Landers: Fundamentals of Free Vehicle Design and Operation

Date: September 23, 2013 (Monday), 1 day tutorial

Instructors:

Kevin Hardy, Global Ocean Design, San Diego, CA

Craig Higgins, Edgetech, Inc., West Wareham, MA

John Head, PREVCO Subsea Housings, Fountain Hills, AZ

Larry Herbst, camera control specialist

Untethered free vehicles are absolutely the most cost-effective way to get to mid-water or benthic locations. They can carry traps, samplers, and sensors. They can travel to any depth, and remain from short periods of time to multiple years. They can be released with countdown timers, acoustic command, galvanic time releases, or a pre-programmed event trigger. Operations may be conducted on smaller charter vessels from ports close to the site of interest, freeing explorers from the cost and scheduling issues of larger oceanographic ships. Some are small enough to be lifted with one hand from the ocean, but strong enough to journey to the bottom of any ocean trench. Small free vehicles with no HazMat have been flown overnight on passenger aircraft to remote destinations. The deepest places in the Atlantic and Pacific are close to American Trust Territories, Puerto Rico and Guam, respectively, simplifying U.S. Customs approval. Free ascent vehicles may be integrated into larger bottom platforms, providing the option of interval recovery of a back-up data recorder without disturbing the primary science platform.

Free vehicles complement the other classes of undersea vehicles: Remotely Operated Vehicles (ROVs), gliders, Autonomous Undersea Vehicles (AUVS), mid-water floats, towed platforms, and manned submersibles. Each has a distinct suite of strengths and weaknesses. Component technologies such as batteries, glass spheres, syntactic, cameras and lights, may be tested prior to installation on the other classes of undersea craft using a robust, cost-effective free vehicle. When a free vehicle is deployed as a seafloor robotic station, we refer to it as a “lander”. Some samplers, such as drop arms with baited traps, sediment samplers, time-lapse photography, or stitched panoramic views of a site are best done with a lander. Sitting stationary on the seafloor, landers are absolutely quiet, allowing recording of ambient sound fields. Ocean engineers gain valuable experience, confidence, and competence in training deployments of free vehicles.

Using a SWOT approach (Strengths, Weaknesses, Opportunities, Threats), this tutorial will walk attendees through defining a free vehicle based on a potential cruise profile. A cruise doesn’t start when a team leaves port, but when the work to get there begins. The limitations of the port facility and surface support ship will be considered. Commercial Off-The-Shelf (COTS) sources of components will be shared, permitting end-users the opportunity to intelligently consider the Make-Buy decision, based on factors of time, cost, and quality.

Attendees will consider what is needed to establish and maintain a Lander Lab at their own institution, based on recent experiences at Scripps Institution of Oceanography/UCSD.

Instructor Bios:

Kevin Hardy, is President of Global Ocean Design (San Diego, CA). Hardy retired as a Senior Development Engineer from Scripps Institution of Oceanography/UCSD in June 2011 following 36 years of service. He was the “Lander Commander” of James Cameron’s Deepsea Challenge Expedition in 2011/2012.

Craig Higgins, Edgetech, Inc., West Wareham, MA, supported adaptation of their BART board and acoustic deck units to Hardy’s glass sphere ocean trench free vehicles, providing Cameron’s explorers with a suite of acoustic command options.

John Head, PREVCO Subsea Housings, Fountain Hills, AZ, is a manufacturer of underwater pressure housings, available in a standard line or built to customer specification.

Larry Herbst drew on his experience with digital photography, camera controller interfaces, programming, batteries, and mass storage devices to successfully adapt a high definition Canon 5D camera for both still and video operation forJames Cameron’s Deepsea Challenge Expedition in 2011/2012. His system captured the finest high-resolution color images and video of the absolute deepest ocean depths ever made.