

HANA O KE KAI “Work of the Ocean”

NEWSLETTER OF THE OCEAN AND RESOURCES ENGINEERING DEPARTMENT, Fall/Winter 2023, Volume 26, Issue 2

Chair’s Message

Zhenhua Huang, Chair



A few update updates for the ORE Ohana. We are so excited that Dr. Frances Zhu has joined the us as an ORE cooperating faculty member. With her experience, she will be a great addition to the Department. Thanks to Dr. Mike Krieg, ORE ‘s new wave flume in HIG151 is up and running now. This new faculty will enhance our engineering research and teaching. The department now has 35 graduate students enrolled in the Fall semester 2023, including 11 students studying for their PhD degrees. This is a great achievement of the collective effort of the ORE faculty.

Congratulations to Troy Heitmann on achieving his Ph.D. Malia Selman, Jonathan Chase, George Burkley, Zachary Niezgodski, Kyle Pappas and Nicholas Ulm completed their Master’s degrees in the Summer or Fall semester. Congratulations on your well-deserved success.

A few things to look forward to in next semester. The ORE’s computer lab will have 5 new computers added to its current capacity. The department is upgrading the furniture in three student offices: Holmes Hall 407, Holmes Hall 408 and POST 132. It will be implemented in phases: first Holmes Hall 407 and POST 132, then Holmes Hall 408. I know there will be inconvenience during the furniture upgrading period, so please bear with us. It is anticipated that the project will be completed by the end of the Spring semester, 2024.

Cheers to a new year!

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ORE is hiring—Assistant Professor of Oceanographic Engineering

Details regarding our open Tenure-Track Faculty position in Oceanographic Engineering are available here: <https://www.soest.hawaii.edu/ore/extras/employment/ore-assistant-professor/>

Student News

Malia Selman defended her MS PlanB Project **Analysis of XBeach Non-Hydrostatic Model Capability in Processing SWAN Spectral Input** in August 2023

Jonathan Chase defended his MS PlanA Thesis **Using Nonhydrostatic XBeach to Simulate Wave Transformations in Fringing Reef Environments** in August 2023

Troy Heitmann defended his PhD Dissertation **Enhanced Fully Nonlinear Boussinesq-type Equations in Conserved Variable Form and Linear Analytical Properties with Compact Finite Difference Schemes** (August 2023)

Kyle Pappas defended his PlanA Thesis **Fluid-Structure Interaction Analysis of an Oscillating Wave Surge Energy Converter using LS-Dyna** in November 2023

Zachary Niezgodski defended his PlanB Project **Feasibility of Retrofitting Tinian Breakwater in CNMI** in November 2023

Wyatt Burkley defended his PlanB Project **Tagging and Mapping of Low-Flying Aircraft via Acoustic and Radio Broadcast Data** in December 2023

Nic Ulm earned his MS enroute to PhD in December 2023

Inside ORE

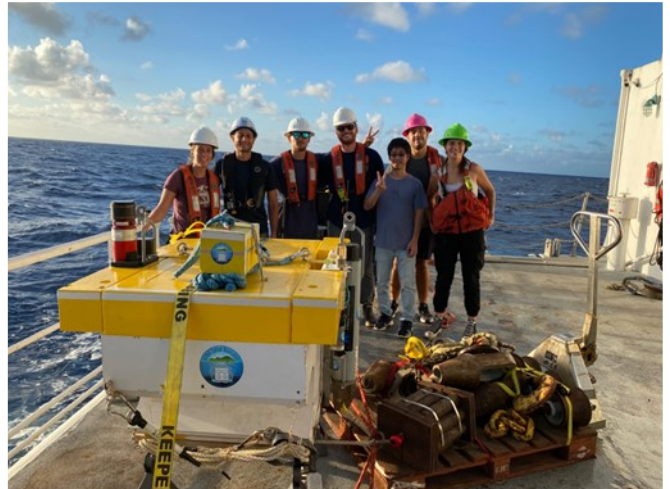
Research Cruise KM-2312A,B: ACO Service and DWS Deployment

ORE students: Clara Encke, Tyler Inkley,
Kei Manabe, Will Robert,
Merritt Shepherd, Guilherme Silva



The ALOHA Cabled Observatory (ACO), located 100 km north of Oahu at Station ALOHA (A Long-term Oligotrophic Habitat Assessment), serves as the world's deepest power and internet node, positioned at a depth of 4278 meters. It continually transmits real-time oceanographic data from the seafloor to the shore, operating seamlessly with plug-and-play capability since June 2011. These extended, deep ocean measurements play a crucial role in simulations of ocean circulation, global climate, and ecosystem behavior.

