ORE since 1966
OCEAN AND RESOURCES ENGINEERING
IN THE SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY AT THE UNIVERSITY OF HAWAI'I AT MĀNOA

HANA O KE KAI "Work of the Ocean"

NEWSLETTER OF THE OCEAN AND RESOURCES ENGINEERING DEPARTMENT, Spring 2022, Volume 25, Issue 1

Chair's Message

Zhenhua Huang, Chair

As I take on the job of department chair, I would like to thank Eva-Marie Nosal, the outgoing chair of ORE, for her leadership over the past five and a half years. She doubled the size of the department with Professors Justin Stopa, Mike Krieg, Deniz Gedikli and Ellen Briggs, and significantly increased the student enrollment. ORE's extramural funding reached an almost record amount by the end of 2021. She worked with Professor Kwok Fai Cheung to lead ORE through a successful ABET review last year. ORE office also had a new department administrator (DA), Mr. Dustin Lee, in 2021. Due in part to her leadership as Chair, SOEST has provided ORE with the former ESF "shop" as an ORE's new lab space. I also would like to thank Professor Kwok Fai Cheung for maintaining his role as ORE's Graduate Chair.

Professors Bruce Howe and Mike Krieg are currently leading an effort to convert the former ESF "shop" to a flexible, multi-purpose lab space. The new lab space will support our teaching activities and ORE/HNEI's research.

Other updates to ORE space include an upgrade to the computer room. Thanks go to DA Dustin Lee, our TAs Kei Manabe and Lauren Heslop, and Professors Deniz Gedikli and Mike Krieg for reorganizing the Holmes Hall 407 and upgrading the aging computers to brand new machines with new chairs and new software tools such as Solidworks and Altair for teaching and research.

All of this new equipment and space comes just in time as ORE is expecting about 12 new students to join our ORE Ohana in the Fall semester. Thank you, Professor Ellen Briggs, for organizing the buddy program for our incoming students. We also thank Dr. Pat Cross, the program manager of Wave Energy Test Site (WETS) and an ORE's cooperating faculty member, for his continued support to ORE's graduate programs through his research projects.

Everyone in ORE is working hard to grow our department in every way possible and we particularly appreciate the contributions from our ORE alumni. Thank you for giving talks at ORE seminars and being a guest lecture to share your real-world experience with our students. As ORE is expanding, the alumni involvement has become ever more important to improve our program and help our students better prepare for their future careers. Please send us your suggestions for our program, we value your input; if you have any newsletter items that we can share in ORE's newsletters, keep us updated. Please email me your suggestions or ideas directly at zhenhua@hawaii.edu.

In this issue

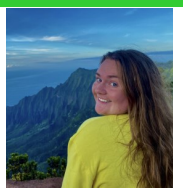
Department News

- **Andrew Storey** defended his MS Plan A Thesis "Seasonal Wave Climate Anomalies on the North Shore Indicative of Erosion Conditions" in April 2022

Inside ORE

Making Waves: New Teaching/Research Laboratory

Michael Krieg
Lauren Heslop



The ORE Department is excited to announce that we are renovating a new multi-use laboratory facility that will greatly aid in achieving the department's strategic goals moving forward. The facility, which will be located on the ground floor of the HIG building, will include a flexible multi-use laboratory space suitable for both teaching and state-of-the-art research, a small-scale fabrication and assembly area, and an additional office space.

Figure 1. Proposed Wave Flume

We plan to install a large wave flume as the centerpiece of this versatile laboratory space (see Figure 1). The selected flume will have an inner cross section of 800x800mm and a length of 12m. The large width is adequate for research purposes, so that it can fit workable scale models of energy converters, marine vehicles, and offshore structures. The flume will have a paddle type wave generator, which can be used to generate either monochrome waves with a single specified wavelength and wave height, or panchromatic waves with a specified spectral density function, such as a Bretschneider spectrum.

