

# HANA O KE KAI

“Work of the Ocean”

NEWSLETTER OF THE OCEAN AND RESOURCES ENGINEERING DEPARTMENT, Fall 2017, Volume 21, Issue 1

## Chair’s Message

Eva-Marie Nosal, Chair



**T**his is an exciting time for research and engineering at ORE. In this edition, you’ll read about two new projects in ORE: ORE Prof. Huang was recently funded to explore the possibility of integrating pile breakwaters with wave energy converters, and ORE Prof. Howe (as co-PI) will be helping develop a water column profiler capable of sampling to the deepest parts of the ocean. Also in this newsletter is an update from HNEI Specialist Patrick Cross on work at the Navy’s Wave energy test site, which involves various members of our ORE Ohana. In other news, thanks to the hard work and enthusiasm of many in ORE, the wave flume and sea-gliders were a huge hit with students at the 2017 SOEST Open House in October – read more about it below.

I’m very pleased to announce the recent launch of the new ORE website. Many thanks to Brooks Bays in SOEST Illustration for creating the site for us and to SOEST Dean Taylor for providing support. In addition to a layout that works cross-platform (including on mobile devices) and easily modifiable content, the new site will feature news as it occurs. Check it out at: [www.soest.hawaii.edu/ore](http://www.soest.hawaii.edu/ore) I welcome your feedback, input (including stories and content, if you have anything to share), and constructive criticism.

Finally, I extend my warmest welcome to our incoming students from the Fall 2017 semester and I congratulate and wish our recent MS graduates – Ian Hardy (MS-B), RJ Uglow (MS-B) and Vincent Varamo (MS-A) and Yaprak Onat (MS-B *en-route* to PhD) – the very best as they continue their careers and/or studies.

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## Editor’s Corner

Nicholas Ulm, ORE TA



First off, I would like to extend a special mahalo to ORE for providing me this opportunity as the department TA. I’ve had the pleasure of getting to know the department and field more intimately through interacting with guest lecturers and editing this issue. Mahalo and enjoy this version of *Hana O Ke Kai*.

## Department News

- **Ian Hardy** defended his MS Plan B Thesis Presentation “Assessment of Delft3D as a Modeling Tool for Kaa-napali Beach” on December 11, 2017
- **Ronald J. Uglow** defended his MS Plan B Thesis Presentation “Site-Specific Design for Modular Expeditionary Small Boat Pier, Carlson Harbor, Kwajalein Atoll, Republic of the Marshall Islands” on December 11, 2017
- **ORE Website** is live! Check it out at: [www.soest.hawaii.edu/ore](http://www.soest.hawaii.edu/ore)

## Inside ORE

### SOEST 14th Biennial Open House

Nicholas Ulm



**T**he Department of Ocean and Resource Engineering took part in celebrating SOEST (School of Ocean and Earth Science and Technology) 14<sup>th</sup> Biennial Open House this academic year. The SOEST Open House, held in October, showcases a diverse array of entertaining and educational hands-on activities and demonstrations to highlight the research of our faculty, students, and staff. With close to 2000+ students and families on campus over the course of the weekend, campus was buzzing with excitement.



MS Student Nicholas Ulm explaining to students the ways that waves can break at the 14th Biennial Open House. Photograph courtesy of Kei Manabe

Students and families who came were able to learn about volcanoes, tsunamis, El Niño, hurricanes,, marine ecosystems and many other topics. As part of ORE's contribution and under the leadership of Dr. Huang, students learned about ocean waves from the wave flume in front of the HIG building. Armed with questions and strong desire to learn, students inquired into topics such as seasonal waves, wave-induced currents, beach loss, and wave formation.

By all accounts, the SOEST Open House was a success that brought together both students and educators with the intention to inspire youth about possibilities of the future that they had not considered. ORE extends a big mahalo to all the volunteers who made the weekend possible (including but not limited to Zhenhua Huang, Kei Manabe, Bradley Beeksmas, Justine Brakefield, Nicholas Ulm, Assaf Azouri). Thank you all!