During a recent research expedition aboard the R/V Kilo Moana, the scientific team performed maintenance on the Observatory. This included the installation of a new icListen hydrophone generously provided by OceanSonics and the recovery of two malfunctioned camera systems.



ORE student group photo



R/V Kilo Moana

In tandem with servicing the ACO, the Naval Research Laboratory (NRL) achieved success in deploying three prototype Deep Water Sentinel (DWS) fuel cells. These cells harness the difference in oxygen concentration between sediment (low) and the overlying water (high) to generate approximately 50 mW of electrical power through microbial mediation in the sediment. The successful execution of this project relied heavily on the Remotely Operated Vehicle (ROV) Lu'ukai. Rigorous testing was conducted before its use in scientific operations, considering the ROV's inactivity during the COVID period. Thankfully, it performed admirably during the ACO maintenance and DWS deployment tasks.

The ROV crew demonstrated exceptional performance, working extended hours to sustain operations despite being short one engineer/pilot. Six graduate students from the ORE Department had the opportunity to gain sea experience, contributing to the deployment of the hydrophone and the elevator's deployment and recovery. The R/V Kilo Moana operated exceptionally well, with the captain, crew, and marine technicians playing integral and supportive roles in the overall success of the mission.



Research Cruise KM-2312A,B group photo

Inside ORE

ORE Research/Teaching Lab Updates

Mike Krieg & Deniz Gedikli
ORE Assistant Professors

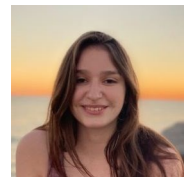


The new combined teaching and research laboratory (HIG 151) is finally coming into it's own. Sealing issues with the wave flume have been resolved and it is fully operational along with the dynamic model positioning system mounted to the top of its frame. Research using this wave flume has already begun, as have public demonstrations including a towing tank demonstration during this year's SOEST Open House (CROSS-REFERENCE). The space is also already in use for our department's class laboratory modules (including ORE 411, ORE 601, and ORE 657).

HIG 109, another ORE shared research and teaching space, has also recently undergone a reorganization to enhance its functionality. This dynamic facility now features a wave energy utilization test bench (HNEI) and an edge recirculating water tank equipped with a Particle Image Velocimetry (PIV) system for detailed flow field analysis. Complementing these resources is a tensile machine for material testing, offering students a comprehensive platform for ocean and renewable energy research. Students have been actively involved in using HIG 109 for research, making use of the available equipment. The lab has been integrated into courses such as ORE 609 - Hydrodynamics of Fluid-Body Interactions and ORE 677 - Marine Renewable Energy. During the Fall 2023 semester, ORE 677 students developed a vortex-induced vibration-based hydrokinetic energy harvesting device, conducting tests in the recirculating wave tank in HIG 109 as part of their final project. Additionally, the recirculating water tank, featuring fluid-structure interaction demonstrations, was displayed at the recent SOEST Open House and attracted a diverse audience. Looking ahead, exciting renovations, including a fresh coat of paint and updates to old cabinets, are in progress, further enhancing the environment for collaborative learning and innovative research.

Welcome back party & Congratulations! to Dr. Cheung

Cami Dillon
ORE TA and MS student



For the first time since the implementation of COVID-19 protocols, the ORE department hosted a welcome party for incoming and current students. The party began with a celebration of Dr. Kwok Fai Cheung's 30 years of service to the University of Hawaii at Manoa ORE program. Dr. Cheung is a valued ORE Professor and is the current Graduate Chair for the ORE department. His research interests include coastal and offshore engineering, marine hydrodynamics, computational methods, sediment transport, and water wave mechanics.