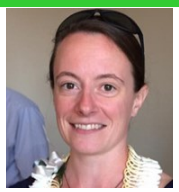
This facility will allow our classes to create laboratory modules to improve student engagement and retention and is anticipated to be utilized for ORE 202: Ocean Technology, ORE 203: Surf Science and Culture, ORE 411: Buoyancy and Stability, ORE 601: Ocean Engineering Laboratory, ORE 657: Autonomous Marine systems, and ORE 791: Ocean Instrumentation and Technology (soon to be ORE 653, see pg 3). As ORE develops an Ocean Engineering undergraduate track (with College of Engineering) additional classes will be introduced that require an Ocean Engineering Teaching Laboratory as well. The teaching lab will also support student research, capstone projects, and outreach efforts, providing a cutting-edge facility for students to work on independent projects. In addition to these internal classes, we plan to improve the university wide cooperation and partnership by making this facility available to classes from other departments/units. We have already coordinated with the OCN department to utilize the lab for at least three of their courses (OCN 201, 620, and 660).

Without knowing the exact needs and requirements of future laboratory experiments, we plan to optimize versatility and modularity to guarantee success. Next to the flume, the facility will have 4 general use workstations, each which can accommodate 4-6 students. Each workstation will contain common elements shared by requirements for various experiments, including a computer, a benchtop power supply, a benchtop multimeter, and an NI external USB data acquisition card to sample from whatever sensors are being tested.

On top of these advantages, the facility will significantly benefit active research being conducted, ranging from coastal modeling, to renewable energy, to offshore structures design. The wave flume will allow HNEI to perform testing on medium scale energy converters decreasing the amount of time needed for testing at expensive, larger, out of state facilities. There will also be a partitioned-off section of this facility specifically for sensor/instrument/electronics/ hardware prototyping and troubleshooting.

We are very excited about the development of this new versatile lab space, and we anticipate having all equipment installed and the facility fully operational by the end of the Fall 2022 semester.

Inside ORE



Special Topics Course: Ocean Instrumentation and Technology

Ellen Briggs

During the spring 2022 semester, a new course was being developed and offered by Dr. Briggs: ORE 791 Ocean Instrumentation and Technology. We hope to make this a regularly offered course (ORE 653) each spring term and one of the required electives for the Oceanographic Engineering specialization track in the ORE MS program. Currently there are 8 students enrolled in the course including 1 student from Oceanography and 1 from Mechanical Engineering in addition to ORE students.

Figure 2. ORE students Jonathan Chapman, Lauren Heslop, Tyler Inkley, Kyle Pappas, and Jesse Gray learn about the ROV Lu'ukai at the UH Marine Center

The objective of this course is to provide an overview of past, present, and emerging technologies and instrumentation that support oceanographic and marine operations and to cover the design, operation, and maintenance of the mechanical, electrical, and computing components of these systems. There are theoretical, practical, and hands-on components including a class project. This semester student projects have included building a CTD (conductivity, temperature, depth) probe, designing and testing a 3D printed pressure housing, learning about assembling and overhauling a prototype carbon sensor, and communicating with various pressure sensors and strain gauges.

We had a fun field trip to the UH Marine Center where we learned more about the ROV Lu'ukai from Max Cremer, Blue Eisen and the rest of the Lu'ukai crew. They went through the standard operations for powering and communicating with the ROV dockside and successfully demonstrated picking up a traffic cone with the manipulator arms. Lu'ukai is rated to work down to 6,000 m and we learned a lot about the engineering challenges associated with working under extreme pressure and in the marine environment in general. In the future we hope to make a day at sea part of the curriculum as well.

Editor's Corner

Lauren Heslop, ORE TA

This semester saw the start of a return to normalcy as in-person learning resumed following the lifting of Covid-19 restrictions. It has been wonderful finally being able to see all your lovely faces in person! I'd like to extend a big mahalo to the ORE department for making my time as TA truly extraordinary. I've had the opportunity to work with many amazing individuals while making some great friends along the way. I hope you enjoy this version of Hana O Ke Kai!

