School of Ocean and Earth Science and Technology

The Department of Ocean and Resources Engineering

2013-2018 Academic Review

University of Hawai‘i at Mānoa

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Cover: The 2018 Maile Mentoring cohort used traditional motifs in making ceremonial kīhei.

5.0 The Department of Ocean and Resources Engineering

5.1 Overview and Mission

1. What is the mission of the department? How do the mission and objectives align with the School/College, UH Mānoa and UH System strategic plans?

The mission of the Department of Ocean and Resources Engineering (ORE) is to provide high quality education, research and service to its constituents. Major Goals of the Department are to:

- Educate top quality ocean and resources engineers to meet the needs of Hawaii, the nation and the engineering profession
- Conduct and disseminate research in the field of Ocean and Resources Engineering
- Provide service to the State of Hawaii, Pacific Basin and engineering profession through seminars, conferences, consultancy, government advisory committees and professional societies

2. What is the vision for the next five years? Discuss how planned or pending academic program actions fit within the vision. How are academic program decisions made? Is communication regarding campus and college priorities adequate?

Ocean and resources engineering is an interdisciplinary field that brings classical engineering fields to the ocean. Personnel from across the UH campus and the Hawaiian Islands develop and use ocean resources: The scope of activity in Hawaii in ocean and

resources engineering extends well beyond our department. Our vision is to provide a vibrant, inclusive, central “hub” – an ORE Ohana – for education, research, engagement and service to the broad UH and Hawaii engineering communities.

Pending academic program actions include:

1) Hire of a new faculty member (arriving January 2018). This will bring our regular (tenured/tenure-track research/instructional) faculty body up to 7 (from 5, occasionally 6 over the past decade). This “critical mass” will allow us (at long last) to move ORE forward out of survival mode.

2) Increase available student support (assistantships and scholarships). This moves in part parallel with increased faculty numbers and in part on renewed emphasis on providing student support through external grants.

3) Expand internship programs with local engineering firms to provide financial support and facilitate on job training for graduate students.

4) Establish and maintain successful 3+2 programs and other programs that attract international students (as of this writing, 2 3+2 programs have recently been established, with the first student cohort expected in Fall 2019).

5) Recruit and retain professional (possibly part-time) MS students

6) Increase cross-fertilization with other units to encourage support and advising of ORE students (e.g. via co-operating faculty membership and activity)

7) Remove barriers to and encourage cross-unit collaboration, teaching and advising (e.g. course cross-listings and program flexibility)

8) Evaluate the potential for establishing an undergraduate program in Ocean Engineering at UHM (in close collaboration with other units in SOEST and CoE)

Our strategic plan prompts many related actions that reach well beyond our academic program, but that will benefit our program and our students via increased visibility and interaction with the extended ORE Ohana. Examples include:

- Expanding ORE’s body of researchers and cultivating opportunities for visiting scholars

- Maintaining and strengthen partnerships with ocean engineering industry in Hawaii
- Hosting seminars, symposia, workshops, colloquia that engage the ORE-Ohana
- Re-connecting with and engaging ORE alumni

Our full strategic plan (2018-2023) is available online.

Program decisions are made by the faculty body in consultation with our students, alumni, external advisory committee, and the SOEST Dean's office. School priorities are communicated to units at the monthly SOEST executive committee (EXCOM) meeting. Campus priorities are communicated via the SOEST Dean's office, also at EXOM meetings.

3. In what ways does the department foster a climate of respect for diversity of backgrounds, ideas, and perspectives among the faculty, staff and students?

ORE is fortunate to enjoy diverse faculty, researcher and student bodies, setting the scene for a vibrant, productive, and inclusive climate. As a highly employable field, ocean engineering attracts highly qualified students and personnel nationally and internationally. Establishing and maintaining a healthy work environment is among our top priorities, and the faculty work hard to maintain inclusiveness and diversity. We maintain open-door policies, strong lines of communication at all levels, regular reporting mechanisms, and anonymous feedback options to ensure that all potential miscommunications or misaligned expectations are efficiently and effectively addressed and resolved.

Despite our small student body (15 or less on average), our students come from around the world. Current/recent students came from Brazil, Canada, China, France, Germany, India, Indonesia, Iran, Japan, Turkey. At any given time, 40 to 60% of our student body is of international origin. Since ORE is highly selective in accepting graduate students, our students are highly motivated. Their common focus on learning, achievement and success brings these students from vastly different backgrounds together to meet common goals.

Although women remain underrepresented in ORE, our numbers ~15-25% are in line with national averages for engineering.

4. What is the national/international reputation and/or ranking of the department? What are your areas of program distinction? Is the department satisfied with the level of the ranking?

Our MS program is fully ABET accredited with no deficiencies or weaknesses, and among only a handful of ABET accredited MS programs. We are especially strong in faculty research. Our faculty are recognized global experts in tsunami modeling, wave forecasting, coastal engineering, underwater acoustics, and ocean observing systems. The unique Hawaii location and environment play a major role in this regard and lead to an additional strength at ORE; students and faculty have acces to, and are engaged in many sea-going activities involving undersea vehicles, marine observatories, and marine testing capability.

5. Please identify peer programs at other U.S. institutions. How does the general quality of your programs compare with those of other institutions? What data support these comparisons?

Per ABET there are eight accredited ocean engineering programs in the U.S.: Florida Atlantic University, Florida Institute of Technology, Massachusetts Institute of Technology, Texas A&M University, United States Naval Academy, University of Rhode Island, Virginia Polytechnic Institute and State University.

Except for our ABET accredited MS program, these are all accredited at the undergraduate level. Several other departments have ocean engineering specialties through their undergraduate programs (e.g. UC Berkeley, Ocean Engineering major in ME).

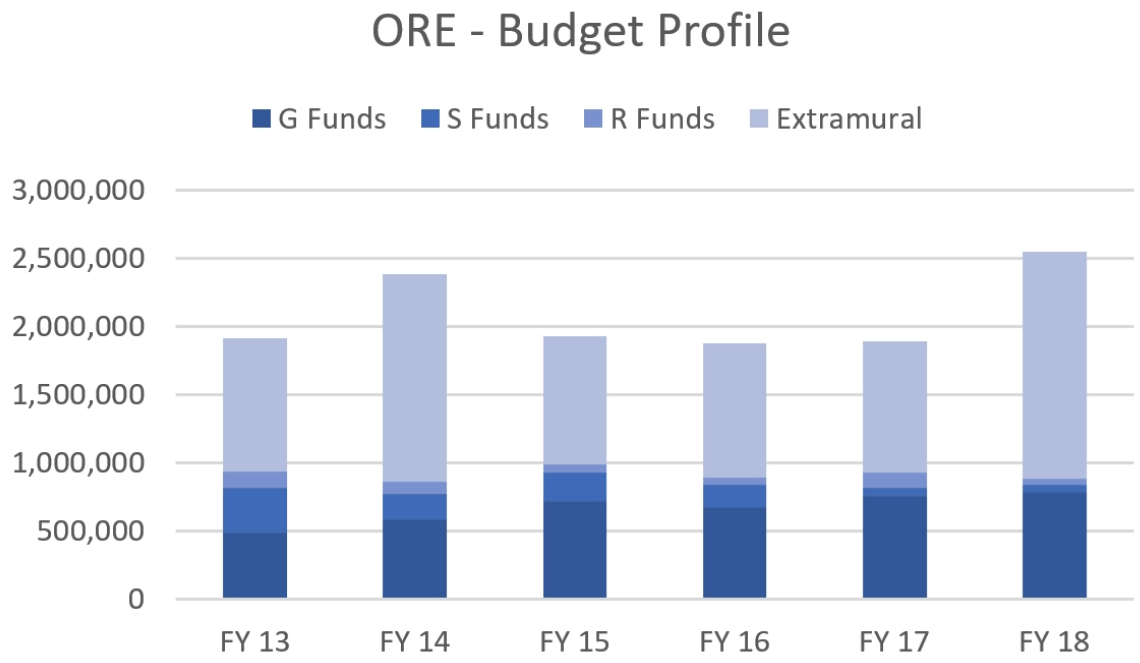
Peer programs at the graduate level include:

- MIT, Mechanical Engineering Department: MS is Ocean Engineering, MS in Naval Architecture and Marine Engineering, MS in Oceanographic Engineering (joint with MIT/WHOI), PhD or ScD
- MIT/WHOI Joint Program in Applied Ocean Science and Engineering
- Florida Atlantic, Mechanical Engineering MS and PhD with Major in Ocean Engineering
- Florida Institute of Technology, MS and PhD in Ocean Engineering
- University of Florida, Civil and Coastal Engineering: MS, MEng and PhD in Coastal and Oceanographic Engineering
- University of Miami, MS in Ocean Engineering
- University of Rhode Island, MS and PhD in Ocean Engineering
- Texas A&M: MS, MEng and PhD in Civil and Ocean Engineering
- Virginia Tech: Naval Engineering, MS and PhD in Aerospace and Ocean Engineering
- Stevens Institute of Technology, MS and PhD in Ocean Engineering
- University of New Hampshire, MS and PhD in Ocean Engineering
- Oregon State, MS, MEng and PhD in Coastal and Ocean Engineering
- University of Michigan, MS, MSE and PhD in Naval Architecture and Marine Engineering
- University of New Orleans, MS and PhD in Naval Architecture and Marine Engineering

5.2 Research & Faculty

1. Outline the department's research productivity relative to faculty size and identified peer programs.

The ORE budget profile is provided in the graph below. Over the period 2013-2018, 6 tenured/tenure-track ORE faculty published 148 papers in peer-reviewed journals (*appendix*) and were cited 3358 times. Faculty H-indexes range from 9 to 31. **Table 1** lists ORE faculty members and endeavors.



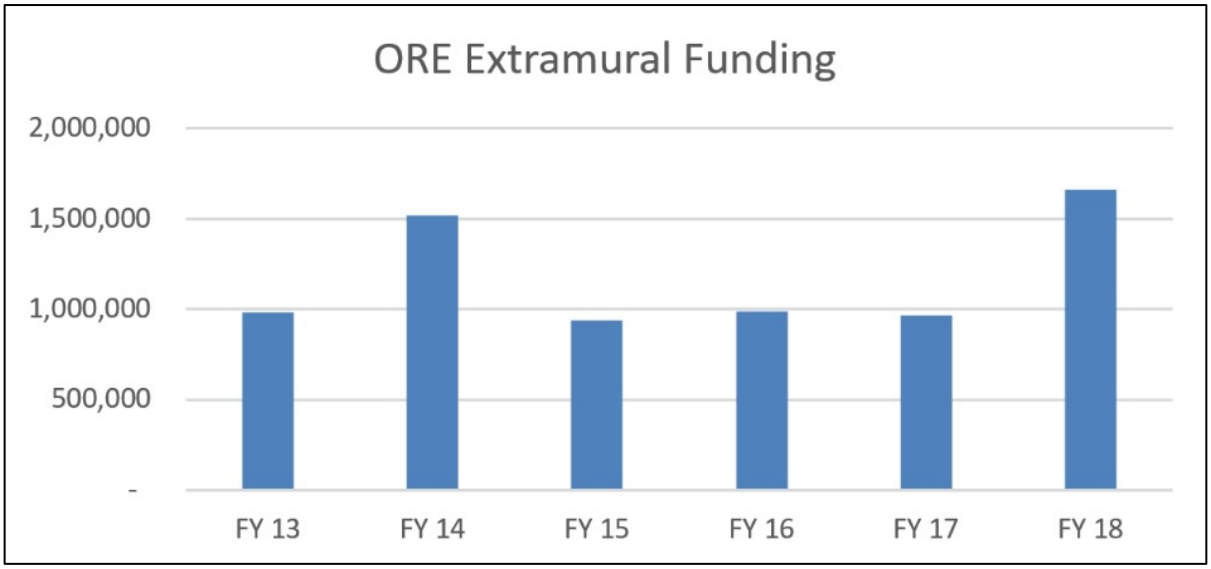
2. Please discuss efforts to generate research support, including grants, fellowships, awards, contracts or commissions. Please explain the increase or decrease in the number of extramural grants over the last five years (per ORS report).

Consistent with SOEST's culture of excellence in innovation and research supported by extramural funds, bringing in extramural funding to support our students, engineering and research is a top priority for ORE faculty. Over the period 2013-2017, our ~5 tenure/tenure-track faculty ORE faculty members attracted over $5.35M in external funding. The rate of funding has been relatively consistent over the last 5 years. External funds by year are presented in the graph "ORE Extramural Funding".

Table 1 ORE faculty

Name	Rank	Tenure	Year PhD	Years at ORE	Research Area	# students supported	# students primary adviser	Courses* Taught
Cheung	I5	Yes	1991	1993 -	Ocean wave modeling, coastal engineering and flood hazards	13	16	608, 661, 783B
Ertekin (ret.)	I5	Yes	1984	1986 - 2015	Hydrodynamics, offshore engineering	5	8	411, 609
Greeson	S	Non-TT	1997	2000 - 2016	Offshore engineering, deep submergence systems	0	1	612
Howe	R5	Yes	1986	2008 -	Ocean acoustics, seafloor cabled observatories	2	2	202, 654
Huang	I4	No	2004	2014 -	Coastal engineering, sediment transport, marine energy	2	5	202, 601, 609, 664
Nihous	I4	Yes	1983	2009 -	Marine renewable energy	2	6	411, 609, 677, 783, 792
Nosal	I4	Yes	2007	2008 -	Ocean acoustics, bioacoustics	4	3	603, 608 766, 792
Stopa	I3	No	2013	2018 -	Ocean wave mechanics and climate, remote sensing	-	-	607
Wiltshire	S	Non-TT	1983	1990-2008	Offshore minerals and energy	3	0	202, 330, 631, 678, 792

* ORE 202 Ocean Technology: Man in the Sea; ORE 330 Mineral & Energy Resources of the Sea; ORE 411 Buoyancy and Stability (core); ORE 601 Ocean Engineering Laboratory (core); ORE 603 Oceanography for Ocean Engineers (core); ORE 607 Water Wave Mechanics (core); ORE 608 Probability and Statistics for Ocean Engineering; ORE 609 Hydrodynamics of Fluid-Body Interaction; ORE 612 Dynamics of Ocean Structures; ORE 641 Environmental Fluid Dynamics; ORE 654 Applications of Ocean Acoustics; ORE 661 Coastal and Harbor Engineering; ORE *664 Near-shore Processes and Sediment Transport; ORE 677 Marine Renewable Energy; ORE 678 Marine Mineral Resources Engineering; ORE 699 Directed Reading or Research; ORE 707 Nonlinear Water Wave Theories; ORE 766 Numerical Methods in Ocean Engineering; ORE 783 Capstone Design Project; ORE 791 Special Topics; ORE 792 Seminar in Ocean and Resources Engineering.*



3. What is the average research workload of the current faculty? What is the average instructional and advising/mentoring workload of the current faculty?