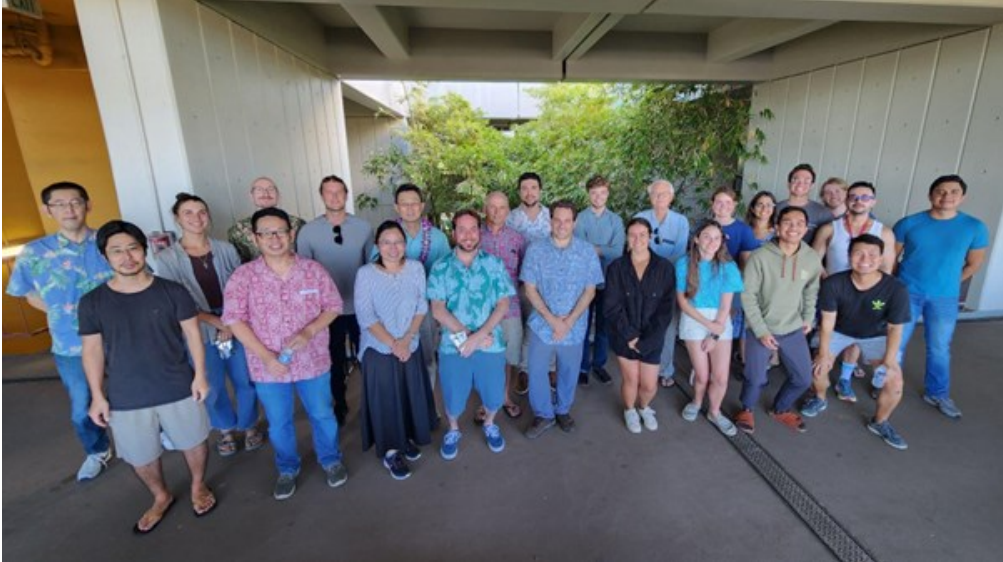
The event provided an opportunity to meet and socialize with fellow students, ORE faculty members, ORE adjuncts, and cooperating faculty members and staff. The gathering supplied an array of food which helped foster conversation between students and faculty giving ample time for those who attended to become acquainted. A special thanks to everyone who organized and helped set up the party, including ORE Associate Prof. Eva-Marie Nosal, ORE Department Admin. Jasmine Ogata, ORE Teaching Assistants Cami Dillion and Eliza Taylor and ORE Student Assistants.



Dr. Chung cuts his celebratory cake—30 years!

Inside ORE

Welcome back party & Congratulations! to Dr. Cheung—continued



Group picture from the F23 ORE Welcome Party



Formal welcome & informal conversations

SOEST Open House

Mike Krieg & Deniz Gedikli
ORE Assistant Professors



This Fall SOEST reinstated a popular tradition that was temporarily put on hold during the Covid pandemic. The SOEST Open House is regularly held once every other year as an outreach event to the local community to help awareness of and increase participation in STEM fields. K-12 students and their parents are invited to the open house, where academic units from throughout SOEST set up exhibits with information and demonstrations on all the interesting science taking place within our school.

This year the ORE department contributed 2 exhibits to the SOEST Open House to showcase our research capabilities. The first was a scale model towing tank demonstration using the new wave flume in HIG 151. Towing tank experiments consist of making a scale model of a ship and dragging it through a water channel while measuring drag force, pressure readings, wake structures etc., and these experiments are crucial for determining ship resistance. However, there are very few facilities in the entire country that can perform towing tank tests in controlled wave-state environments, as is possible in the new ORE facility. During the demonstration, Dr. Krieg and his graduate student Tyler Inkley showed a scale model of the Polynesian voyaging canoe Hōkūle’ā (which had its own exhibit at the open house) to interested students, and towed the model through regular waves to create wake patterns behind the ship. The presentation also included some historical context of towing tank experiments in general.



Dr. Krieg shows the scale model of the Polynesian voyaging canoe Hōkūle’ā

Continued on p.5

Inside ORE

SOEST Open House – continued

The second display featured two demonstrations of fluid-structure interactions led by Dr. Gedikli. The first demonstration showcased a newly constructed recirculating wave tank, offering insight into the movement of bluff bodies through flow visualizations. It was led by Clara Encke, a graduate student in Dr. Gedikli's Fluid-Structure Interactions and Nonlinear Dynamics (FSINLD) lab. In the second exhibition, Jonas Behnen, another graduate student from the FSINLD research group, demonstrated the effects of wave impact on floating offshore structures. Located just outside of HIG 109, the wave flume offered a variety of exciting activities, including the opportunity to race ducks and investigate how a duck swims in a variety of wave settings. The presentations also benefited from the presence and assistance of Dr. Gedikli's postdoc Dr. Ozgur Demir, as well as his other graduate students



ORE MS student Clara Encke demonstrates a flow visualization



ORE MS student Jonas Behnen demonstrates wave tank experiments

Meysam Rajabi and Kyle Pappas, who contributed to the success of both exhibitions. The interactive nature of the displays not only captivated the audience but also provided a valuable opportunity for meaningful engagement, showcasing cutting-edge research within the department. The enthusiastic response from attendees underscored the success of both exhibitions in fostering awareness and interest in the dynamic field of fluid-structure interactions, offering a hands-on experience for all to understand the fascinating world of fluid dynamics and ocean engineering.