Check out photos from the event on the ORE facebook page at:

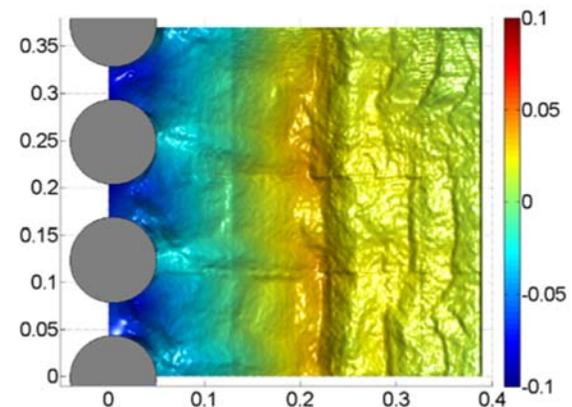
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### Controlling Cross-shore Sediment Transport

Zhenhua Huang



**R**ising sea level puts beaches and coastal infrastructure at risk. Ocean and coastal engineers traditionally protect coastlines and harbors by building breakwaters that redirect and/or dissipate wave energy. However, this represents a significant loss of energy – energy that might be put to other use! In fact, wave energy conversion (WEC) devices are specifically designed to harness wave energy. Is it possible to design a WEC that is also a breakwater? Can we harness wave energy while protecting our coasts/harbors at the same time? This is the aim of a new project funded by the National Research Foundation: Controlling Cross-shore Sediment Transport by Integrating Pile Breakwaters with Wave Energy Converters for Sustainable Coastal Management. Relying on recent development in two-phase flow simulations, this research will improve understanding of hydrodynamic and sediment processes in the vicinity of bottom-sitting coastal structures of complex geometry. It will enable better prediction of shoreline evolution protected by an Oscillating Water Column (OWC)-pile breakwater. This three-year project is led by ORE Associate Professor Zhenhua Huang.



Measured bed elevation change on the leeside of a pile breakwater model after running multiple solitary waves in a wave flume. Scour at the breakwater caused by jet flow through the gaps between piles can be observed.

