

HANA O KE KAI

“Work of the Ocean”

NEWSLETTER OF THE OCEAN AND RESOURCES ENGINEERING DEPARTMENT, Fall 2016, Volume 20, Issue 1

Chair’s Message

Eva-Marie Nosal, Chair



Welcome to the Fall 2016 edition of *Hana O Ke Kai* - my first as ORE Department Chair. ORE is celebrating its 50th anniversary this academic year, and I feel a strong sense of honor and responsibility in leading the department into the next half century. I’d like to extend a warm thank you to outgoing chair Bruce Howe for 6 years of service to ORE as Department Chair. Thanks also to my co-chairs Kwok Fai Cheung and John Wiltshire for maintaining their roles in the department as Graduate Chair and Associate Chair – their continued service adds continuity to ORE’s leadership and helps make my role more manageable and enjoyable.

My top priority over the next several years is to enrich the student experience at ORE. This includes an emphasis on hands-on activities (e.g. participation in cruises and opportunities for lab and field work), increased collaboration with people outside of ORE (e.g. in other departments in SOEST, the College of Engineering, and other UH units), a reinvigoration of relationships with local industry (e.g. site visits, joint projects, and internships), increased participation in engineering projects, contests, and societies, and improvements to student facilities (e.g. new office furniture and supplies). I’d also like to increase the alumni involvement and public profile of the department, which is important to improve our program and help our students best prepare for their future, in getting us more engaged in our community, in raising funds to support students and improve our facilities and program, and in helping us to attract and retain top-notch people (students, postdocs, faculty, technicians, visiting scholars etc.). On a fun note, to help us to get to know each other and keep in touch, I’ll be encouraging and holding more social events (pizza parties, BBQs etc). If you’re on Oahu but not getting my invitations to ORE social events and would like to, please let me know and I’ll add you to my “ORE-social” mailing list.

We’d love to hear from you. If you have any ORE-related feedback, suggestions, or ideas to share, please email me directly at nosal@hawaii.edu, call me at 808-956-7686, or use my department feedback form:

<https://goo.gl/forms/WGD8iay0l9mUqpVq1>. We especially welcome feedback from ORE alumni; now that you have real-world experience, your suggestions for our program are very valuable to us. Also, if you have any news that we can share in our next edition(s) of *Hana O Ke Kai*, we are eager to hear it. Let’s keep in touch!

Editor’s Corner

Ian Hardy, ORE TA



First off I’d like to thank ORE for providing me this opportunity as the department TA. Editing the ORE newsletter this past semester has given me a chance to look back at the history of the department with it being its 50 year anniversary. I am extremely grateful to come to Hawaii to study Ocean Engineering and I hope this newsletter provides you a chance to keep up with current events within the department and to look back on the rich history of ORE. Mahalo and enjoy this version of *Hana O Ke Kai*.

Inside this issue:

Chair’s Message	1
Department News	2
ORE 50 th Anniversary	3
50 Years of Ocean Engineering at the University of Hawaii	4
Ocean Technology: Lessons Learned from Failure	6
Tsunami Safety Products for the Maritime Community in Hawaii	7
SMART Cables for Earthquake and Tsunami Science and Early Warning	8
Recent Publications/ Meetings Calendar	10
New in ORE	11
Final Page	12

Department News

- **ORE** is celebrating our 50th anniversary this academic year.
- **Courtney Rocha** defended her MS Plan B Thesis presentation "Response of the Global Wave Climate to El Nino Southern Oscillation" on July 27, 2016.
- **Andreia Queima** defended her MS Plan B Thesis presentation "Optimization of Multi-Purpose Artificial Surfing Reef Geometry" on June 29, 2016.
- **Florian Hillenhagen** defended his MS Plan B Thesis Presentation "Numerical Modeling of Surfactant-Oil-Mixtures in Sea Water" on December 9, 2016.
- **Daniel Curley** defended his MS Plan B Thesis presentation "Evaluation of Design Methods for Modular Expeditionary Small Boat Pier" on December 8, 2016.
- **Paul Manglona** defended his MS Plan B Thesis presentation "Field Manual for Evaluating Usability of Ports and Harbors for United States Naval Vessels During Humanitarian Missions" on December 8, 2016.
- **Fadli Syamsudin** spent 3 months at ORE this fall as a Fulbright Visiting Scholar from Indonesia. He worked with Bruce Howe on acoustic tomography to monitor the Indonesian through-flow in the Lombok Strait.
- **ORE** assistant researcher Lora VanUffelen moved on to a great job as Assistant Professor in Ocean Engineering at the University of Rhode Island—congratulations Lora!
- **ORE** is now on Facebook. Check us out at: <https://www.facebook.com/HawaiiORE/>
- **ORE** has a new department video. Big mahalos to Marcie Grabowski, SOEST outreach, for coordinating to Brian Taylor, SOEST Dean, for encouraging and supporting production, and to our ORE Ohana for providing material. Check it out at: <https://vimeo.com/199042793> or <https://www.youtube.com/watch?v=cV1tRBRUH0Q&feature=youtu.be>



ORE TA's Conghao and Ian representing the ORE department this past semester at the ASUH Grad Fair. Photo by Dr. Eva-Marie Nosal.