Editor's Corner

Eva-Marie Nosal
ORE Associate Professor



I'm glad to have the opportunity to share updates in ORE with you via Hana O Ke Kai. If you have news or announcements to share for future editions, please send them along to me at nosal@hawaii.edu

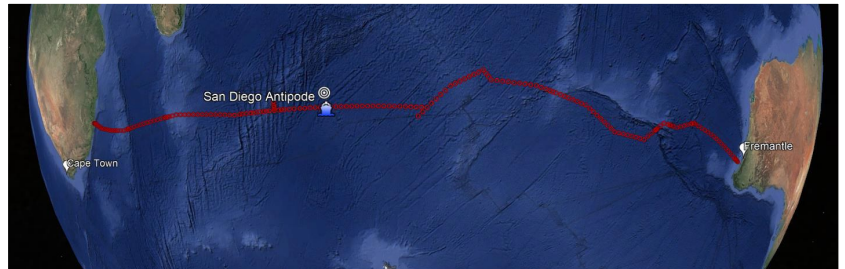
Inside ORE

GO-SHIP student experience: Global Ocean Ship-based Hydrographic Investigations Program

Jomphol (Jom) Lamoontkit
ORE MS student



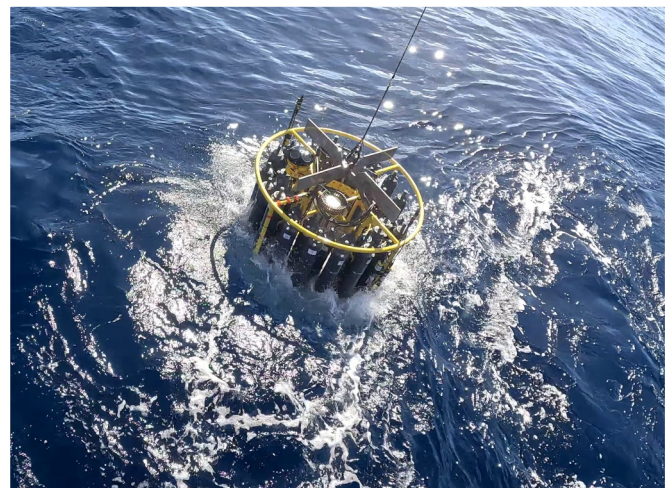
The Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) brings together scientists with interests in physical oceanography, the carbon cycle, marine biogeochemistry and ecosystems, and collectors of hydrographic data to develop a globally coordinated network of sustained hydrographic sections as part of the global ocean/climate observing system.



Last summer, I had the unique opportunity to join the US GO-SHIP I05 research cruise as a CTD watch stander student. (CTD stands for Conductivity, Temperature, and Depth sensor; on this cruise, we integrated the CTD sensor with several seawater sampler). We sailed across the Southern Indian Ocean, departing from Fremantle, Australia, and docking at Cape Town, South Africa. Along the way, we collected seawater samples spanning from the sea surface to the seabed, down to the maximum depth of 6,000 meters and analyzed

their pH, Dissolved oxygen, Dissolved inorganic carbon, and trace gases. We also integrated the Lower Acoustic Doppler Current Profiler (LADCP) with the rosette to track the current along the vertical profile. The cruise took about 55 days to complete its mission.

We operated in 12-hour shifts. My responsibility involved operating the CTD rosette alongside a crew in the winch room. At each station, our procedure was to lower the CTD rosette to within 10 meters above the seafloor, using the altimeters on both the ship and the rosette to gauge depth. Once we reached this point, we commenced seawater collection along the water column (by left-clicking a mouse to trigger the sampler). The rosette we utilized had 36 sample bottles, allowing us to strategically gather 36 samples at each station. Aside from assisting with the rosette's operations, I had the opportunity to prepare the CTD rosette, as well as assist in collecting samples for Alkalinity, Oxygen Isotope, and Salinity measurements.



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Inside ORE

GO-SHIP student experience—continued



I highly recommend ORE students to apply for graduate student positions. From this cruise, I gained hands on experience with Oceanographic Instrumentation, at sea laboratories, and I got to meet a lot of people in oceanographic society. On top of these, I learned that I love being at sea. I do enjoy rough sea conditions, and the challenges that come with them. They are typically looking for 4 CTD watch-standers, 1 LADCP watch-stander, and 1 trace-gases student. The GO-SHIP program usually sends out applications throughout the year.

