



2024

REQUEST FOR PROPOSALS

**Deep Ocean Research and
Imaging System (DORIS)**

Introduction

About Ocean Discovery League

Ocean Discovery League's (ODL) mission is to accelerate deep ocean exploration by developing accessible systems to broaden the community of those who explore and understand the deep sea. By lowering the cost-prohibitive and logistical barriers to deep-sea exploration, we aim to broaden access to communities historically excluded from ocean exploration and research and expand the area of the seafloor explored and characterized while reducing the cost.

ODL Development History

At ODL, we work with communities across the globe to develop effective sensing systems, employing a collaborative design process to promote inclusion and equity in deep-sea exploration. Our first low-cost sensor system, Maka Niu, was created in 2020-2021 by the MIT Media Lab Open Ocean Initiative (now ODL), with the MIT Future Ocean Lab, Polynesian Voyaging Society, and other collaborators. Maka Niu is a low-cost, easy-to-use deep-sea imaging and sensor platform that can collect video, still imagery, depth, temperature, and GPS up to 1,500 m while costing less than \$900 in parts.

Inspired by the LEGO® building system, we also developed a low-cost, low-logistics exploration system, Wayfinder, composed of modular components that users can configure in any imaginable way. Wayfinder features a main computational housing to which modules (CTD, altimeter) are easily interconnected and can communicate wirelessly. Each module is stand-alone, improving simplicity by allowing modules to clip on for operation. Wayfinder is limited in its depth capacity (150 m) and diversity of modules. Wayfinder provided us with critical information on designing ocean instruments with ease of use and modularity as the end goal.

Project Summary

Goals & Objectives

Our next generation of low-cost systems will expand upon our years of experience testing and deploying previous units within the community to develop the **Deep Ocean Research and Imaging System (DORIS)**. This next-generation system will expand the operational range for low-cost deep-sea work and create a suite of new sensing modalities. This project serves as a technology transfer into a viable product to be distributed to the ocean-observing community.

Target Users

The target users are technically proficient early- to mid-career researchers from under-resourced universities, research labs, government agencies, and NGOs/non-profits whose capacity can be expanded by exposure to accessible technology and training.

System Requirements

DORIS will achieve depths up to 6,000 m and support a broad range of sensing/operational capabilities with these core components:

Main Computational Housing: The main computational housing is the control and computational center of DORIS, to which all sensing and operational modules interconnect and communicate in any desired configuration.

Sensing Modules: Sensing modules to be developed through the scope of this RFP are 1) Camera, 2) Conductivity, Temperature, and Depth (CTD), and 3) Altimeter.

Operational Modules: Operational modules required to be developed through the scope of this RFP are lighting (powered), structural trusses critical to deployment and recovery, and a lander configuration (unpowered).

Firmware and User Interface: Firmware for system operation will be required, in addition to an initial easy-to-use user interface that will allow for mission planning and management.

Additional System Requirements

- All DORIS systems must reliably and repeatedly withstand pressures equivalent to 6000 m ocean depth (~9000 psi). The system must be tested and pressure cycled in a thermal-controlled pressure chamber.
- The system must operate without a tether, be deployable using a two-person lift, and be easily recoverable.
- All connections (i.e., interlocking between modules) must be wireless.
- The system must have a functional battery life of at least 24 hours.
- Each module is sealed and self-contained to prevent water intrusion or failure around penetration points.
- All data collected by the Sensing Modules must be transferred and stored locally on the Main Computational Housing.
- Users must be able to communicate wirelessly with the Main Computational Housing using the user interface developed prior to and after deployment.
- Data must be offloaded from DORIS using wireless connections (Wi-Fi, Bluetooth) and be compatible with data pipelines.
- The user interface must be easy to use to lower the barrier to use.
- The components of DORIS must be easily repairable by a novice user.
- All interlocking modules must feature an easy-to-use locking mechanism to ensure modules do not separate during subsea missions.
- Components should be easily sourceable to the extent possible, and the entire unit should be mass-produced at scale.

Scope of Work & Timeline

This project will be a three-year initiative beginning with the design and development of DORIS and culminating in the fabrication of fifteen units to be deployed in multiple locations with our partners. The full project timeline is 36 months, beginning in 2024.

We anticipate developing DORIS's technical subsystems in phases, with hardware (mechanical, electrical) and software subsystems being developed in parallel. Intellectual property developed as part of this project will be retained by Ocean Discovery League.

Budget

The budget for this project is \$340K, distributed over three years, and includes design, development, materials, and testing for the creation of 15 units. ODL is currently fundraising for additional support to amplify this budget.

Measures of Success

Success will be measured through the development of a system that meets the requirements stated above and the fabrication of 15 DORIS systems.

Validating the quality of the collected sensor data per type of sensing module will be critical to success.

Software must be stable, archived, and documented prior to completion, and all hardware subsystem designs must be thoroughly documented prior to successful completion.

Eligibility & Submissions

We are looking for an engineering firm that is passionate about our mission of expanding access to deep ocean exploration and accelerating discovery.

Our ideal partner has experience relevant to the field of ocean engineering (i.e., designing oceanographic instrumentation, vehicles, and subsea platforms), with extra consideration to groups with experience designing instrumentation for deep ocean environments. Applicants should preferably have mechanical, electrical, and software engineers on staff and in-house technical project management. Preference will be given to firms that have experience with the mass fabrication of a physical product. All firms must comply with the OFAC sanctions list and be proficient in English.

Submitted responses should include:

- A proposed technical approach that meets the scope and needs included herein and is presented in a clear and organized manner.
- Descriptions and documentation of organizational background and staff, including their technical expertise, experience, and locations. Include whether you provide in-house project management support.
- Examples of previous work pertaining to product deliveries, including relevant client testimonials and references. Describe or indicate if you have developed instruments for use in the ocean environment and/or explicitly in deep-ocean environments.
- Describe any fabrication capabilities you have and whether they are in-house or outsourced.
- Describe any environmental testing facilities you have or have access to.
- Summarize a typical workflow for the design, development, and fabrication of a physical product from start to finish.
- Propose an estimated budget accounting for time, materials, and fabrication.

Deadline and Submission

Please submit an electronic copy of your proposal or any follow-up inquiries to doris@oceandiscoveryleague.org.

The deadline for submission is June 14, 2024.