## Inside ORE

### Hadal Water Column Profiler

Bruce M. Howe

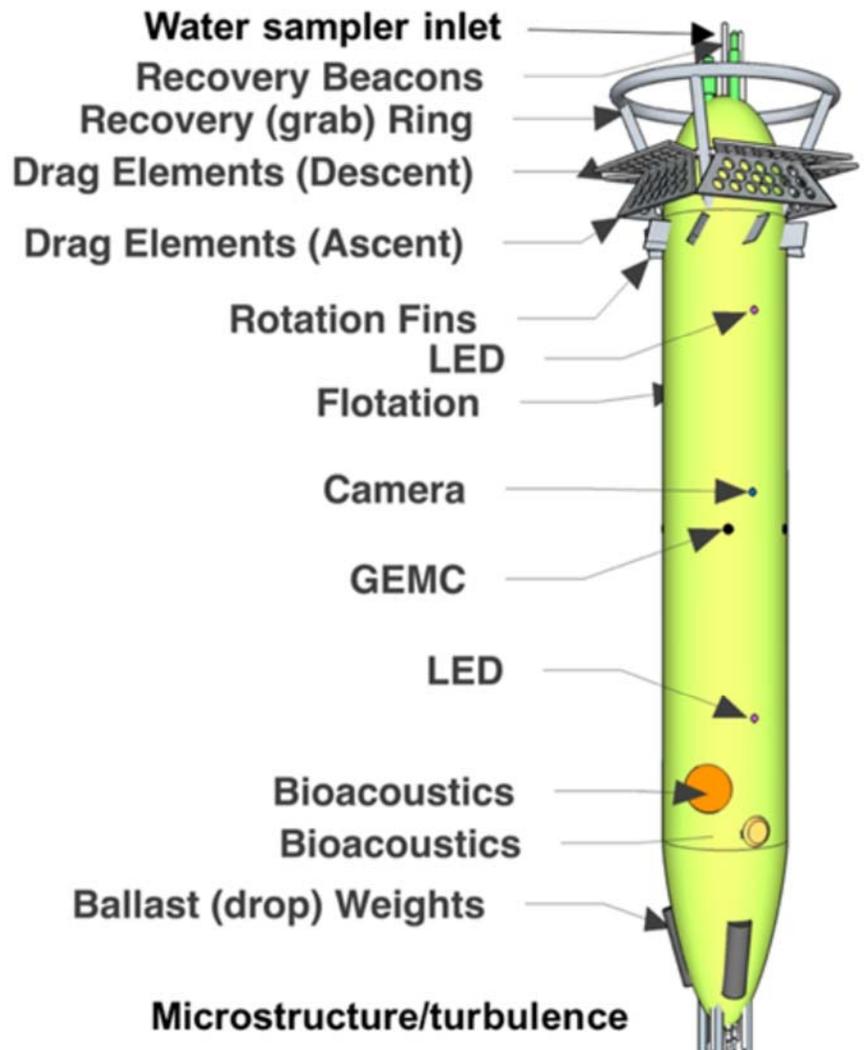


**D**o the waters in the deep trenches mix, and if so how? Is it by advection, trapped internal waves dissipating, or submarine landslides, or some combination? These are just some of the questions being asked that are motivating the development of an autonomous free falling (and rising) vehicle to sample the water column microstructure and turbulence, water chemistry, and biology (via video and acoustics) – all the way to the deepest – hadal – depths of the ocean, 11,000 m.

The W. M. Keck Foundation has funded PI Glenn Carter (turbulence and profilers) and co-PIs Chris Measures (water chemistry and sampler) and Jeff Drazen (deep sea biology, all in Oceanography) and myself (acoustics, deep instrumentation) to develop and use the HWCP. Other major contributors are Ron Al-lum (chief engineer of James Cameron's Deep Challenger vehicle, for the buoyancy, pressure-balanced batteries, and overall hadal experience), and Rockland Scientific (microstructure instrument).

The picture shows the concept design. Microstructure (at the nose) and geo-magnetic current meter instruments are active on the way down, to access uncontaminated water and because the former sensors are extremely sensitive to electronic noise from other instruments. The water sampler is in the interior but collects sample from the tail on the way up. The camera with LED lights and the backscatter bioacoustics will provide measures of the biological population densities. Together, these instruments will provide data that we expect will go a long way to answering the motivating questions. Further, the HWCP can also of course be used in shallower water, with the advantage that other work (e.g., CTD casts) can be going on at the same time.

Design and component work will proceed in 2018, system integration and testing in 2019 and first field testing in 2020. We are excited to be working on this challenging project, with interesting people with an excellent, right mix of expertise.



## Inside ORE

### Update on the Navy Wave Energy Test Site

Patrick Cross



The U.S. Navy’s Wave Energy Test Site (WETS), located off Marine Corps Base Hawaii in Kaneohe, has been fully operational since the spring of 2015, when power/data cables were laid from the two most recently added test berths at 60 and 80m water depths, which complement a preexisting berth at 30m. These three test berths constitute the only grid-connected wave energy test site in the U.S., and one of just a few worldwide, bringing global attention to the results to be obtained here in Hawaii. The site has been host to three different wave energy developers to date – beginning with Ocean Power Technologies intermittently between 2004 and 2011, and continuing more recently with Northwest Energy Innovations from May 2015 to December 2016 and Fred. Olsen, Ltd. from March 2016 to April 2017. Both recent devices are scheduled for redeployment for shorter periods in 2018 to assess key variations in mooring strategy, device configuration, and, in the case of the Fred. Olsen Lifesaver, to demonstrate the direct use of generated electricity to power a suite of sensors and a subsea charging capability integrated with the device, in collaboration with colleagues at the University of Washington. Toward the end of 2018, the next WEC to deploy at WETS will be a large oscillating water column device from Irish developer Ocean Energy – a device which may produce as much as 500 kW of power.