Most ORE faculty spend approximately 40% of their time on teaching duties, 40% on research, and 20% on service. Instructional faculty generally teach 2-3 courses per year; research faculty teach 1-1.5 courses per year. Instructional/research faculty support and advise ~2-5 graduate students per year (including students outside of ORE) and serve on 2-10 graduate student committees a year (including students from department outside of ORE, such as GG, OCN, Marine Biology, CEE, EEE, and Zoology).

4. To what extent are scholarship, research and creative activity linked to the improvement of teaching and learning? Are library resources sufficient to support research and instruction?

Research and teaching are very closely integrated in ORE programs. Examples include: ORE 603 Oceanography for Ocean Engineers which incorporates reading and discussion of cutting-edge research papers; several courses such as ORE 608 Probability and Statistics for Ocean Engineering and ORE 766 Numerical Methods in Ocean Engineering use data collected from various research projects. Data collected during the ORE 601 Ocean Engineering Laboratory class supports student research projects in some cases.

Library resources are sufficient for teaching. Research makes extensive use of online subscriptions and listings, as well as the prompt and efficient inter-library loan system. An

online interface allowing personnel to browse and search subscriptions without the need to log in each time would go a long way to improve efficiency.

5. How effectively can the department balance appropriate expectations for faculty research and scholarship with teaching and mentoring of students?

Most faculty are successful at balancing their teaching and research loads. Student mentorship is intricately tied to ORE research, as graduate students are usually a critical element in the success of various research projects. By embedding students in grant-funded research, they learn first-hand the process of doing research. Many of our students publish their research in peer-review journals – having become experts in their sub-disciplines and moving forward the boundary of knowledge in their areas.

6. To what extent are adjunct and part-time faculty used to provide core courses to support the academic programs? How are these faculty engaged in assessment, and oriented/integrated into academic life of the department?

ORE has a number of (currently 11) cooperating faculty members from other research or academic units at UH (including Oceanography, Earth Sciences, Hawaii Natural Energy Institute, Civil and Environmental Engineering, Mechanical Engineering, and Mathematics). Cooperating faculty members give seminars on their research, serve on student research committees, and advise and support students on their theses or independent research projects.

ORE has several (currently 6) affiliate faculty members from the engineering and scientific communities. Affiliate faculty members volunteer their time and bring individual expertise, external perspectives and real-world engineering experience to the academic program. Some of them serve on student research committees and team-teach the capstone design project with the ORE faculty.

ORE only recently started incorporating adjunct faculty. We currently have one adjunct faculty member who regularly contributes to our program via guest lectures, seminars, and general interaction on ORE (and other UH) projects. Encouraged by the success of this arrangement, we are in the process of establishing another adjunct appointment.

A list of our adjunct, cooperating, affiliate faculty members and can be found on our website.

ORE has recently begun making use of the "Assistant Researcher" category of hires to bring on innovative, dynamic researchers to drive and support new research, and engage with our students and programs and directly with others across campus. We currently have 2 assistant researchers, and given their success, hope to bring on additional researchers.

7. Please discuss faculty recruitment and retention efforts over the last five years. How are recruitment efforts connected to changing needs of the discipline and academic program?

ORE faculty body has been gradually evolving over the past 5 years into a new and younger cohort. One recruitment in 2014 targeted coastal engineering, replacing a faculty member who moved to UC San Diego in 2012. An ORE specialist (non tenure-track) retired in 2016 and was not replaced. A recent hire (Fall 2018) replaces a tenured instructional faculty member who retired in 2015. The focus of the incoming faculty member is on ocean waves, in particular, extreme events which are critical for engineering design and are poorly understood but critical in a changing climate, particularly for our island setting. To regain the offshore engineering expertise we lost in the 2015 retirement, an additional (new) faculty member, currently a professional practicing offshore engineer, will be joining ORE faculty in Fall of 2019. This will bring our regular, tenured/tenure-track faculty number to 7. Our recruitment efforts are tied directly to the needs of the academic program and to the changing needs of the discipline.

8. Please list any faculty awards and recognitions received during the review period.

Kwok Fai Cheung – 2014, Resource Conservation and Climate Change Project-of-the-Year Award, Strategic Environmental Research and Development Program, Department of Defense.

Kwok Fai Cheung – 2014, Dr. Gaylord R. Miller Award for Excellence in Tsunami Preparedness, Hawaii Emergency Management Agency, State of Hawaii.

John C. Wiltshire – 2018, International Marine Minerals Society Lifetime Service Award.

9. Attach a brief curriculum vitae for each faculty member and instructor (lecturer or graduate assistant).

Publications and grants are provided in the appendix.

5.3 Academic Programs

Curricula

1. What actions were taken in response to previous program review recommendations? What has transpired in the unit since submission of your three-year progress report following the previous program review?

Previous program review recommendation: Effort should be made to consolidate ORE students and faculty within the Holmes building and upgrade facilities and office space to provide an appropriate working environment.

This recommendation remains unaddressed. It is beyond ORE's capacity to consolidate or obtain additional space. Since ORE is based in Holmes Hall and since SOEST doesn't control Holmes Hall space (which primarily houses the College of Engineering), space is an ongoing and important limiting factor for ORE. See the section on staff and facilities for additional details.

2. Describe or attach degree and certificate requirements.

MS students choose one of 5 option areas: coastal, offshore, resources, oceanographic engineering, or an interdisciplinary field of study. The ORE program at the MS level has the following requirements:

- Pre-program
- MS General Exam
- Core, option-area, and elective courses and
- MS thesis and defense (Plan A) or independent project and presentation (Plan B)

PhD students are required to achieve a broad understanding of the principal areas of ORE, as well as a thorough understanding of their research area. Students are expected to have knowledge related to fundamental engineering courses as well as to the core courses of the ORE MS degree. Doctoral students are also encouraged to take courses relevant to their research interests. The ORE program at the PhD level has the following requirements:

- PhD qualifying exam
- An advanced mathematics course at the graduate level and ORE 792 Seminar
- PhD comprehensive exam, and
- PhD dissertation and defense

Additional details related to degree requirements are available online in our graduate student handbook.

3. Are current program requirements accurate in program brochures, the Manoa catalog, and student handbook?

Yes, current program requirements are accurate and up-to-date.

4. To what extent are scholarship, research and creative activity linked to the curricula?

Scholarship, research, and creative activity are very closely linked to the curricula. For additional information, see question 4 of the section on research and faculty.

