine industry. It is perfectly suited for students wanting an introductory exposure to optical communications as well as those requiring systems design knowledge.

The course covers practical aspects of optical technology, with emphasis on applications. The participants learn how to quickly assess the feasibility of applying optical communications to their special requirements. Extensive course notes lead the attendee through the entire design process. In the morning session, the fundamental building blocks of optical communications systems are covered: optics principles, transmitters, fibers, cables, connectors, couplers, multiplexers, and receivers. In the afternoon session, learning design at the system level, students integrate component parameter details into comprehensive analyses.

This tutorial employs link optimization and trade space techniques by considering both power-limited and bandwidth-limited regimes. Graphical analyses using design curves are particularly highlighted. Component selection criteria are considered based on their relative advantages and features. Design procedures are methodically presented and then reinforced with illustrative case studies. Attendees are divided into small design groups and work together through data link examples. Applications to ROV high-speed links, duplex free space optical telemetry, and optical sensors are provided. The end product of this tutorial is a detailed comprehension of optical communications systems design.

Instructor Bio:

Michael Brininstool is president of United Spectra, a consulting firm specializing in optical technology. Mr. Brininstool has 31 years of military-related optical

communications experience. At SPAWAR Systems Center Pacific, he led the Advanced Concepts branch of the Ocean Systems division. Specializing in undersea and ship-based fiber and free space optical systems, his contributions cover all phases of technology from conception and modeling, through design, build, test, and deployment. He has published extensively on military optical devices, instrumentation, systems, and security. He holds seven patents. To date, 524 students have completed optical communications courses taught by Brininstool. Course offerings range from full semester, accredited classes at the Naval Postgraduate School, Monterey and University of California, San Diego, to tutorials and workshops given to dozens of public and commercial organizations.