Personnel in ORE and at HNEI are directly supporting this Navy and Department of Energy testing. The daily wave forecast developed by Drs. Kwok Fai Cheung and Ning Li, as well as their 36-year wave hindcast database, are critical elements of the support provided to sponsors and wave energy developers. Dr. Kumar Rajagopalan, who completed his post-doc in ORE under Dr. Gerard Nihous in 2015, now works for HNEI providing key hydrodynamic modeling associated with WECs and their mooring systems. Also, Dr. Li is working with UW colleagues and with Dr. Eva Nosal to analyze a growing body of acoustic data collected near deployed wave energy converters. UH support to WETS is the result of two recent infusions of congressional funding from the Naval Facilities Engineering Command, with another likely in 2018 that will allow expanded studies of wave energy systems beyond those being tested at WETS, including concepts being explored by Dr. Zhenhua Huang and recent ORE graduate Dr. Richard Carter. In both cases, the HNEI/ORE team’s intent will be to numerically develop these concepts and move to scaled tank testing at a mainland facility.



Fred. Olsen, Ltd. Lifesaver during deployment at WETS in March 2016.  
Photo courtesy of Sea Engineering, Inc.

*Dr. Patrick Cross is a Specialist at the Hawaii Natural Energy Institute. Among other roles, he serves as program manager for the Wave Energy Test Site (WETS). Learn more about WETS on the HNEI website: <https://www.hnei.hawaii.edu/projects/wave-energy-test-site-wets>*

## Inside ORE

### 10 Years at ‘Marine Georesources and Geotechnology’

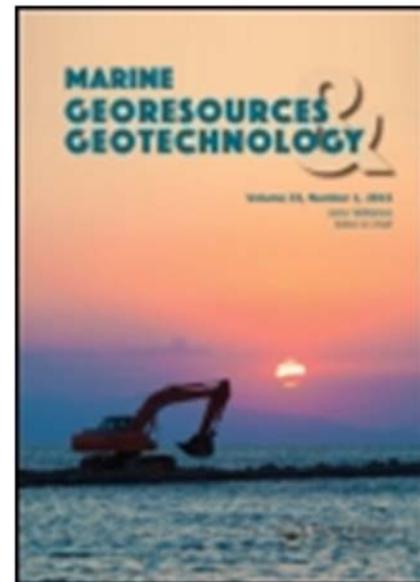
John Wiltshire



One of the bedrocks of academic life is the publishing of journal articles. The key to a successful academic career is publishing. The flip side of this is the editing and production of a journal. John Wiltshire, the Department’s Associate Chairman has been the editor-in-chief of ‘Marine Georesources and Geotechnology’ for the past 10 years.

The journal has expanded greatly in the last two years now receiving 300 manuscripts a year of which it publishes about 125 in 1200 pages spread over 8 issues. The journal looks at key issues in the development of marine mineral resources and marine geotechnology including coastal development. The most recent issue is a collaboration with Wuhan University on coastal reclamation along the east coast of China. Dr. Wiltshire will go to Wuhan in mid 2018 to work on the promotion of the journal and foster further collaboration.

The January 2018 special issue of *Marine Georesources & Geotechnology*, entitled ‘*Land reclamation and enhancement of soft marine sediment for building.*’ addresses the expanding industrial development along the east coast of China and the value of waterfront land increasing greatly to accommodate the new ports, airports, roads, warehouses and living facilities demanded by the burgeoning development and new wealth of the area. This pushes the creation of new land to accommodate these uses. However, rather than taking fill from existing land to accommodate this expansion, it is much easier to use dredge fill taken from the clearing of harbors and channels. While an apparently benign solution, this can be fraught with unseen difficulties for later construction, as the use of these very soft sediments raises a whole series of engineering challenges and potential problems; one need only think of the classic leaning tower of Pisa! The reclamation of land from the ocean has long been practiced and should be a most welcome and attractive solution to solve such a difficult problem as the quest for new land. However, it is not simple. At the moment, the application of new land reclamation technologies is growing with remarkable speed, owing to the irrepressible demand for sustainable infrastructure development. This is pushing some very innovative reclamation techniques.



In summary, three distinct areas of scientific research and engineering practice were specifically addressed in this themed issue, namely:

(1) *Soil solidification*: Usage of hydraulic binders such as cement has been encouraged to enhance the strength and bearing properties of soft soils, but more attention could be paid to the new environmentally friendly solidification methods using widely available clean industrial by-products.