ORE601 students preparing the ADCP for field work. Photo by Prof. Zhenhua Huang.

ORE50

ORE 50th Anniversary

Eva-Marie Nosal & Ian Hardy

The Department of Ocean and Resources Engineering is celebrating our 50 year anniversary this academic year. ORE hosted a celebratory event (ORE50) on 12 Nov 2016 at the Waikiki Aquarium. We had a wonderful turnout of over 175 guests, including alumni, faculty, staff, students, industry sponsors, friends and family, for an evening of food, stories, music, engineering displays, aquarium exhibits and overall camaraderie.

ORE extends big mahalos to ORE50 industry sponsors – EKNA Services, Navatek, and Sea Engineering – for gifts that made the evening possible. We also appreciate Makai Ocean Engineering's gift to support our graduate students in recognition of ORE's 50th anniversary. Many thanks also to SOEST (School of Ocean and Earth Science and Technology) and JIMAR (Joint Institute for Marine and Atmospheric Research) for their support of ORE50, and to Jana Light of the UH Foundation who played a big role in the success of the event. Finally, the evening would not have been possible without the help and energy of Darrick Lu from the Waikiki Aquarium and our many volunteers (including but not limited to Fawn Howe, Natalie Nagai, Telma Sigurdardottir, Sam Mitchell, RJ Uglow, Ian Hardy, Vincent Varamo, Lean Teodoro, Linyan Li, Eric Klingberg, Yaprak Onat, Brendan Rideout, Hideichi Mori). Thank you all!



Figure 1. Hans Krock, Kwok Fai Cheung and Alex Malahoff at the ORE50 event. Photo by Dr. Tom Fedenczuk.

By all reports, ORE50 was a big success that brought together many people in our ORE Ohana to enjoy a special evening in celebration of a significant milestone in ORE's history. Check out photos from the event on the ORE facebook page at:

<https://www.facebook.com/media/set/?set=a.1892195261023486.1073741836.1695030347406646&type=1&l=02d6f05fec>



Figure 2. ORE50 guests enjoy dinner while taking in the stories from the various speakers. Photo by Dr. Tom Fedenczuk.

50 Years of Ocean Engineering at the University of Hawaii

John Wiltshire



The Ocean and Resources Engineering Department (ORE) was one of two early ocean engineering departments in the US. It was founded in 1966 by renowned coastal engineer, Charles Bretschneider (famous for the Bretschneider wave spectrum equation). Originally the Department was part of the College of Engineering. It focused on wave modeling and coastal processes. The department had as one of its initial strengths the J.K.K. Look Laboratory of Ocean Engineering that at ORE's founding had been transferred to the University from the US Army Corps of Engineers. This gave the Department a coveted major facility to model harbors and detailed coastal processes in specific locations. Shortly after its founding, the Department also added a focus on offshore engineering to take advantage of the interest in offshore platforms and large floating structure design being pioneered in the offshore oil industry which was gearing up in the 1970's. The third area of research focus was in innovative ship design, SWATH ships in particular.



Figure 1. Charles Bretschneider

The Department's early growth was aided by the 1973 Arab oil embargo. This energy shock revealed the total dependence of Hawaii on outside fuel and energy sources. It led to a new emphasis on Hawaii based energy sources through the formation of the Natural Energy Lab of Hawaii (NELHA) on the Big Island and major funding for Ocean Thermal Energy Conversion (OTEC) investigations. OTEC became a central focus of the Department in



Figure 2. "Mini-OTEC" 1979. Photo credit unknown.

the late 1970's and 80's. Several parallel organizations were also formed as a result of the energy shock. These included the Hawaii Natural Energy Institute (HNEI) which became part of SOEST and supported many ORE students and the Pacific International Center for High Technology Research (PICTHR) which help bring Pacific countries to Hawaii to engage in joint projects, particularly with respect to OTEC. The development of Ocean Thermal Energy Conversion funded much work and many students over several decades. The focus was on OTEC cycle design itself as well as associated investigations including deep water pipe design, corrosion, deployment and associated aquaculture, sea-water cooling and cold water agriculture. This bumped up the study of the whole area of Ocean Resources which now became the third track of the Department's course offerings (after coastal and offshore).

