

Lost at Sea: Locating and Recovering Underwater Scientific Packages with Mini ROVs

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When conducting underwater experiments and research, the safety and accessibility of the equipment and devices is absolutely imperative to the success of the operation. In the unfortunate case that a device goes missing, the operation must be halted until the device can be located and recovered either to its previous location or to the surface for inspection. Searching for lost equipment can cost research organizations precious time and resources, as well as valuable and irreplaceable data. Even if the location is known, deploying divers to recover it can be expensive and extremely dangerous. If the device cannot be recovered, the entire expedition usually must start from the beginning.

Inspection class, or mini ROVs, are an alternative method to locating and retrieving lost scientific packages. ROVs can conduct safer and more efficient searches at a fraction of the cost of a diver deployment. Unencumbered by the limits of physical exhaustion or oxygen tanks, a mini ROV can search longer and deeper than a diver could. The addition of sonars and positioning systems allows the ROV to “see” in low visibility conditions and keeps track of the location of the ROV, and ultimately the device.

After a package is located, the mini ROV can be used to recover the equipment to the surface. Equipped with a manipulator arm, the mini ROV can lift objects up to 10 times its weight underwater using the tether and the manipulator, once a good grip is established. Heavier objects, even up to several hundred pounds, can be lifted using specialized techniques to attach recovery lines. If the package is still too heavy or delicate, divers can follow the mini ROV's tether to the specific target location, minimizing their dive time.

Since 2009, Submerged Recovery & Inspection Services, led by Craig Thorngren, has recovered 12 scientific lander packages for Oregon State University (OSU), Woods Hole Oceanographic Institute (WHOI) and the National Science Foundation (NSF), as well as verified the condition of scientific devices for the Ocean Observatories Initiative (OOI) using VideoRay Pro 4 ROVs. The total value of the gear recovered is more than \$1 million U.S. dollars, while the data itself is almost priceless.

Thorngren and Submerged Recovery & Inspection Services were first contacted about recovering a lost scientific package in September 2010. A 300-lb acoustic hydrophone array owned by Oregon State University's Hatfield Marine Science Center had malfunctioned, and needed to be recovered from 175 feet underwater and six miles offshore. The array contained critical data for the Northwest Marine Renewable Energy Center for an environmental impact study of wave energy conversion devices, research sponsored by the US Department of Energy, the Oregon Wave Energy Trust, and Oregon State University. Even though the crew knew the location, sending down divers would

be cost-prohibitive and far too dangerous. Fortunately, Joe Haxel from Oregon State was familiar with an alternative method: mini ROVs.

When Submerged Recovery & Inspection Services arrived on the scene, there were only three hours – including travel time – for the crew to locate and assess the condition of the equipment, develop a plan for recovery, and execute the plan successfully. They planned an initial dive to locate and assess the array and its recovery lines to help them develop the best plan for retrieval. A VideoRay Pro 4 ROV equipped with BlueView P900-130 imaging sonar and LYNN real-time video enhancement quickly located and imaged the equipment, and recognized that the buoys that were meant to bring the array to the surface were entangled in the recovery line, damaging the buoy.

The ultimate plan was to attach a carabineer to a recovery line, fly a second VideoRay Pro 4 ROV down to the array, attach the carabineer to the retrieval line at around 90 feet, and then pull the array to the surface. Most of the scientists were unsure that a mini ROV like the VideoRay would be able to accomplish the complex task of attaching a carabineer with line attached to it; however it was a technique Thorngren was familiar with from conducting several similar recoveries. The method was successful, and the array – and its data – were quickly recovered.

The minimal size and power requirements of a mini ROV make it an ideal solution for deployments on the water. The entire system can be transported and deployed by one person from a small vessel. The mini ROV can be mobilized in a matter of minutes from a standard power source and can be operated by one person for as

long as the operator is willing. The cost of an ROV recovery service is significantly lower than the replacement cost of lost equipment and most importantly, the lost data.