(2) *Ground improvement*: Dredged sediments are commonly used as the main fill materials for land reclamation. They generally have negative properties, including high water content, high compressibility and low permeability. Two approaches for amelioration techniques are discussed in the special issue, those being vacuum preloading and electro-osmosis consolidation.

(3) *Marine environment and structures*: The serviceability analysis of nearshore rigid piles, compressed sand and helical piles, geo-membrane enhanced groins, and suction caissons among other structures assists in the modern design methods for coastal and offshore foundations, mainly to improve the practical survivability of marine infrastructure. Analysis of cyclic behavior of marine soils under complex conditions such as storm-wave loading and traffic loading reveals, in detail, their mechanical response such as stress-strain relationships, failure modes and pore water pressure.

## Station ALOHA

## International Congress on Ultrasonics 2017 Honolulu

Suk Wang Yoon



**D**r. Suk Wang Yoon, ORE Adjunct faculty member and President of International Congress on Ultrasonics (ICU) successfully held the 2017 ICU Honolulu at Hawaii Convention Center on December 18 – 20, 2017. This Congress brought together multidisciplinary subjects on all aspects of Ultrasonics and led us into the future of "Eco-sound."

For the Congress, 302 papers were presented in 51 technical sessions including two plenary lectures:

1. *"The Best Short Range Active Sonar System On This Planet"* by Whitlow W. L. Au, Emeritus Research Professor, Hawai'i Institute of Marine Biology, University of Hawai'i at Manoa
2. *"Optimal Sound Absorbing Structures"* by Ping Sheng, Dr William M W Mong Chair Professor of Nanoscience, Department of Physics, Hong Kong University of Science and Technology

The Program / Abstract Book of 2017 ICU Honolulu can be downloaded from their website:

<http://www4.eng.hawaii.edu/~icu2017/03program.html>

### History of International Congress on Ultrasonics

The International Congress on Ultrasonics (ICU) was constituted in 2005 as the result of the merger of two existing international Congresses: The World Congress on Ultrasonics (WCU) and Ultrasonics International (UI). The ICU is currently an internationally affiliated member of the International Commission for Acoustics (ICA), the parent organization of many national and regional acoustical societies.

Although the history of the ICU is relatively short, the history of the two Congresses integrating ICU, is much longer: the UI started in the 1960s and the WCU started in 1993. UI was the first international congress devoted to ultrasound and was linked to the journal "Ultrasonics" (created by the group Butterworth-Heinemann in England and later acquired by the well-known publisher Elsevier). The WCU was created as an independent world congress by a group of ultrasound scientists from several countries.

The first attempt towards a merger occurred at the third WCU, held jointly with UI in Lyngby, Denmark. The merge became solidified at the last WCU meeting, again jointly with UI, held in Beijing, China in 2005. This meeting marked the starting point of the definitive merger of both Congresses into the present ICU. Since its creation, the ICU has enjoyed many subsequent meetings: the first 2007 ICU Vienna at the Vienna University of Technology, Austria, the 2009 ICU in Santiago, Chile, the 2011 ICU in Gdansk, Poland, the 2013 ICU in Singapore, and the 2015 ICU in Metz, France. The most recent and sixth ICU was held in Honolulu, Hawaii, U.S.A for December 18-20, 2017.

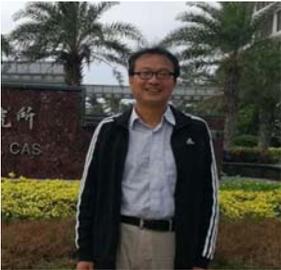
## New in ORE

### Suk Wang Yoon, PhD



Dr. Yoon joined ORE as Adjunct Professor in January 2017. He is Professor in the Department of Physics, SungKyunKwan University in Korea since 1985. Dr. Yoon’s research interests include underwater acoustics, the acoustic roles of bubbles in sound propagation at sea, nonlinear acoustics, ocean sediment acoustics, ambient sound in the ocean, physical acoustic characterization, and biomedical acoustic applications.