My Experience with TEAMER– A Great New Resource for Marine Energy Testing

Nic Ulm

What is TEAMER?

The *Testing Expertise and Access for Marine Energy Research* (TEAMER) program is a US Department of Energy sponsored program that provides marine energy developers with a funding pipeline to finance advising and testing of marine energy technologies.

The goals of the TEAMER program are:

1. Access to testing infrastructure: provide device developers with access to a wide range of pre-certified facilities at minimal cost and allow for a much faster and more streamlined integration of physical testing and validation into the design process.
2. Access to world-class expertise: pair technology developers with the nation's leading marine energy experts, providing desktop assistance and access to modeling tools and support.
3. Consistent testing protocols: implement consistent testing protocols for use in the facility network and create a repository of marine energy performance data that will serve the industry as a whole.

How was my experience with TEAMER testing?

I was fortunate enough to be selected for Request for Technical Support (RFTS) 1 and upcoming tests in RFTS 4. In RFTS 1, our HNEI wave energy lab team traveled to the OH Hinsdale Wave Research Laboratory at Oregon State University (OSU). We conducted model testing of a floating and fixed oscillating water column type wave energy converter in the directional basin to characterize the capture width and directional dependence of a novel geometry. The whole process was straightforward, with most questions clearly explained on TEAMER website (FAQs – TEAMER (teamer-us.org)). When I did have additional questions, the team at the Pacific Ocean Energy Trust (who direct the TEAMER program) were quick to respond and assist with any confusion. Once my application was accepted, I was able to hop on a weekly call with the OSU staff to hash out the details of our testing plan, such as advised sensors, data management, and wave conditions needed. The testing plan should take roughly 2 months to complete and is submitted by the test facility. With our test plan complete, we submitted the plan, where we subsequently received confirmation of the review (and acceptance) of our plan. During testing, I found an apartment near OSU to rent for the month that I was at the test facility. TEAMER covered the cost of rent, a rental car, and my airfare. This reduced the headache and stress of staying at a hotel. We accomplished everything we were looking to do during testing. From there, we processed the data, sent it off to POET, finalized our report, and then applied again!

Figure 3. Nic Ulm (left) and Duncan Lajousky (right) carry the floating prototype to the basin

In our second round of testing, we experienced scheduling issues with our first choice test facility that made it impossible to accomplish testing during our desired timeline. Our contacts at the Pacific Ocean Energy Trust were very accommodating, and helped us to find a suitable replacement facility that fit our needs. I would highly recommend the TEAMER testing program to any prospective marine energy developer, graduate student, or professor interested in testing a design they have come up with. The process was clear, the directing agency is incredibly easy to work with, and test facilities available provide world class expertise on conducting marine energy testing.

Continued on p.5

My Experience with TEAMER– A Great New Resource for Marine Energy Testing

Continued from p.4

What did I get funding to test?

My testing focuses on the laboratory testing of a novel oscillating water column type wave energy converter named *Hālona* in a directional wave basin. We received two separate rounds of funding to test 2 scale models and investigate the power capture capabilities of the geometry. As this device is intended to be a floating wave energy converter, we are also in the process of assessing the hydrodynamics and mooring design of the device.

In the first round of testing, we concurrently tested a floating and fixed geometry of *Hālona* to understand the capture width of the wave energy converter, as well as to understand the directional dependence of the geometry. It was observed that the geometry behaves as an omnidirectional wave energy converter, meaning that the direction of incident wave energy has a negligible impact on the power performance of the device.

Figure 4. Fixed (right) and Floating (left) prototypes OWC wave energy converters

In the second round of testing, we will be investigating how scaling affects the viscous damping of the buoy, as well as investigating the impact of a mooring on the power performance of the buoy.

