

Enabling New Underwater Robotics Capabilities at the Woods Hole Oceanographic Institution

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Recent developments in onboard energy storage and communications capabilities are enabling us to create a new generation of autonomous, remotely operated, and hybrid underwater vehicles. These hybrids take many of the best qualities of both autonomous underwater vehicles and conventionally tethered remotely operated vehicles. The first of such vehicles built at the Woods Hole Oceanographic Institution (WHOI) was *Nereus*. *Nereus* operates as both an autonomous and remotely operated vehicle and utilizes a lightweight fiber optic tether to reach great depth with minimal surface support equipment. *Nereus* explored the bottom of the Challenger Deep at nearly 11000 meters in 2009 and has been used for scientific exploration at other deep sites. The success of *Nereus* has inspired a new generation of vehicles that we call *Nereids*. We believe these vehicles will prove useful for a variety of tasks currently previously infeasible, including exploration under glacial ice, deep water operations from modest support vessels, and a recently-demonstrated capability for intervention operations with no tether.

These vehicles are enabled by a combination of emerging technologies, including optical and acoustic communications systems, energy systems, navigation systems, advanced materials, new sensors, and control systems. We believe these new technical elements will strongly support WHOI's demonstrated abilities to field advanced robotic systems for science and the commercial sectors that can result in new solutions to oceanographic and industrial problems. WHOI's work in these areas extends beyond the group that created *Nereus* to the laboratories that created the *Remus* and *Seabed* families of vehicles as well as other groups that focus on enabling technologies like communications systems and sensors. To better enable our Institution to respond to these new opportunities, we have established the Center for Marine Robotics (CMR) so that WHOI can interact more easily with industry and government. A primary goal of CMR will be to establish a focus for all marine robotics activities at WHOI and to setup new relationships with industry. CMR will focus on a variety of activities ranging from basic robotics research, technology development, system development, and the application of new robots to both scientific and industrial problems.