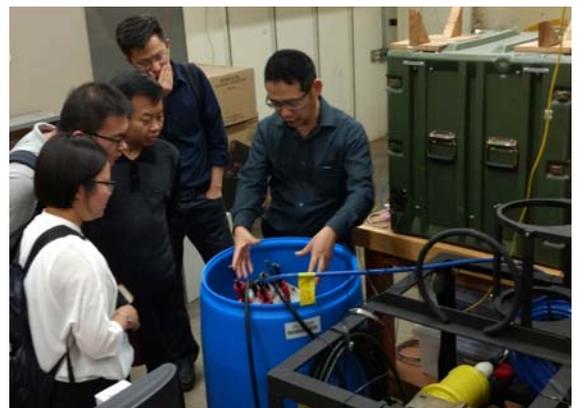
### Chunrong Liu, PhD



I am a professor at Xiamen University of Technology in China since 2013 and worked at Nanyang Technological University in Singapore from 2007 to 2009. I am a visiting scholar with Dr. Huang for one year to work on breakwater and wave energy. My research interests include numerical wave tank simulations, wave energy, sediment transport and vibration isolation.

## Recent Publications

- ◆ Ye, L., Lay, T., **Bai, Y., Cheung, K.F.**, and Kanamori, H. (2017). The 2017 Mw 8.2 Chiapas, Mexico Earthquake: Energetic Slab Detachment. *Geophysical Research Letters*, 44(23), 11,824–11,832.
- ◆ **Bai, Y., Lay, T., Cheung, K.F.**, and Ye, L. (2017). Two regions of seafloor deformation generated the tsunami for the 13 November 2016, Kaikoura, New Zealand earthquake. *Geophysical Research Letters*, 44(13), 6597–6606.
- ◆ **Wiltshire, J.C** (2017), Sustainable Development and Its Application to Mine Tailings of Deep Sea Minerals in Rahul Sharma editor *Deep Sea Mining: Resource Potential, Technical and Environmental Considerations*, Springer p. 423-445



ORE Prof. Zhenhua Huang demonstrates Kilo Nalu hardware during a visit from a delegation of researchers from the Qingdao National Laboratory for Marine Science and Technology.

## New in ORE

### Bradley Beeksma, MS Student



Hi! I grew up on Kaua'i and for my undergraduate did a dual degree program with Whitworth University in Spokane (Applied Physics, BA) and Columbia University in New York (Mechanical Engineering, BS). This year I have a graduate assistantship as an engineering intern at Navatek LTD, an engineering company in Honolulu that specializes in ship hull design and ocean structures. During my time as a student of the ORE department, my plan is to focus on marine renewable energy and offshore engineering, with hopes of using my knowledge and abilities to benefit the people and environment of Hawai'i.

### Justine Brakefield, MS Student



Greetings! My background is in structural engineering from the University of Illinois. I worked in Seattle for a couple of years before deciding to attend graduate school to learn about our ocean, as well as engineering in the marine environment. At ORE and beyond, I plan to focus on marine energy research, collaborating with the Hawaii Natural Energy Institute. Outside of class, I enjoy playing guitar, piano, singing, and spending time in the outdoors.

### Sitthichat Sukpholtham (Boris), MS Student



Hello, I'm Sitthichat Sukpholtham, but people call me Boris. I grew up Bangkok, Thailand. My background is in mechanical engineering. During my undergraduate study, I particularly worked in a student formula car team. Attending ORE, I am interested in ocean observation technology including underwater robotics and ocean acoustics. Currently, I am an RA under Dr. Bruce Howe. In my free time, I love surfing, hiking and diving (if financially available).

### Nicholas Ulm, MS Student



Aloha all! Originally from O'ahu, I grew up in Aiea and left the islands for my undergraduate degree in mechanical engineering at Johns Hopkins University. This year I have had the pleasure of working on a wave energy drone under Dr. Reza Ghorbani, with guidance from Dr. Huang. My intention is to continue to work in ocean based renewable energy in hopes that it will help change the way we power coastal and island countries. In my free time, I am outdoor educator and love to rock climb, hike, and free dive.