ORE50

This new emphasis on some of the science related aspects of the study of the ocean led to the incorporation in 1989 of the Department into the new School of Ocean and Earth Science and Technology (SOEST) which had been founded in 1988 as a way to integrate academic departments and ocean research units into one administrative unit. A related goal was to take advantage of some of the new emphasis and funding for ocean related research coming about as part of the 1984 declaration of the US Exclusive Economic Zone as part of Law of the Sea negotiations. SOEST incorporated the 4 academic units of Oceanography, Geology and Meteorology along with ORE to join 8 ocean related research units to form the new school. This gave the Department some added status and visibility in a time of considerable growth in the field of ocean engineering.

In the early 1990's the expansion triggered by the oil embargo and enhanced by the EEZ declaration continued. One of its manifestations was the Marine Minerals Technology Center which had been created by the U. S. Bureau of Mines to look more closely at the huge potential of future metal resources on the deep sea floor. It operated through the Hawaii Natural Energy Institute (a research division of SOEST). There was consideration of merging the Hawaii Natural Energy Institute with ORE in the late 1990's at approximately the same time as consideration was also being given to incorporation the new marine bio-products engineering center (MarBEC) into the department. After several years of consideration both of these options were ultimately rejected and the department moved forward with its three options of coastal, offshore and resources tracks of study.

After two decades of general expansion, the nineties and the end of Cold War funding brought a raft of problems to the Department. The first of these was the loss of the Look Lab which was taken by the State in the early 2000's to make room for a waterfront park. The department was not compensated for the loss of lab space through other university lab facilities and this resulted in negative accreditation findings for several years. In fact, the Look Lab building stood for 15 years unused before only recently being dismantled. The loss of the Look Lab facilities was eventually partially compensated by cooperation with Department of Civil Engineering to use their hydraulics lab, the creation of the Kilo Nalu near-shore ocean observatory and a close association with the Hawaii Undersea Research Lab and its facilities on Makai Pier. The second problem involved the decision in Washington to shut down the US Bureau of Mines and with it the Marine Minerals Technology Center, removing a strong source of research funding and student support. The third challenge of the nineties was a University report recommending the closure or amalgamation of ORE. This was vigorously opposed by faculty, students, the local engineering community and finally the faculty union and members of the State Legislature. University Administration finally relented and the Department continued, ultimately being recognized for its turn around by the Accreditation Board for Engineering and Technology (ABET) and eventually receiving a perfect accreditation score in the last accreditation cycle.



Figure 3. Gary Niemeyer in 1978 (Photo courtesy of Edith Katada).

The 2000's brought some new support with the addition of faculty recruited for two ocean observing positions and the formal incorporation of faculty from the Hawaii Undersea Research Lab into the Department. This brought the faculty count from 4 to 8 and greatly strengthened the acoustics and instrumentation research in the department to the point where acoustics and instrumentation are becoming an additional track of departmental study.

The saddest event in the Department's History was the sinking of the December 1978 charter vessel Holoholo by newly appointed 31 year old assistant professor, Gary Niemeyer. The vessel was lost in a storm off the Big Island with all 10 aboard including Niemeyer, cutting tragically short his very promising career.

ORE50

This first 50 year period of the Department covers what may turn out to be the Golden Age of Ocean Engineering. During this period, the offshore oil industry came into full strength to become the largest industry in the ocean, supplying a third of the world's gas and oil. It employs many of the Department's graduates on some of the largest engineering projects in the world. The oil crisis brought the rebirth of OTEC and the associated aquaculture and deep water pipe projects. The declaration of the EEZ brought new ocean awareness, interest and funding. New computer modeling techniques allowed the development of SWATH ships, wave models, tsunami run-up predictions and even floating cities.

What will the next fifty years bring? Climate change has come to be realized for the threat that it is and will be. This necessitates strengthened coastal structures and better wave and climate models. The role of storm surge and tsunamis on more threatened coastlines will receive emphasis. Ocean observation, wave and temperature modeling and all of their associated technologies including deep-water observatories, autonomous underwater vehicles, robotic surface vessels, buoys and gliders will all be seen as ways to get a handle on ocean change, climate and weather prediction including the likelihood of worsened and more frequent hurricane events. In an effort to mitigate climate change and reduce carbon dioxide, power generating ocean technologies including OTEC, offshore wind, wave and current power will all get a new look. For the aspiring ocean engineer, the future has much to offer and many problems to be solved.

Ocean Technology: Lessons Learned from Failure

Bruce M. Howe



Science observation of the ocean is difficult. The cost to repair/replace a failed device can run many orders of magnitude higher than the base component cost. Representatives from ocean observatories around the world attended this workshop to share their experiences and exchange ideas for improvement. Attendees were asked to describe specific examples of trouble and approaches for mitigation.