5. How are disciplines changing, and what research/data support these changes?

Advances in technology and demand for improved instrument capability in oceanography and ocean observing are driving advances in oceanographic engineering. There is an increasing demand for skills related to ROV design and operation, underwater robotics, and marine instrument design. In parallel, ocean resources engineering is moving towards sustainable systems and energy, such as wave, wind, and tidal energy. There is also a growing emphasis on ocean engineering solutions for resilience and adaptations to a changing climate. These changes are reflected in funding opportunities related to these areas, and in the interest statements of ORE student applicants.

6. In what ways have courses and programs been modified to reflect new knowledge and/or changes in recognized disciplinary or professional standards?

Course material is updated continuously to incorporate advances, new knowledge, and the latest peer reviewed literautrew. ORE made several changes to our graduate program at the MS level that became effective in the Fall 2017 semester. In addition to our existing 3 tracks of coastal, offshore, and ocean resources engineering, we added the option for students to pursue an oceanographic engineering track or to develop an interdisciplinary field of study. Oceanographic engineering involves the design and maintenance of the mechanical, electrical, and computing systems and instrumentation that support oceanographic and

marine operations. The interdisciplinary option caters to rapidly evolving elements of ocean engineering and attracts students who want to combine ocean engineering with other disciplines in science and engineering.

These program changes also give students in all options more flexibility in their class selection, allowing them to tailor their curriculum more closely to their educational objectives. The changes serve to accommodate the educational objectives of a wider student body, thereby improving student enrollment and retention in the program, as well as improving the preparation that students receive for their future careers. The change is prompted by input from alumni and local and international advisory panels, by changes in the faculty and interests/expertise, and by ever-changing societal needs, funding climates and job markets for ocean engineers.

Assessment

7. What are the student learning outcomes (SLOs) for each certificate, undergraduate and graduate program? To what extent are program student learning outcomes reflected in course syllabi?

Upon graduation, students are expected to have the following program outcomes.

1. A broad education necessary to understand the impact of engineering solutions in a global and societal context;
2. An ability to apply knowledge of mathematics, science, and basic engineering topics that include statics, dynamics, fluid mechanics, solid mechanics, and probability and statistics;
3. Proficiency in the core program that comprises hydrostatics, oceanography, water waves, fluid-structure interaction, underwater acoustics, laboratory and at-sea experience;
4. Working knowledge of at least one of the three option areas that include coastal, offshore, and ocean resources engineering;
5. An ability to use the techniques, skills, and latest engineering tools necessary for ocean and resources engineering practice;
6. An ability to identify, formulate, and solve ocean and resources engineering problems;
7. An ability to design and optimize engineering systems to meet the needs of the marine community;
8. An ability to work independently and function on multi-disciplinary teams;
9. An appreciation of professional and ethical responsibilities;
10. An ability to communicate effectively to technical and non-technical audiences;

11. An awareness of the latest research and contemporary issues in and beyond the marine community, and;
12. Recognition of the need for, and an ability to engage in life-long learning and continuing professional development.

The program depends on the students' prior education and/or pre-program undergraduate courses outside the department to fulfill Program Outcomes 1 and 2. The coursework, capstone design, and independent research experiences provided to students in the ORE program combine to deliver Program Outcomes 2 through 10, while attendance of seminars and participation in student and professional activities addresses Program Outcomes 11 and 12.

SLOs are directly reflected in course syllabi, per ABET requirements.

8. Summarize assessment findings, including student achievement on each undergraduate and graduate program SLO. On which SLO's are students demonstrating high achievement? On which SLO's are students demonstrating need for improvement?

A group of 12 ABET-approved rubrics are used to assess both the effectiveness and achievement of the program outcomes and objectives. These rubrics are:

Direct Measures:

1) The master's qualifying exam
2) Committee verification of undergraduate ABET requirements and assignment of remedial action
3) Capstone Design Class
4) Master's thesis defense and evaluation of thesis for outcome elements
5) Circulation and review of thesis proposals by all the faculty
6) Student employment placing, particularly repeat hires by employer

Indirect Measures:

7) Local and International Advisory Panels
8) Employer Surveys
9) Student Exit Interviews
10) ABET course reviews done at the end of each course by both students and faculty
11) Alumni Surveys
12) Student advising meeting to determine fulfillment of undergrad requirements and progress

Student and instructor assessment of these rubrics is collected and made for every class in every semester. Generalizations are difficult to make, but based on these rubrics, student achievement can be broadly categorized as:

- Very high ratings on research and contemporary issues
- Very high ratings on ocean engineering core and specialization aspects
- High ratings on objectives related to general education and basic math and engineering preparation
- Good but weaker ratings on less technical (but equally important) objectives such as communication, managerial and ethical issues, and team work.

Students also assess the overall program during their exit interviews – compiled results from these exit interviews are given in Table "ORE Exit survey", taken from our ABET Self-study report. Detailed statistics and descriptions are available in our most recent ABET Self-study report:

ORE Exit survey. Exit survey results for student outcomes (4 is high, 0 is low)

Program Outcome	**Importance**	**Preparation**	**Difference**
1. General education	1.5	1.3	-0.2
2. Basic science, math, & engineering	2.8	2.5	-0.3
3. Ocean engineering core	2.8	2.3	-0.5
4. Ocean engineering specialization	2.5	3.0	0.5
5. Use of latest tools	2.5	2.1	-0.4
6. Problem formulation & solution	3.0	2.5	-0.5
7. Design & optimization	2.8	2.3	-0.5
8. Independent & team work	2.8	2.0	-0.8
9. Professional issues	2.5	2.0	-0.5
10. Communication skills	2.5	2.0	-0.5
11. Research & contemporary issues	1.5	1.5	0.0
12. Life-long learning	2.5	1.5	-1.0

9. Explain specific ways in which the department uses assessment findings to guide decision-making, particularly when student achievement falls short of expectations.

Faculty regularly review student progress and program assessments. Changes to program requirements are made on a regular basis to improve achievement. For example, increased emphasis and opportunities for student presentations have been incorporated into the program to address communication shortfalls.

10. Describe where your department is in the process of using undergraduate Institutional Learning Objectives (ILO)—e.g., in preliminary discussions with faculty and staff, in the process of aligning program outcomes to the ILOs, in the process of creating or modifying experiences to increase students' opportunities.

ORE does not have an undergraduate program at this time.

11. What factors prohibit students in your major(s) from graduating in 4 years? What data support these assumptions?

ORE does not have an undergraduate program at this time.

12. How does the department ensure that its programs can be completed within a timely manner? What is the rotation for required courses in your majors?

ORE closely monitors and guides each student's progress. Core courses are offered on a regular schedule that allows students to complete the program in a timely manner. The rotation is such that motivated MS students can graduate in 3 semesters – core courses and offered yearly and in a sequence that can be followed linearly for students entering the program in the Fall semester. Option area course selection has been made more flexible; one benefit is in giving students more programmatic leeway.

13. Assess the overall health of your academic programs.

ORE received the highest available ABET accreditation in 2015. Graduates and employers are pleased with the program. Our students all obtain good jobs in industry, government, and academia. By these measures, ORE health is high. However, our student numbers are low (for various reasons, including small faculty numbers and recent retirements) and opportunities for field and hand-on engineering experiences are limited. Our strategic plan targets improvements in these areas.