## New in ORE

### Matthew Spencer, ORE Student Assistant



Hi, my name is Matthew Spencer. I am a second year student studying accounting and management information systems in the Shidler college of business. My hometown is Waikale, Hawaii, but I currently live in the dorms. In my free time I like to go to the beach and work out at the gym with my friends. I am also very active in Delta Sigma Pi, the business fraternity in Shidler.

## Meetings Calendar

- ◆ **International Conference on Coastal and Ocean Engineering:** Shanghai, China from Apr 27-29 2018  
<http://www.iccoe.org/>
- ◆ **175th Meeting of the Acoustical Society of America:** Minneapolis, Minnesota from May 7-11 2018  
<http://acousticalsociety.org/asa-meetings/>
- ◆ **International Conference on Ocean, Offshore and Arctic Engineering:** Madrid, Spain from Jun 17-22 2018  
<https://www.asme.org/events/omae>
- ◆ **International Offshore (Ocean) and Polar Engineering Conference:** Hokkaido, Japan from June 10-15 2018  
<http://www.isope.org/conferences/conferencesINT.htm>
- ◆ **International Conference on Coastal Engineering:** Baltimore, Maryland from Jul 30-Aug 3 2018  
<http://www.icce2018.com/>
- ◆ **32nd Symposium on Naval Hydrodynamics:** Hamburg Germany from Aug 5-10 2018  
<https://www.tuhh.de/SNH2018/>
- ◆ **OCEANS MTS/IEEE:** Charleston, South Carolina from Oct 22-25 2018  
<http://charleston18.oceansconference.org/>
- ◆ **Offshore Wind Technical Conference:** San Francisco, California from Nov 4-7 2018  
<http://www.asme.org/events/iowtc>
- ◆ **Acoustics Week in Canada 2018** will be held in Vancouver, British Columbia from Nov 5-9 2018  
<https://awc.caa-aca.ca/index.php/AWC/awc18>



OREers enjoy refreshments on the ORE lanai at the start of the Fall 2017 semester.

## Final Page

The ORE Department relies on involvement and support from our alumni and friends—we wouldn't be where we are without you! Please consider donating to ORE enrichment fund to help us as we move forward in the next 50 years. To donate online, visit the ORE Enrichment Fund website:

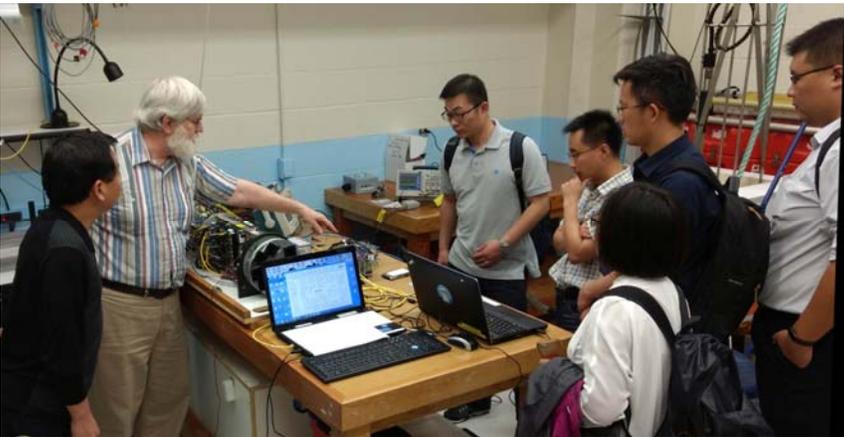
<https://giving.uhfoundation.org/funds/12373104>

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

Jana Light  
School of Ocean and Earth Science and Technology  
1680 East West Road, POST 841  
Honolulu, HI 96815

If you have any questions about your donation, or about how ORE is using donor support, please contact Jana Light at 808-956-9172 or [jana.light@uhfoundation.org](mailto:jana.light@uhfoundation.org).

Mahalo for your support!



ORE Engineer Jim Jolly demonstrates Aloha Cabled Observatory hardware during a visit from a delegation of researchers from the Qingdao National Laboratory for Marine Science and Technology.



### Hana O Ke Kai

Newsletter of the  
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OCEANS SINCE 1966!**