Instruments supplied by commercial oceanographic equipment vendors fail at unacceptably high rates. Most observatories have developed testing and burn-in procedures to weed out problem instruments early but failure of a tested instrument after deployment is still common.

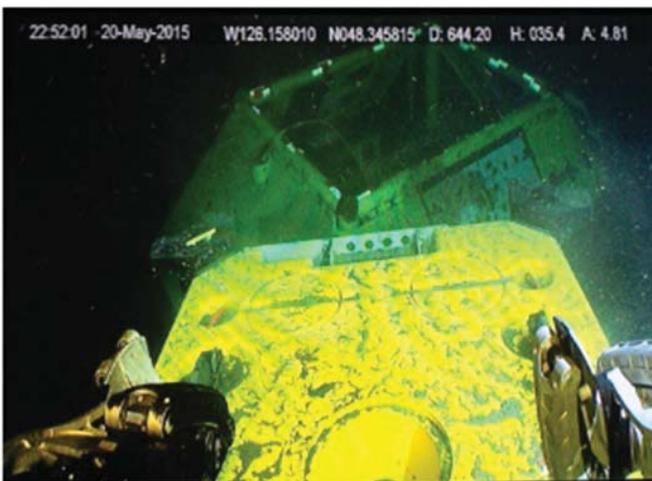


Figure 1. "Trawl Resistant" Frame (background) with its node (foreground) yanked out by a passing trawler. Image courtesy of Ocean Networks Canada and Pelagic Research Services.

Human interference, both purposeful and accidental, is an ongoing problem. Observatories using surface buoys regularly find their equipment vandalized, stolen, or damaged by human activity. Subsea equipment is subject to damage by fishing operations (see figure)

After attendee presentations, working groups were formed to tackle issues in three categories: Cables and Connectors, Systems, and Testing and Operations. The groups brainstormed how to gain improvements in these arenas. The presentations and full workshop report will be available soon on http://www.soest.hawaii.edu/Workshop_OceanTech_Lessons_Learned/.

This material is from the draft reports, with help from Eric McRae, Applied Physics Laboratory, University of Washington.

Inside ORE

Tsunami Safety Products for the Maritime Community in Hawaii

Kwok Fai Cheung



The National Tsunami Hazard Mitigation Program (NTHMP) is supporting state and territory efforts in mapping of tsunami hazards for emergency planning and management. After completing the two-tier inundation maps based on historical and extreme tsunami events, we are embarking on a new project to map hazardous surges and currents for harbors and marinas in Hawaii.

Numerical models have been extensively validated for inundation modeling and mapping, but their capability in predicting coastal currents is not well understood. NTHMP organized a benchmarking workshop in 2015 to ensure its funded models meet the standard for use in maritime hazard mapping. The workshop examined eight nonlinear shallow-water models, three Boussinesq-type models, four three-dimensional models, and NEOWAVE, which is a depth-integrated non-hydrostatic model developed by Yoshiki Yamazaki as part of his PhD dissertation in our department. NEOWAVE ranks first among the 12 depth-integrated models and outperforms three of the three-dimensional models in reproducing laboratory measurements of separated flows behind a submerged cone (see Figure 1).

The maritime hazard mapping project is performed under the auspices of Hawaii Emergency Management Agency with involvement of multiple community stakeholders and government agencies. A United States Coast Guard (USCG) advisory group, including representatives from the Pacific Tsunami Warning Center, Hawaii Department of Transportation, Hawaii Pilots Association, shipping companies, and port operators, has provided input to the products development. The Hawaii Earthquake and Tsunami Advisory Committee has reviewed the technical approach and provided recommendations to the state regarding the data products. Through the national program, we solicit feedback from the United States Geological Survey on tsunami source characterization and collaborate with maritime hazard mapping projects in California and Oregon to ensure consistence of standards and products among the states.