9th Workshop on Detection, Classification, Localization and Density Estimation of Marine Mammals using Passive Acoustics

Eva-Marie Nosal

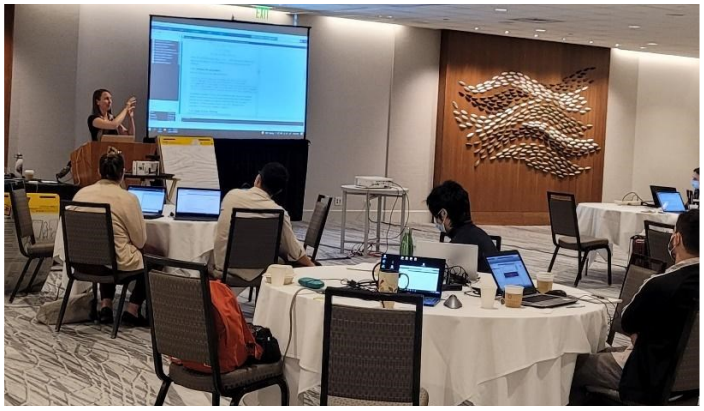


Figure 5. Dr. Pina Gruden teaches multi-target tracking during the tutorial: "Connect the dots! Multi-target tracking in acoustics"

The 9th Workshop on Detection, Classification, Localization and Density Estimation of Marine Mammals using Passive Acoustics (DCLDE) was held at the 'Alohilani in Waikiki on Oahu during the week of March 7 2022. The workshop welcomed over 180 researchers from across the globe; a much welcome first time "in-person" event for many of us after over 2 years of solely remote contact. To accommodate broader participation and folks unable to travel, the DCLDE 2022 was hybrid with about a third of our participants joining remotely.

Continued on p.6

9th Workshop on Detection, Classification, Localization and Density Estimation of Marine Mammals using Passive Acoustics

Continued from p. 5

DCLDE has been bringing together researchers and practitioners in the field every 2-3 years since 2003. The workshop series has been successful in advancing the field by providing a forum for researchers to share/compare methods, and build collaborations. The series has also served as an entrance point for students and researchers new to the field. As with previous workshops, a common dataset was provided to allow participants to directly compare algorithms and methodologies (the 8TB dataset was hosted by google, and is now available via NCEI).

Figure 6. DCLDE 2022 Oahu participants enjoy a dinner event at the Hoʻokupu Center – it was a much welcome opportunity to catch up and unwind after 2 years of separation (and the food was delicious, thank you Kupu folks!)

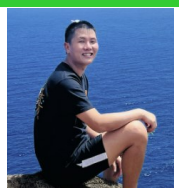
DCLDE 2022 had a strong ORE contingent, including ORE Prof. Eva-Marie Nosal as workshop co-chair along with co-chair Erin Oleson, Leader of the Cetacean Research program at NOAA Fisheries, Pacific Islands Fisheries Science Center (PIFSC); CIMAR/ORE Acoustics Researcher Pina Gruden leading a tutorial on multi-target tracking along with NOAA/PIFSC colleagues Yvonne Barkley and Selene Fregosi; ORE PhD students Brendan Rideout and Kei Manabe presenting their research; and ORE alumni Kay Gemba (now Associate Professor in the Department of Physics at the Naval Postgraduate School) and ORE affiliate faculty member Laura VanUffelen (Assistant Prof. in Ocean Engineering at the University of Rhode Island) as participants. Beyond ORE, the local contingent included many folks from NOAA, the Navy, the Hawaii Institute of Marine Biology and others as participants, presenters, volunteers, and/or organizers.

A big mahalo to DCLDE 2022 sponsors - NOAA, the Office of Naval Research, the Navy's Living Marine Resources Program, the Acoustical Society of America; to Google for hosting the dataset; to the amazing folks on the local organizing committee (Ann Allen, Marc Lammers, Jennifer McCullough, and Aude Pacini); to the steering committee for their guidance and encouragement through multiple covid-induced delays and uncertainties; to ORE's Dustin Lee for coordinating student support; and to all the folks who participated to make DLCDE 2022 an engaging, productive, and most memorable event.