5.4 Students

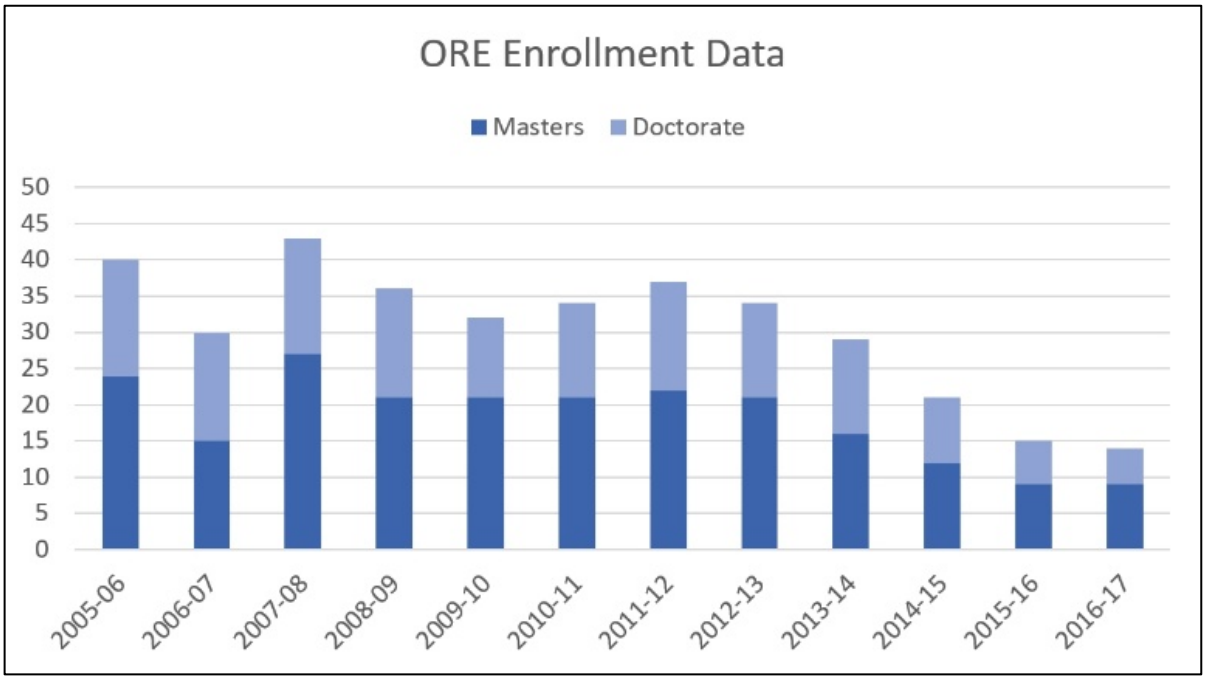
1. What is the department's overall satisfaction with your current students?

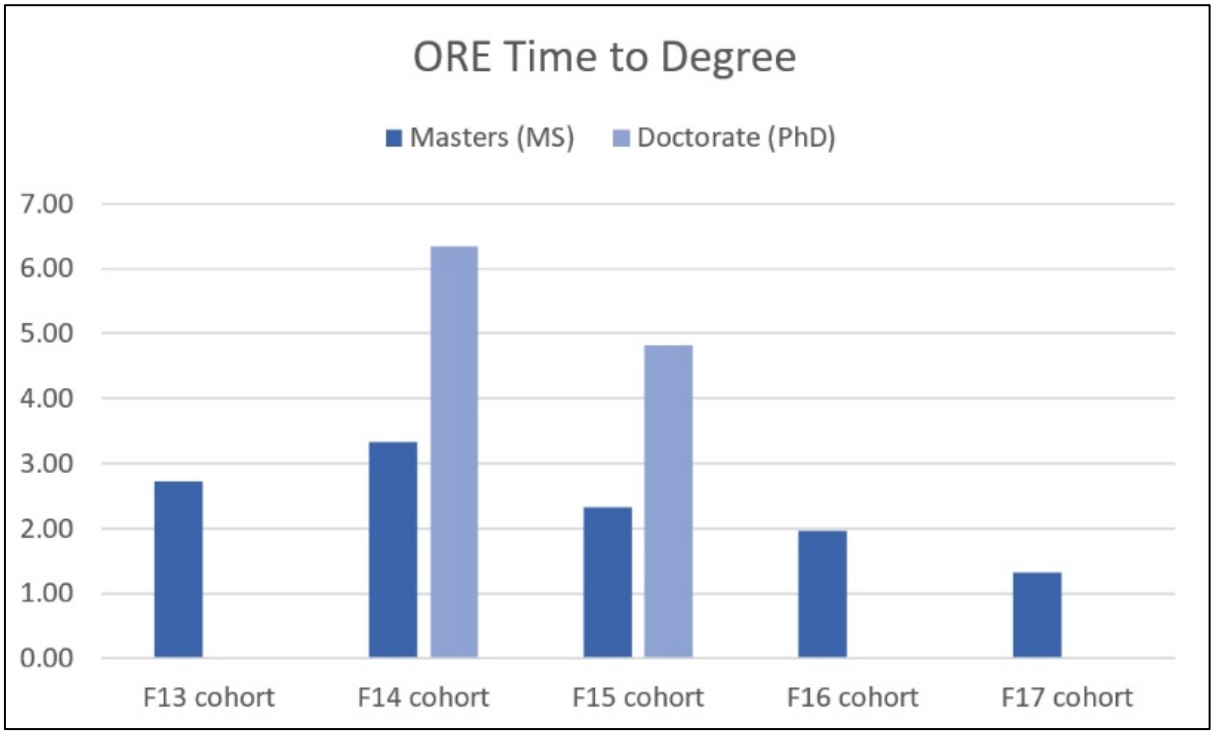
ORE is very pleased with the level and attainment of our students.

2. To what extent is the department satisfied with enrollment trends, retention, time-to-degree and the number of degrees earned?

Enrollment has been decreasing (*graphs*), a trend that needs to be turned back towards growth. Currently, this is the greatest challenge and opportunity for ORE. Part of the reason for low numbers is that ORE has been operating with only 5 tenure-track faculty members

who bring in research grants to support student graduate assistants. We expect available assistantships to increase as our tenured/tenure-track (grant-securing) faculty body is increased to seven in January 2019. In addition, several strategies for increasing enrollment have been implemented, including: 1) increasing program flexibility, 2) increased engagement with the broader UH community, 3) establishing 3+2 programs, and 4) program marketing. Additional details are available in the ORE strategic plan.





It is possible for a motivated a MS student to finish our program in 3 semesters (MS Plan B), although most Plan B students take 4 semesters and most MS Plan A students take 4-5 semesters. Plan A usually takes a little longer since students are expected to do an independent research thesis, and most publish a paper.

PhD students should be able to complete our program in 3-4 years, though most take longer since they take additional courses (personal choice for interest/enrichment), get involved in projects not directly related to their degree (personal choice for interest/enrichment), and can take some time to develop their own research expertise and independence (e.g. most PhD students publish ~3 papers on their dissertation work).

3. Describe briefly how the department markets its programs and recruits students. What percentage of applicants are accepted, and enrolled in your graduate programs? Discuss program retention and graduation rates.