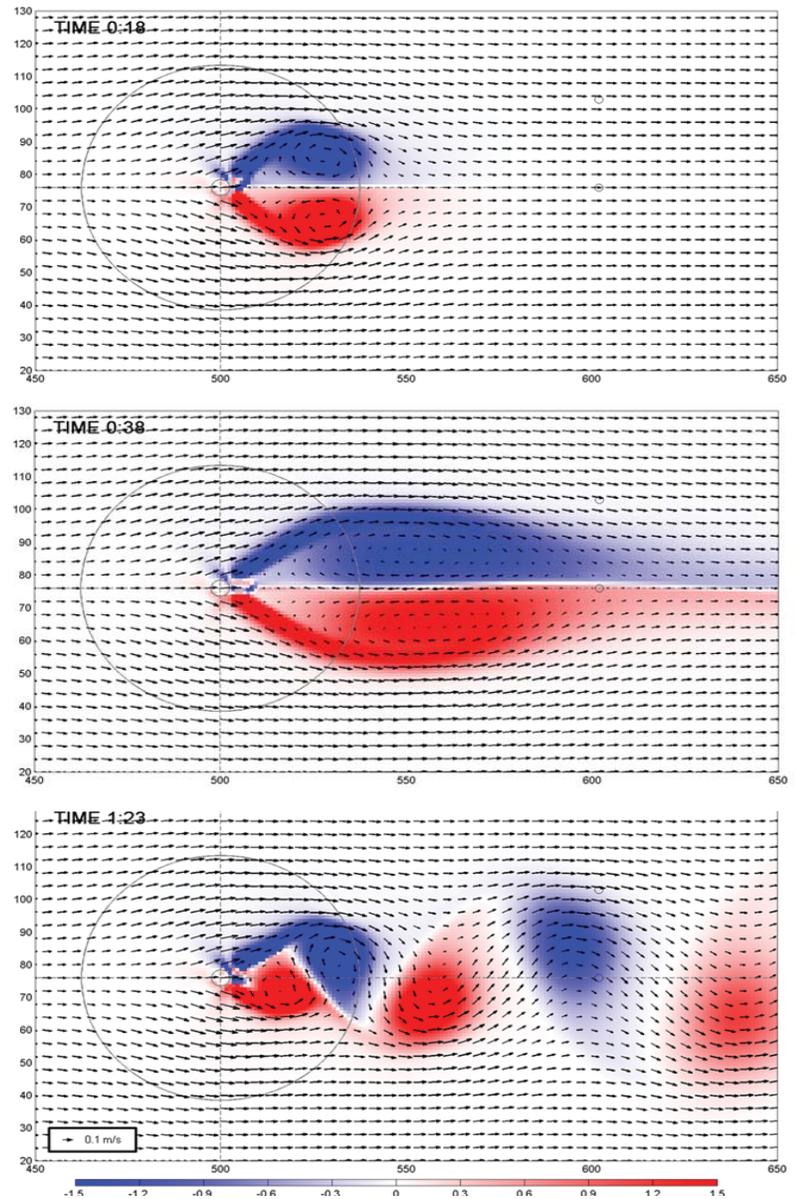


Figure 1. NEOWAVE results for NTHMP Benchmark No. 1 showing development of a vortex street behind a submerged cone in otherwise uniform flow. The circles indicate the bottom and top of the cone as well as locations of flow velocity measurements.

Inside ORE

The Hawaii mapping effort caters to the specific needs of the local maritime community. The state harbor operations procedures call for evacuation of ships and shore personnel in the event of a tsunami warning. The offshore safe zone, which is presently defined outside the 100-m depth contour for all warning-level tsunamis, is reexamined with the extreme tsunami scenarios used in the inundation mapping for the state. Of primary concern to the maritime community is occurrence of advisory-level tsunamis, which have predicted near-shore amplitude of less than 1 m and do not require evacuation. Localized surges might pose navigational hazards and damage ships and mooring systems (see Figure 2). We are producing a GIS/KMZ map database of surge, drawdown, and current for possible tsunamis from around the Pacific Rim that can enable event-driven assessment of potential hazards in harbors and channels by the USCG Captain of the Port.

We have completed the data products for Honolulu Harbor and will begin work on other locations in the state as well as Apra Harbor, Guam and Pago Pago Harbor, American Samoa.