To apply for a graduate student position, check GO-SHIP website: <https://www.go-ship.org/>
Cruise article: <https://tos.org/oceanography/assets/docs/36-2-3-erickson.pdf>



New in ORE

Frances Zhu

ORE Cooperating graduate faculty

Frances Zhu is a new ORE cooperating graduate faculty member. She earned her B.S. in Mechanical and Aerospace Engineering from Cornell University, Ithaca in 2014 and a Ph.D. in Aerospace Engineering at Cornell in 2019. Dr. Zhu was a NASA Space Technology Research Fellow. Since 2020, she has been an assistant research professor with the Hawaii Institute of Geophysics and Planetology at University of Hawaii, specializing in machine learning, dynamics, systems, and controls engineering. She is also an executive board member for Mahina Aerospace LLC and graduate cooperating faculty with the following departments: information and computer sciences, mechanical engineering, electrical engineering, and earth science. She likes to rock climb, sketch landscapes, and seek out new good food.



New in ORE

Griffin Bourjeaurd, MS student



Griffin is interested in ocean resource engineering, including desalination, marine renewable energy, and seawater mineral extraction. He previously received bachelor's degrees in Interdisciplinary Engineering from Florida International University and finance from the University of Western Ontario. He is currently a graduate research assistant at the Hawaii Natural Energy Institute, where he is working with the wave energy conversion team. His research covers electrochemical methods of desalination and mineral extraction and integrating wave energy conversion with ocean resource production systems. In his free time, he enjoys being on the ocean, hiking, and live music.

Eliza Taylor, MS student

Eliza is a recent graduate from the University of Rhode Island with a BS in Ocean Engineering. She is excited to be pursuing her Master's degree here at UH, with a focus in underwater acoustics. Eliza spends her free time sailing, hiking, and skiing.



Norman Chung

MS student with Prof. Krieg
 Interests: Oceanography, oceanographic engineering, renewable wave energy, underwater robotics
 Hobbies: Weightlifting, cooking, spinning poi



Cami Dillon

MS student with Prof. Krieg
 Interests: Coastal engineering
 Hobbies: Scuba diving, hiking, traveling



George Evans

MS student with Dr. Krieg
 Interests: Underwater robotics, fluid-body interactions
 Hobbies: Biking, fabrication, eriting, sketching



Prajna Jandial

MS student with Prof. Nosal & Prof. Zhu
 Interests: Robotics, acoustics, machine learning, adaptive sampling
 Hobbies: Diving, cooking, painting



Xinyi Zhang

MS student with Prof. Huang
 Interests: Coastal Engineering
 Hobbies: Traveling, hiking, reading, music



Jacob Dennis, MS student

Dylan Stegman, MS student

Some Recent ORE Publications

Bai Y, **Y Yamazaki**, and **KF Cheung** (2023). Intercomparison of hydrostatic and nonhydrostatic modeling for tsunami inundation mapping. *Physics of Fluids*, 35(7), 077111.

Li N, G García-Medina, Z Yang, **KF Cheung**, D Hitzl, Y-L Chen (2023). Wave climate and energy resources in the Mariana Islands from a 42-year high-resolution hindcast. *Renewable Energy*, 215, 118835.

Wood N, J Peters, **KF Cheung**, **Y Yamazaki**, D Calvo, C Guard C (2023). Modeling non-structural strategies to reduce pedestrian evacuation times for mitigating local tsunami threats in Guam. *International Journal of Disaster Risk Reduction*, 95, 103859.

Yamazaki Y, Y Bai, LL Goo, **KF Cheung**, T Lay (2023). Nonhydrostatic modeling of tsunamis from earthquake rupture to coastal impact. *Journal of Hydraulic Engineering*, 149(9), 04023033.

Gove JM, GJ Williams, JLecky, E Brown, E Conklin, C Counsell, G Davis, MK Donovan, K Falinski, L Kramer, K Kozar, **N Li**, JA Maynard, A McCutcheon, SA McKenna, BJ Neilson, A Safaie, C Teague, R Whittier, GP Asner (2023). Coral reefs benefit from reduced land-sea impacts under ocean warming. *Nature* 621, 536–542.

<https://www.nature.com/articles/s41586-023-06394-w>

M Krieg (2023). A Novel 3D Path Following Scheme for a Class of Underactuated Underwater Vehicles with Unconventional Actuation. In Proceedings of the IFAC World Congress, Yokohama, Japan, July 9-15, 2023.

