



## SEA-CARE Initiative: Democratizing Access to the Ocean



**Vision:** The **SEA-CARE (Science, Education, and Access through Creative, Affordable Research Equipment) Initiative** is rooted in the vision that curiosity should not depend on one's location or resources. We envision an **ecosystem of low-cost, high-quality, easy-to-use underwater instruments** that can be built, deployed, and maintained locally by people of all ages for science, education, and exploration.

**Approach and Pathways for Innovation:** SEA-CARE is designed to ensure that **new, accessible ocean tools are continuously and rapidly developed, tested and shared** through a sustained education and outreach pipeline:

- Graduate students in the Department of Ocean and Resources Engineering at UH Mānoa will build, document and test a new instrument each year in a 16-week course called Ocean Instrumentation and Technology.
- Instrument ideas and design criteria will be **solicited through an annual open call to the broader Hawai'i community** including community groups, NGOs, state and federal scientists and university researchers. By co-developing with end-users, we will ensure instruments are at the right technical level and meet real monitoring and stewardship needs.
- As part of the Hawaii Ocean Learning and Observing K-PhD Academic Integration (HOLOKAI) at the University of Hawaii Marine Center, graduate students will teach **Hawaiian high school students** to build, deploy and test the new instrument in a **3-day, at-sea summer program** that also develops seamanship, leadership and fieldwork skills.
- Outcome:** Each year, one new, community-driven instrument will be added to the SEA-CARE *ecosystem* while Hawai'i youth gain direct, hands-on experience at sea with novel ocean tools.

All instruments will be made freely available through an **online platform with open documentation, build guides, and instructional videos**, ensuring broad adoption and impact.



### Flagship Instrument: Modular, Autonomous Water Sampler (MAWS)

MAWS is a low-cost, open-source, automated water sampler designed to expand coastal water quality monitoring by making high-frequency, spatially-distributed sampling accessible to more users. Built from off-the-shelf components and controlled by open-source software, MAWS provides robust performance without custom circuitry at an estimated cost of about \$800 for a single-sample base unit and \$250 per additional sampling module. It can collect and preserve seawater for laboratory analysis of carbonate system parameters (e.g., pH, total alkalinity, dissolved inorganic carbon, etc.) and can be adapted for trace metals or organic matter. MAWS will enable researchers to capture short-term variability and long-term trends that traditional manual sampling and expensive commercial systems often miss. This instrument serves as the first anchor of the SEA-CARE *ecosystem*, setting a new precedent for rapidly developing affordable, community-driven ocean tools.



*For more details, please come to listen to Cameron Richardson's presentation titled*

*"Low-Cost Automated Water Sampler for Monitoring Coastal Water Quality" on November 14, 2025, at 9:00 am*

### How to Support this Effort:

- Submit an Instrument Idea:** To partner with Spring 2026 students, fill out the interest form at <https://pagniello-lab.github.io/ORE653.html>
- Fund Class Materials (\$10K):** Covers all build costs for the Ocean Instrumentation and Technology course.
- Sponsor a Graduate Student (\$52.6K):** Supports a graduate student to continue to work on the design and documentation of the instrument after the class as well as lead the summer mentoring.
- Support Ship Time (\$5K per day):** Funds the at-sea program for Hawaiian students and field testing.

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