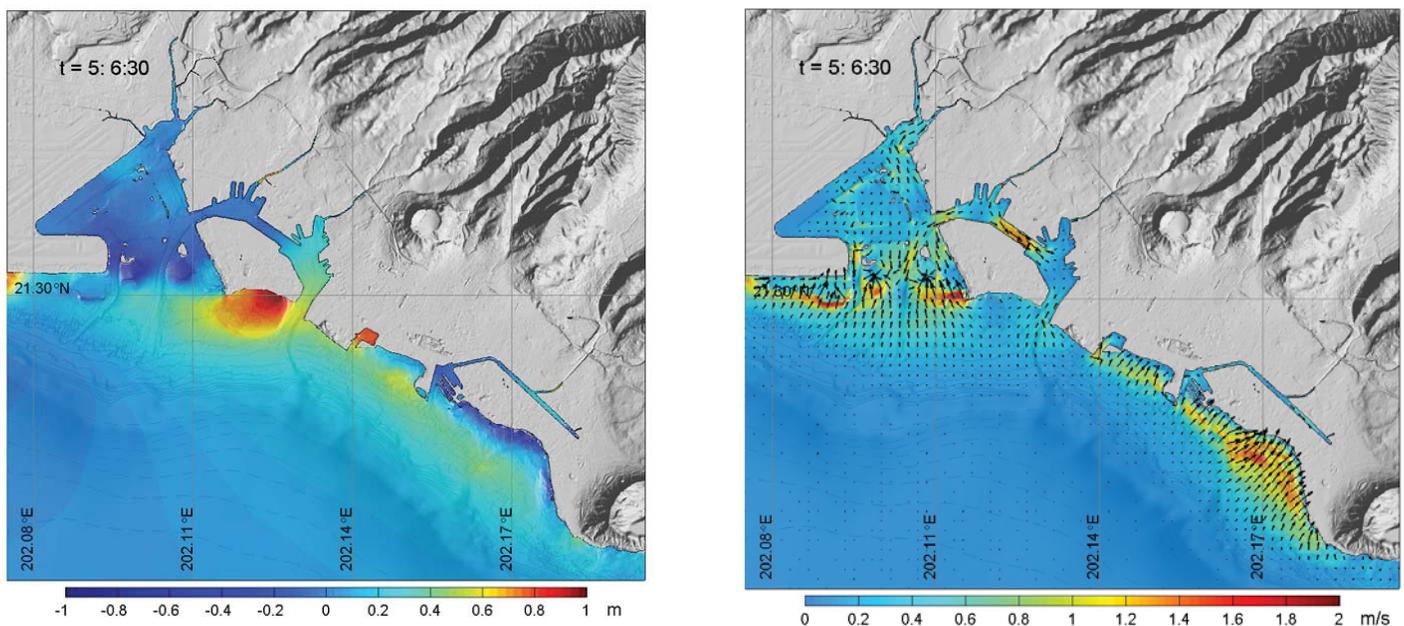


Figure 2. Surface elevation and flow field in Honolulu Harbor from a tsunami generated by an Mw 8.4 earthquake in the Aleutian-Alaska subduction zone.

SMART Cables for Earthquake and Tsunami Science and Early Warning

Bruce M. Howe 

In the Fall 2015 newsletter I introduced the concept of SMART – Science Monitoring And Reliable Communications – cable systems. Environmental sensors would piggyback on the extensive infrastructure of commercial, trans-oceanic submarine telecommunications cable systems, providing near global coverage for disaster mitigation (earthquake and tsunamis), as well as climate and ocean circulation monitoring (Figure 1; <http://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx>).

A workshop on the first topic was held 3-5 November 2016, at the German Research Centre for Geosciences in Potsdam, led by Frederik Tilmann. See <http://www.itu.int/en/ITU-T/Workshops-and-Seminars/201611/Pages/default.aspx>. Very briefly, I give a few highlights of the workshop.

Inside ORE

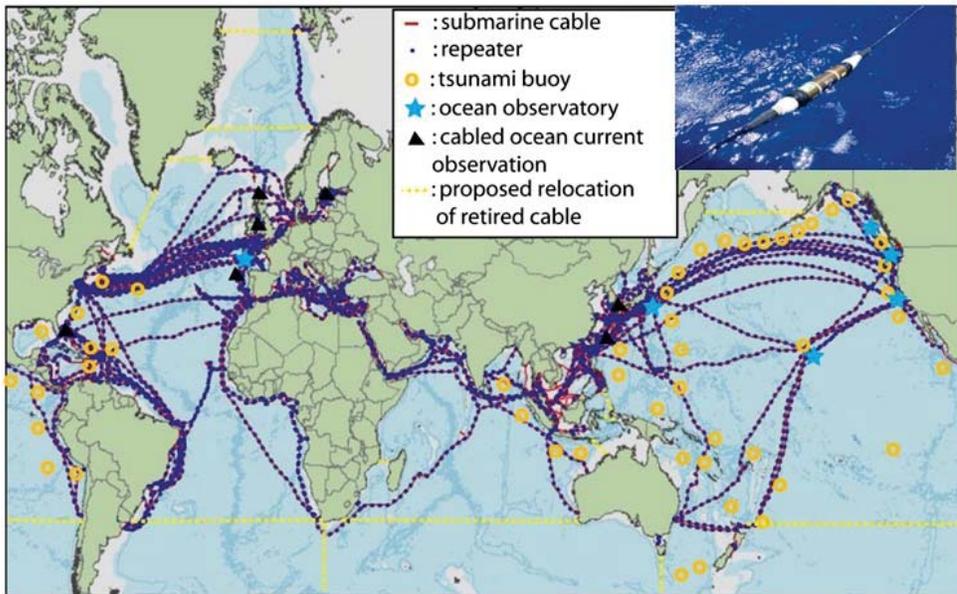


Figure 1. Telecom companies continually add new submarine cable system installations to satisfy Internet demand. A new global-spanning component of the ocean observing system can be established over the next decades in these systems by adding environmental sensors to repeaters (blue dots, every fourth repeater shown). This new component would focus on the societal issues of climate and sea level change and earthquake and tsunami risk mitigation. Credit: ITU/WMO/UNESCO IOC Joint Task Force. Cable distribution data from Global Marine Systems, Ltd.