Some students find ORE via the research and reputation of our faculty. ORE recently revamped our website to make it more attractive, informative, accessible and up-to-date; several of our recently enrolled students found us this way. ORE also recently launched and maintains a social media presence to help publicize and popularize our programs. ORE works through professional engineering societies to increase awareness of our programs.

As students normally apply to many schools and search for the best financial package available to them, we normally send initial acceptances to the students who qualify for our program (about half of those who apply) with a view to getting about 60% of accepted applicants into the program. Typically for a Fall semester we might recieve 30 fully completed applications, send out 15 acceptances, and get 4-8 new students. Students may also start in the Spring semester, but the numbers of applicants are much smaller at that time of year.

4. What financial support does the department provide for graduate students?

ORE provides three kinds of financial support for students: teaching assistantships of which the department has two; internships of which the department has up to four or five; and research assistantships that are funded by an individual professor's grants and are variable in number. All of these provide a tuition waiver (a significant UH advantage) as well as a monthly stipend.

5. In what ways does the department cultivate a research-oriented culture of inquiry at the undergraduate and graduate levels?

ORE is a small tightly knit graduate department. About one-third of our students are at the PhD level and two-thirds at the MS level. There are no undergraduate students. Every student works on a research project, thesis or dissertation, setting the tone for a strong research-oriented culture. MS (Plan A)/PhD students are expected to publish one/three (respectively) peer-reviewed journal articles from their thesis/dissertation. Our weekly seminars, generally well-attended and given by various experts in the field, introduce students to a broad range of ORE-related research and projects.

Advising and Mentoring

6. To what extent are instructional faculty engaged in the advising and mentoring of undergraduate students?

ORE does not currently have an undergraduate program.

7. Has the department connected the major to co-curricular programs and services, such as development of field settings, service learning, or other similar opportunities for practical engagement? Which co-curricular activities within the college and across campus enhance learning opportunities and development for your students?

Students are actively engaged in the ocean engineering laboratory, the capstone design classes, hands-on research, internships at local companies, and attending and presenting at conferences. The department encourages students to take advantage of the many opportunities for professional development offered by the university as well as the broader engineering community. The department encourages students to get sea-going experience through SOEST. ORE will pay for first year membership in the Marine Technology Society (MTS) and the Society of Naval Architects and Marine Engineers (SNAME). The department has sponsored students to attend the annual meetings of SNAME, the Oceanic Engineering Society and the Offshore Mechanics and Arctic Engineering conference (OMAE).

8. How effectively have advising and mentoring helped students to take advantage of and benefit from available educational opportunities and resources within the department and across campus?

Opportunities and resources are described and provided during our incoming student orientation sessions. Students are regularly encouraged to take advantage of available educational opportunities and resources through departmental updates and reminders, and through close advising and mentoring. Some students take full advantage of opportunities and resources; others know about them but choose not to engage.

Governance

9. How does the department define the role of students in departmental decision-making, and how is that role exercised?

ORE students are active in the Graduate Student Organization that deals with graduate student issues in general. On a department level there is a student advisory committee that provides formal input to the faculty at a regular interval. The faculty take all student suggestions seriously and discuss them at length during faculty meetings and report the conclusions back to the students. Faculty meetings themselves are closed to students as there are only ~8-9 faculty meetings per year and these often discuss individual students as well as personnel issues.

10. What are the grievance procedures for students, and how are these communicated to them? How does the department ensure that grievances and complaints are addressed promptly, appropriately and equitably?

Grievance procedures are discussed at our graduate student orientation session and are outlined on ORE and SOEST websites. Since the Department is small, student grievance issues are handled by the department chair or graduate chair depending whom the student wishes to engage. If none of these are appropriate, the student may bring the issue directly to the SOEST Associate Dean of Academic Affairs. The chairs may decide to act him/herself or take the issue further to the SOEST Associate Dean. If the issue cannot be resolved at these levels, then it is taken to the appropriate person at the University level. ORE also provides a confidential reporting option and provides updated links on our website for resources. ORE has no unresolved student grievances.

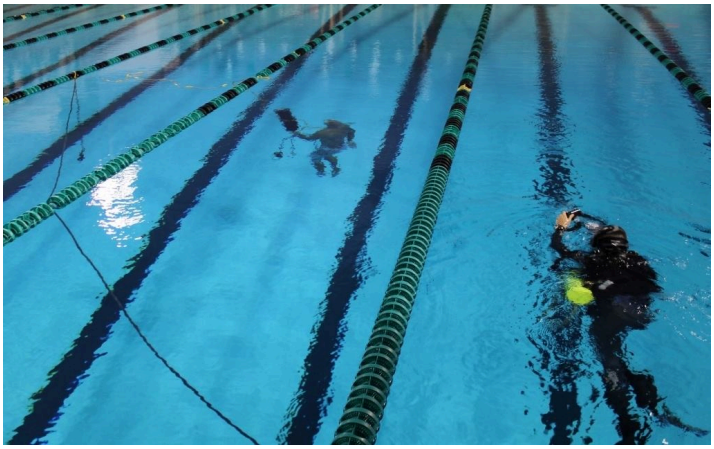
11. Please provide any student recognitions over last five years.

Kay Gemba, 2014 - First place in the in the International Student Challenge Problem in Acoustical Signal Processing sponsored by the Acoustical Society of America.

Troy Heitmann, 2018 - Link Foundation Fellowship in Ocean Engineering and Instrumentation.

5.5 Staff Support and Facilities

1. Assess the continuing adequacy of physical and staff resources. Identify space and equipment managed by the department that support research and instruction.



ORE has one state-funded full-time administrative support staff. Staff are unable to handle the academic and research demands of the department and this is a significant problem. Tasks routinely take an exorbitant amount of time to be completed, require excessive involvement/oversight from ORE faculty, and administrative deadlines are often missed. The problem persists despite help and involvement from the SOEST Dean's office. It is difficult to tease apart the source of these problems – whether they are due to inefficiencies in the office or due to an insufficient number of support staff. To help ameliorate the problem, ORE has hired a part-time student helper paid for by department funds (representing a significant loss of funds available to directly support our programs).

Several ORE grant programs, such as the ALOHA Cabled Observatory (ACO) employ one or more administrative staff to look after their own purchases, travel, personnel issues, etc. This is far from ideal for maximizing research productivity and program quality.

The department has a half-time engineering support staff dedicated almost exclusively to ACO. Technician support staff are individually employed on a project basis, for example glider technicians or deep-sea observatory engineers. This level of *ad hoc* technical support, while cost effective from a UH perspective, is far from ideal from the point of view of supporting a strong and diverse body of skilled researchers who are globally recognized.

ORE laboratory facilities for program support are an ongoing problem. ORE relies on the goodwill of the Civil and Environmental Engineering Department to provide access to their

hydraulics lab for teaching and some research purposes. The Kilo Nalu Observatory – ORE's near-shore cabled observatory – was used in the past as a "natural laboratory" but is currently in-operational due to a lack of funds and support. We are working hard to ameliorate this limitation through partnerships and collaboration with other units at UH.

