

STATEMENT OF WORK

University of Alaska and WHOI will use reasonable research efforts to develop and demonstrate a system for conducting and reporting oceanographic measurements at high-latitudes across a spectrum of open water to ice-covered waters using an autonomous underwater vehicle. The system builds on an existing Tethys System Long Range Autonomous Underwater Vehicle (LRAUV) as it is well-suited for overcoming the many challenges faced, especially for under ice operations.

MBARI's responsibilities towards reaching that goal are to provide designs, software, contacts, and permissions necessary for WHOI to manufacture one operational Tethys System LRAUV specifically for the DHS Arctic Domain Awareness Center project. The items listed below should be the most recent and updated [as of April 20, 2017] versions of the LRAUV, supporting equipment, and software with the standard sensor configuration (CTD, EcoPuck, DO₂ sensor, PAR sensor, and ADCP/DVL). WHOI is responsible for the overall construction, testing, and operation of the vehicle and for any modifications necessary to operate the vehicle at high latitudes and under ice. Hereafter, for administrative purposes associated with this statement of work, this vehicle will be referred to as the DHS LRAUV.

To that end, on a schedule from April 2017 through June 2018, MBARI undertakes to:

1. Provide a complete set of drawings and schematics for the DHS LRAUV, including mechanical drawings, schematics, wiring diagrams, assembly drawings, complete Bill of Materials (BOMs), and costing estimates for the construction of one and four vehicles based on MBARI's current cost structure.
2. Provide contacts of vendors used for fabrication of parts, and communicate permission to vendors, if necessary per MBARI contract with said vendor, for WHOI to purchase LRAUV services and parts from those same vendors for the DHS project.
3. Assemble the following LRAUV sub-assemblies: radio, buoyancy, thruster, actuators, and battery pack given WHOI-purchased parts.
4. Provide shop space and technical support for WHOI to assemble the DHS LRAUV.
5. Provide access to a 10m deep test tank and nearshore vessel support for vehicle checkout.
6. Provide documentation such that it exists for LRAUV testing, calibration, assembly, and servicing fixtures.
7. Provide a list of necessary software and licenses required for WHOI to continue independent development of the Tethys System LRAUV code and shore-side software.
8. During project-year 3, provide onsite training at MBARI and/or engineering and technical phone consulting to support information transfer to WHOI staff during the transition and first-article fabrication process. To that end, MBARI estimates 80 hours of

mechanical engineering, 70 hours of electrical engineering, 54.15 hours of research specialist, and 50 hours of engineering technician and machinist time will be required through June 30th 2017 (end of project-year 3). MBARI will invoice the University of Alaska monthly for work completed with a total through June 2017 not to exceed \$40,000.

9. During project-year 4 (July 2017-June 2018) provide onsite training, technical consultation, LRAUV assembly and testing support to complete the DHS LRAUV. MBARI estimates 125 hours of mechanical engineering, 120 hours of electrical engineering, 120 hours of software engineering, 98 hours of research specialist, and 590 hours of mechanical and electrical technician and machinist time will be required through June 30th 2018 (end of project-year 4). MBARI will invoice the University of Alaska monthly for work completed with a total through June 2018 not to exceed \$150, 182.
10. Provide Tethys System LRAUV and Tethys LRAUV-specific shore-side code for MBARI software during project-year 4.
11. Submit quarterly project reports.
12. One member of the MBARI DHS project team will participate in the annual project meeting in Washington, D.C.; costs associated with attending that meeting will be reimbursed by the University of Alaska.