Stuart Weinstein and collaborators at the Pacific Tsunami Warning Center performed (crude initial) simulations of the improvements in tsunami warning time and concluded that "... a few SMART Cables can speed determination of epicenters by 20% ... and characterization of ocean-crossing tsunamis by ~25%," and this with only sensors every 500 km rather than the expected 50 km.

Charlotte Rowe from Los Alamos National Laboratory showed significantly improved earth interior coverage with SMART cables (Figure 2); this would result in improved source characterization and localization, in addition to improving whole earth tomographic images.

Lastly, Figure 3 shows our current thinking on the technical implementation. We are in the process of identifying funding for a "wet demonstration" project with just a few units, and a request for information/proposals is underway.

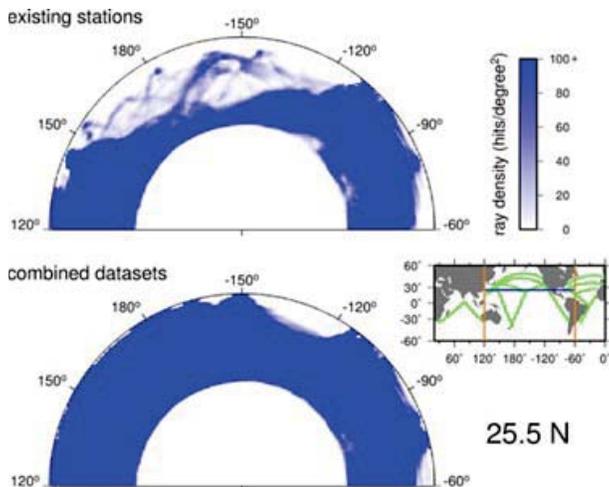


Figure 2. Ray path coverage in a section through the earth with (below) without (above) SMART cables.

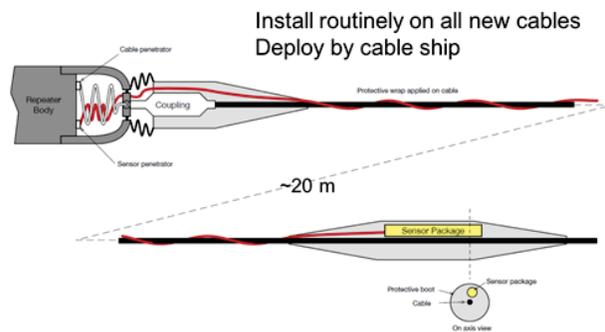


Figure 3. Sensors would reside in a separate pod about 20 m from the repeater housing; no change in the cable ship operations would be required.

Recent Publications

- ◆ **Bai, Y. and Cheung, K.F.** (2016). "Hydrostatic Versus Non-Hydrostatic Modeling of Tsunamis with Implications for Insular Shelf and Reef Environments." *Coastal Engineering*, 117, 23-43.
- ◆ **Bai, Y. and Cheung, K.F.** (2016). "Linear and Nonlinear Properties of Reduced Two-Layer Models for Non-Hydrostatic Free Surface Flow." *Ocean Modeling*, 107, 64-81.
- ◆ **Gemba K., Nosal E-M., Reed T.,** (2017). "Estimating and Removing Colorations from the Deconvolved Impulse of an Underwater Acoustic Channel." *JASA* 141 (1), EL 6-10
- ◆ He, F. Li, M.J., and **Huang, Z.H.** (2016). "An Experimental Study of Pile-Supported OWC-Type Breakwaters: Energy Extraction and Vortex-Induced Energy Loss." *Energies* 9(7), 540. DOI: 10.3390/en9070540
- ◆ Huang, G.X., **Huang, Z.H.**, and Law, A.W.K. (2016). "Analytical Study on Drift of Small Floating Objects Under Regular Waves." *Journal of Engineering Mechanics*. Volume: 142 Issue: 6 Article Number: 06016002
- ◆ Lay, T., **Li, L.**, and **Cheung, K.F.** (2016). "Modeling Tsunami Observations to Evaluate a Proposed Late Tsunami Earthquake Stage for the 16 September 2015 Illapel, Chile, Mw 8.3 Earthquake." *Geophysical Research Letters*, 43(15), 7902-7912.
- ◆ **Li, L., Cheung, K.F.,** Yue, H., Lay, T., and **Bai, Y.** (2016). "Effects of Dispersion in Tsunami Green's Functions and Implication for Joint Inversion with Seismic and Geodetic Data: A Case Study of the 2010 Mentawai Mw 7.8 Earthquake." *Geophysical Research Letters*, 43, 11182-11191.
- ◆ Liu, C.R., **Huang, Z.H.**, and Chen, W.P., (2016). "A Numerical Study of a Submerged Heaving Plate as a Breakwater." *Journal of Coastal Research*. Accepted. DOI: 10.2112/JCOASTRES-D-16-00152.1
- ◆ Oswald, J.N., H. Ou, W. W. L. Au, **B. M. Howe, F. Duennebier,** (2016). "Listening for Whales at the Station ALOHA Cabled Observatory." *Listening in the Ocean* M. Lammers and W. Au. Springer Science+Business Media. New York, DOI: 10.1007/978-1-4939-3176-7_9.
- ◆ Ye, L., Kanamori, H., Avouac, J.P., **Li, L., Cheung, K.F.,** and Lay, T. (2016). "The 16 April 2016, Mw 7.8 (Ms 7.5) Ecuador Earthquake: A Quasi-Repeat of the 1942 Ms 7.5 Earthquake and Partial Rupture of the 1906 Ms 8.6 Colombia-Ecuador Earthquake." *Earth and Planetary Science Letters*, 454, 248-258.