Space remains a significant limiting factor for ORE. Existing ORE space is unconsolidated, with labs and personnel are dispersed between 4 buildings (Holmes Hall, POST, MSB, and HIG). This is detrimental to the sense of unit cohesion and belonging, and reduces the opportunity for personnel to meet, interact and work with one another. Increased emphasis on seminar attendance and social events, on highlighting the work of individual ORE personnel, and on making introductions in person is helping to improve climate and reduce the impact of the space spread, but it cannot completely overcome the fundamental limitations imposed by unmet space needs.

Adding to the difficulty, ORE controls only one small common area that is heavily used for teaching, small meetings (<10 people), presentations, personal access (sink, kitchen, fridge), and student project meetings. ORE doesn't have any classrooms or open common meeting areas, which are necessary to enhance unit cohesion, to improve morale, and to foster collaborations. Meetings larger than ~10 people are scheduled on a case-by-case basis through the UH campus scheduler office and/or by working with other SOEST units. Since there is little consistency on the availability of rooms, meetings with > 10 people are in different rooms in one of 7-8 buildings across campus, again reducing the sense of cohesion, consistency, and belonging.

Office space to accommodate visiting scholars is arranged on a case-by-case basis by requesting favors from colleagues in other units – this takes time and energy to arrange, and often visitors end up seated far from the others in ORE. This isolation combined with the general lack cohesion of ORE personnel space and the lack of a common meeting area means that much of the interaction, richness, and benefit of and to visitors is lost. In several cases, appropriate visitor space couldn't be found and we relied on the goodwill of ORE researchers to make space to share their offices. ORE is ultimately in need of a new home.

2. In what ways does the department support and continue to develop non-academic staff (APT and civil service personnel) in a manner that encourages their effectiveness and actively furthers the mission of the department?

ORE encourages the development of staff through the participation in seminars and other career-building activities. Most of these resources and opportunities are not pursued by staff.

3. Is the ratio of APT and civil service staff in relation to faculty sufficient for the department to achieve its mission and goals?

ORE lacks sufficient support. See related responses in question 1 above.

4. Please provide a list of staff awards and recognitions in the most recent 5-year period.

None

5.6 Extension and Outreach Activities

1. Please describe any relationships with organizations/individuals in the community. In what ways do these relationships contribute to the curriculum, student experience, development, faculty research, or budgetary resources in the department?

ORE maintains strong ties with several professional societies including the Marine Technology Society, the Society of Naval Architects and Marine Engineers, the Oceanic Engineering Society, the International Marine Minerals Society, and the Acoustical Society of America. The Department hosts the student sections of SNAME and MTS.

ORE actively participates in the SOEST open house with popular wave flume and ocean wave exhibits and glider exhibits.

Through its close association with the local engineering community ORE has established several internships with local companies. The internships allow the students to work 20 hours per week for the local companies often gaining material for their theses as well as

gaining income in the form of a graduate assistantship and having their tuition paid. Many students continue as company employees after graduation.

ORE has several affiliate faculty members from the engineering and scientific communities. Affiliate faculty members volunteer their time and bring individual expertise, external perspectives and real-world engineering experience to the academic program. Some of them serve on student research committees and team-teach the capstone design project with the ORE faculty.

2. Attach copies of newsletters, relevant brochures.

Attached in Appendix. Additional newsletter archives are available online.

5.7 Concluding Statement

1. What is your overall assessment of the department? What are the strengths, weaknesses, opportunities and threats? Are you poised to meet these challenges in the future?

The Department of Ocean and Resources Engineering provides a critical component of engineering education serving the workforce in Hawaii. It fills a clear educational mandate for the State of Hawaii in the area of marine technical training. In 2015, ORE prepared a 215-page self-study and was evaluated along with five other UH engineering departments by the Accreditation Board for Engineering and Technology (ABET). The report is available online.

The department was fully accredited for the maximum possible time of accreditation (6 years) with no identification of deficiencies, weaknesses or concerns. This was seen throought SOEST and across campus as a stellar performance.

The fact that ORE graduates are in high demand and that all ORE students find rewarding and engaging employment (often in Hawaii if they wish) speaks to the high value of the program. ORE meets part of the need and demand, state and nation-wide, for skilled ocean engineers, and is poised to gain strength and momentum to more completely meet the demand for ocean engineers. ORE's faculty are currently a strong and collegial team, all of whom lead highly respected and well-funded research programs in various areas of ocean and resources engineering, and all of whom are dedicated to maintaining and evolving a strong and rigorous academic program that prepares students for successful futures.

Excellent opportunities exist to engage more broadly with and bring together ocean engineering related personnel from outside of our department. Indeed, folks from across the UH campus and the Hawaiian Islands develop and use ocean and resources engineering. The scope of activity in Hawaii in ocean and resources engineering extends well beyond our department unit. Our vision is to provide a vibrant, inclusive, central "hub" – an ORE Ohana – for education, research, engagement and service to the broad UH and Hawaii ocean and resources engineering communities.

We are optimistic that our multi-faceted efforts to increase enrollment will be successful.

For ORE to better serve the University and community, and to reach our full potential and vision as a strong, vibrant ORE Ohana, we rely closely on the ongoing support of SOEST and UH administration. We also rely on forging new roads and connections between other UH units, and the fruition of slow and steady efforts to build trust and relationships with personnel and units from across campus. ORE is an interdisciplinary field by nature – we will thrive and be best poised to contribute in a fluid and connected environment. Making the required changes to realize this environment while maintaining our excellence in research, our identity and the quality of our programs, in addition to navigating the practical challenges that we face (including lack of support and facilities), requires thoughtful and well-planned action by effective ORE, SOEST and UH leadership.

Strengths

- After-graduation placement is excellent
- Students in high demand
- Highest possible level of ABET accreditation
- Fill educational mandate in Hawaii
- Area of immediate and critical relevance to Hawaii
- Strong, collegial faculty body
- International reputation for research excellence

Weaknesses

- Small faculty body (this is improving)
- Insufficient space and infrastructure
- Insufficient laboratory facilities
- Lack of administrative and engineering support
- Low student enrollment and SSH numbers

Opportunities

- Many ORE-related folks outside of our unit – bring them together and get them involved
- Strengthened ties and collaborations with College of Engineering
- Increased engagement with community and industry
- Re-connect with alumni
- Take advantage of any opportunities for new support staff and space

Threats

- Classified by UH Borad of Regents as "small department", hence vulnerable

2. What is your assessment of how the department fits within the School/College? What is your assessment of interdisciplinary collaboration and communication across the departments?

Interdisciplinary collaborations on the individual level have been extremely fruitful (e.g. several joint and funded research projects with OCN, HNEI, HIMB, CEE, and EEE have yielded excellent results). Relationships and contributions by cooperating faculty members, who advise students and serve on committees, are generally healthy and productive. Beyond this, however ORE has historically been relatively isolated. This is changing thanks to a gradual shift in administrative strategies and specific practical steps (e.g. SSH following instructors), and also thanks to targeted and concerted efforts at building and strengthening lines of communication and connection with other units. In addition, by modifying our program requirements to encourage/allow students to take courses from other departments, the student experience and cross-over is improving (although at the expense of a hit by reduced SSHs in ORE courses).