Aktosun E, **ED Gedikli**, JM Dahl (2024). Observed wake branches from the 2-DOF forced motion of a circular cylinder in a free stream. *Journal of Fluids and Structures*, 124, 104035.

<https://doi.org/10.1016/j.jfluidstructs.2023.104035>

Peel GJ, **ED Gedikli**, H Hendrikse H (2023). Navigating Arctic Waters: A Summary of Ship Activities and Ice-Ship Interactions in Alaskan Waters. In Proceedings: The 27th International Conference on Port and Ocean Engineering under Arctic Conditions (POAC 2023)

Rajabi M, E Aktosun E, B Mingels B, J Dahl, **ED Gedikli** (2023). 2D numerical forced-motion simulations of vortex-induced vibration wakes: Toward understanding the onset of three-dimensional effects. In Proceedings: 4th International Naval Architecture and Maritime Symposium.

Gemba KL, NC Durofchalk, DR Dall'Osto, RK Andrew, P Leary, **BM Howe**, KB Smith (2023). Basin scale coherence of Kauai-Beacon m-sequence transmissions received at Wake Island and Monterey, CA. *JASA Express Lett*, 1 August 2023; 3 (8): 080801.

<https://doi.org/10.1121/10.0020514>

Ulm N, **Z Huang**, **P Cross** (2023). Experimental Study of a Fixed OWC-Type Wave Energy Converter with a Heave Plate and V-Shaped Channels for Intermediate-Water-Depth Applications *Energies* 16 (16), 5988.

Huang S, **Z Huang** (2023). Hydrodynamics of an idealized reef-lagoon-channel coastal system: A three-dimensional CFD simulation. *Coastal Engineering* 183, 104314.

Updates from retired & affiliate ORE Professor R. Cengiz Ertekin



As Editor-in-Chief of the *Journal of Ocean Engineering and Marine Energy*, Dr. Ertekin invites members of the ORE Ohana to submit papers.

<https://link.springer.com/journal/40722>

Selected recent publications:

- Chen YB, M Hayatdavoodi, BB Zhao, **RC Ertekin** (2024). Scattering of long waves by submerged freely oscillating plates. *J. Offshore Mechanics and Arctic Engineering*, Volume 146, No.2, April, 021201, 11pp. DOI: 10.1115/1.4063181
- [Book] Korde UA and **RC Ertekin** (2023). *Engineering Mathematics for Marine Applications*. Cambridge University Press, Cambridge, UK, xiii+413pp. Online ISBN: 9781108363235, DOI: 10.1017/9781108363235
- Liu J, M Hayatdavoodi, **RC Ertekin** (2023). A comparative study on generation and propagation of nonlinear waves in shallow waters. *J. Marine Science and Engineering*, 11(5), 917, 21 pp. DOI: 10.3390/jmse11050917

Closing



ORE Graduate Chair Prof. Cheung welcomes the incoming ORE class during Fall'23 orientation



Festive little tree in the ORE office

ORE is under full sail! We're powering forward strong and fast. Our faculty and student numbers are up, our office is in full swing, we have an exciting array of well-funded projects, our programs are being guided and supported by industry, and we are now developing our new spaces to jump-start our plans for an improved teaching lab, a computing lab/facility, and improvements to our student and researcher spaces. This is an exciting time for ORE—a time of expansion and impact. We've pulled people and resources together to make some exciting improvements, and we need your support! Your gift will be used directly in support of our programs, resources and infrastructure, and to help talented students reach their potential for impactful contribution to the Ocean State of Hawaii, and to a dynamic world that increasingly relies on well-trained engineers who are prepared to work in, on, and around the ocean. Please consider donating to ORE today:

<https://giving.uhfoundation.org/funds/12373104>

To pay by check, please make payable to University of Hawaii Foundation, indicate the donation is for "ORE 12373104", and send to:

ORE Enrichment Fund Administrator
 Department of Ocean and Resource Engineering
 University of Hawaii at Manoa
 2540 Dole Street, Holmes Hall 402
 Honolulu, HI 96822 USA

If you are interested in making an in-kind donation, if you have any questions about your donation or about how ORE is using donor support, or if you would like to explore other avenues of support, please don't hesitate to contact any ORE faculty member, or UHF Director of Development for SOEST: Meredith Yoro at 808-956-4575 or [meredith.yoro \[at\] uhfoundation \[dot\] org](mailto:meredith.yoro@uhfoundation.org).



Hana O Ke Kai

Newsletter of the
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**ENGINEERING THE OCEANS
 SINCE 1966!**