Meetings Calendar

- ◆ **The Acoustical Society of America Spring Meeting** will be held in Boston, Massachusetts from June 25-29, 2017.
<http://www.acousticalsociety.org/content/acoustics-17-boston/>
- ◆ **36th International Conference on Ocean, Offshore and Arctic Engineering** in Trondheim, Norway from June 25-30, 2017.
<http://asme.org/events/omae/>
- ◆ **OCEANS'17 MTS/IEEE Conference** in Anchorage, Alaska, from September 18-21, 2017.
<http://www.oceans17mtsieeeanchorage.org/>
- ◆ **International Offshore (Ocean) and Polar Engineering Conference** will be held in San Francisco, California from June 25-30, 2017.
<http://www.isopec.org>
- ◆ **Underwater Acoustics Conference and Exhibition** will be held in Koukounaries, Skiathos Island, Greece from September 3-8, 2017.
<http://www.uaconferences.org/index.php/conference/>
- ◆ **4th International Conference on Coastal and Ocean Engineering** will be held in Osaka, Japan from March 28-30, 2017.
<http://www.iccoe.org/>

New in ORE

R.J. Uglow, MS Student



Hi, my name is RJ Uglow, I am currently in the U.S. Navy's Ocean Facilities Program involved in maintenance and development of the Navy's underwater and coastal infrastructure. Prior to starting my studies at ORE, I was born and raised in Minneapolis, MN and graduated with my bachelors in Industrial Engineering from the University of Wisconsin. In my free time, I enjoy surfing, running, and cooking.

Ian Hardy, MS Student



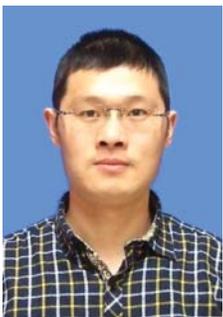
Hi everyone, my name is Ian Hardy and I am a new student as well as department TA for ORE. My hometown is Victoria, BC Canada which is located on Vancouver Island. I completed my undergraduate in Civil Engineering from the University of British Columbia. I enjoy surfing, hiking, and exploring Oahu in my free time.

Jinjin Zhai, Visiting Scholar



My name is Jinjin Zhai (Zhai is my family name), and I am a visiting scholar for one year study at UH as a joint PhD student with Professor Cheung is my advisor.

Xiaofeng Zhao, Visiting Scholar



Xiaofeng Zhao is a visiting scholar from the School of Atmospheric Science at Nanjing University working with Bruce Howe. Research interests include EM and acoustic propagation modeling, optimization, and inverse problems.

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.

Mahalo for your support!



Daniel Curley catches a fun wave during the ORE Fall BBQ at ORE's Makaha outpost. Photo by Eva-Marie Nosal



Hana O Ke Kai

Newsletter of the
 Department of Ocean and Resources Engineering
 School of Ocean and Earth Science and Technology
 University of Hawaii at Manoa

2540 Dole Street, Holmes Hall 402
 Honolulu, HI 96855-2303
 USA

TEL: +1(808)956-7572
 FAX: +1(808)956-3498
 Email: adminore@hawaii.edu
 URL: <http://www.ore.hawaii.edu>

To obtain copies of previous issues of HANA O KE KAI please visit the above URL and then click the 'News' link. To subscribe and/or send your material for the newsletter publication, please email nosal@hawaii.edu.

**ENGINEERING THE
 OCEANS SINCE 1966!**