Figure 7. In-person and virtual participants of DCLDE 2022 Oahu gather for a (quick!) group photo.

Inside ORE

PhD Candidate, Shijie Huang, Won the Second Prize of the Best Student Presentations at the 12th South China Sea Tsunami Workshop



Shijie Huang
Zhenhua Huang

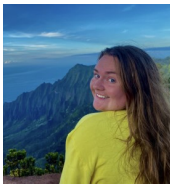
PhD candidate, Shijie Huang, gave an oral presentation on multi-phase flow simulation of solitary-wave induced beach erosion at the 12th South China Sea Tsunami Workshop (SCSTW), which was held online via ZOOM on January 13-14, 2022. SCSTW is an annual workshop series that is dedicated to address on-going research concerning tsunami threats to regions surrounding the South China Sea region. Over 40 researchers and graduate students presented their research at this year's SCSTW.

Devastating tsunamis can transport significant amount of sand and cause coastal morphology change. Therefore, understanding the beach erosion process caused by tsunami is key for tsunami hazard mitigation. Shijie's presentation focused on his preliminary results obtained by using a multi-phase (air, water, and sand) numerical model to simulate the beach erosion process caused by consecutive solitary waves, which have been widely used to represent tsunami waves in experimental and numerical studies of tsunamis.

Professor Philip L-F. Liu (Cornell University, National University of Singapore), the Chairman of SCSTW-12 committee, presented Shijie the second prize certificate with a $200 book coupon provided by the World Scientific Publishing.

Shijie is currently working on further improving the accuracy of the numerical model as well as looking into more details during the beach erosion process that are hard to measure in the experiment. Shijie's PhD research is under the supervision of Dr. Zhenhua Huang.

Old Space, New Look: Updates to the ORE Computer Lab



Lauren Heslop

Updates have been made to the ORE computer lab in Holmes Hall 407. The lab, including all cabinets and shelves, has been cleaned and reorganized. Five brand new computers, monitors, keyboards, and mouse were purchased for the space. New desks and office chairs were purchased as well. Each computer is a Dell Precision 3450 with an Intel core i7 processor and 16 GB of RAM. The system is a 64-bit operating system with Windows 10 Pro. Proteus GS, Matlab (2022a), and SolidWorks have been installed on each computer, and every computer is connected via Wifi to a printer in HH 407. The goal of the new lab is to provide a place where students can collaborate and use software they may not have access to at home. Mahalo to ORE department TAs, Lauren Heslop and Kei Manabe, and ORE department administrator, Dustin Lee, for all their hard work in putting this space together.

Figure 8. The new and improved Holmes Hall 407 looking spiffy!

New in ORE

Tyler Inkley, ORE PhD Student

Tyler Inkley is a first year PhD student in the ORE department. He is working under Dr. Mike Krieg, and is focusing his studies on biomimetics, robotics, and underwater vehicles. In his free time, Tyler enjoys diving, music, and rugby. Welcome to the ORE 'Ohana, Tyler!

Some Recent ORE Publications

Cheung, K.F., Lay, T., Sun, L., and **Yamazaki, Y.** (2022). Tsunami size variability with rupture depth. Nature Geoscience, 15(1), 33-36.

Shijie Huang and **Zhenhua Huang** (2022). Hydrodynamic performance of a row of closely-spaced bottom-sitting oscillating water columns. Renewable Energy. Accepted.

Conghao Xu and **Zhenhua Huang** (2022). An Experimental Study of Characteristics of Solitary-Wave-Induced Scour Around a Pile Breakwater with a Discussion on Effects of the Distance Between Piles. Journal of Earthquake and Tsunami. In-Press. DOI: 10.1142/S1793431122400024

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 now have the space and some department funds 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
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