3. Please identify individuals or groups that you recommend the visiting team meet during the campus visit.

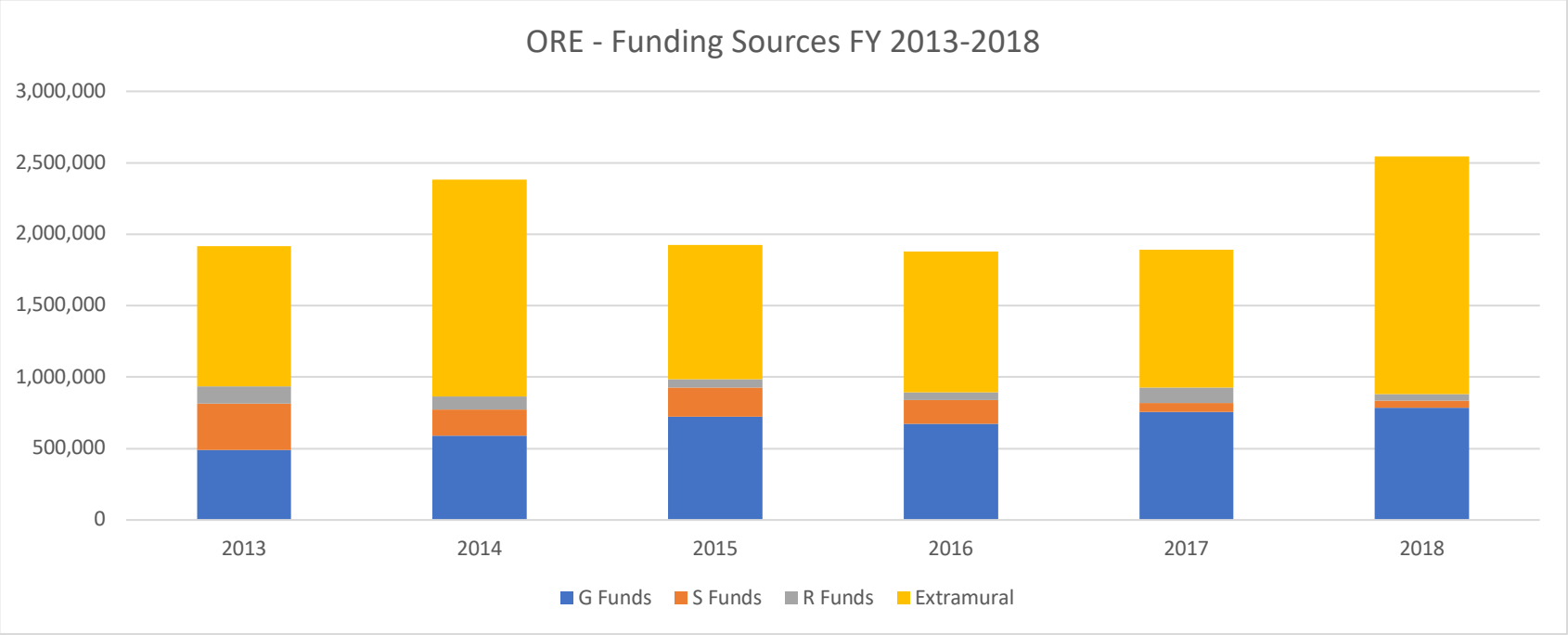
ORE Chair – Eva-Marie Nosal
ORE Graduate Chair – Kwok Fai Cheung
ORE Faculty
ORE Graduate students
ORE Researchers
CoE Dean (and ORE Cooperating faculty member) – Ron Riggs
ORE Cooperating faculty member Oceana Francis (Civil and Environmental Engineering)
ORE Cooperating faculty Reza Ghorbani (Mechanical Engineering)
HNEI Specialist – Pat Cross (works closely with our faculty and students)

4. Please identify facilities that the team should tour during the visit.

ACO/Glider lab
CEE hydraulics lab
ORE student and faculty offices, common areas, and other operating spaces.

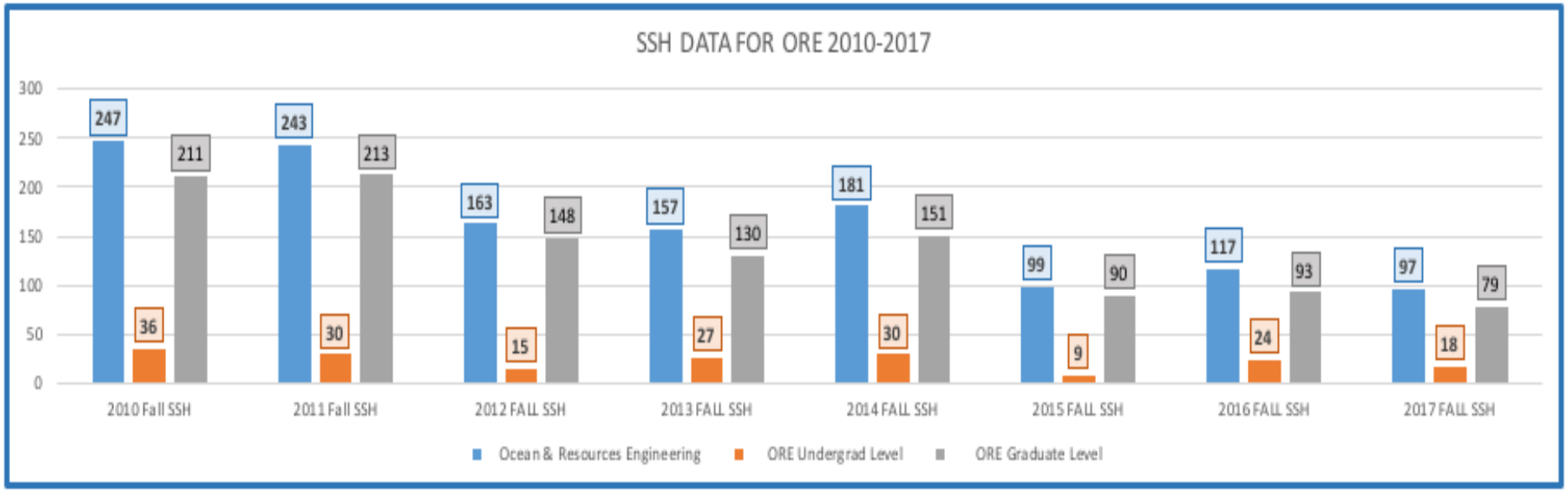
Appendix – Funding Profile, Department of Ocean and Resources Engineering

Year	2013	2014	2015	2016	2017	2018
G Funds	488,370	589,640	724,621	672,929	756,468	786,046
S Funds	327,366	185,254	203,424	165,527	60,489	50,810
R Funds	119,940	91,145	58,097	53,606	111,820	46,137
Extramural	979,976	1,515,971	939,114	985,073	963,254	1,660,013
Total	1,915,652	2,382,010	1,925,256	1,877,135	1,892,031	2,543,006



Appendix – Student Data in Ocean and Resources Engineering, Student Semester Hours

COURSE OFFERING	2010 Fall SSH	2011 Fall SSH	2012 FALL SSH	2013 FALL SSH	2014 FALL SSH	2015 FALL SSH	2016 FALL SSH	2017 FALL SSH
Ocean & Resources Engineering	247	243	163	157	181	99	117	97
ORE Undergrad Level	36	30	15	27	30	9	24	18
ORE Graduate Level	211	213	148	130	151	90	93	79



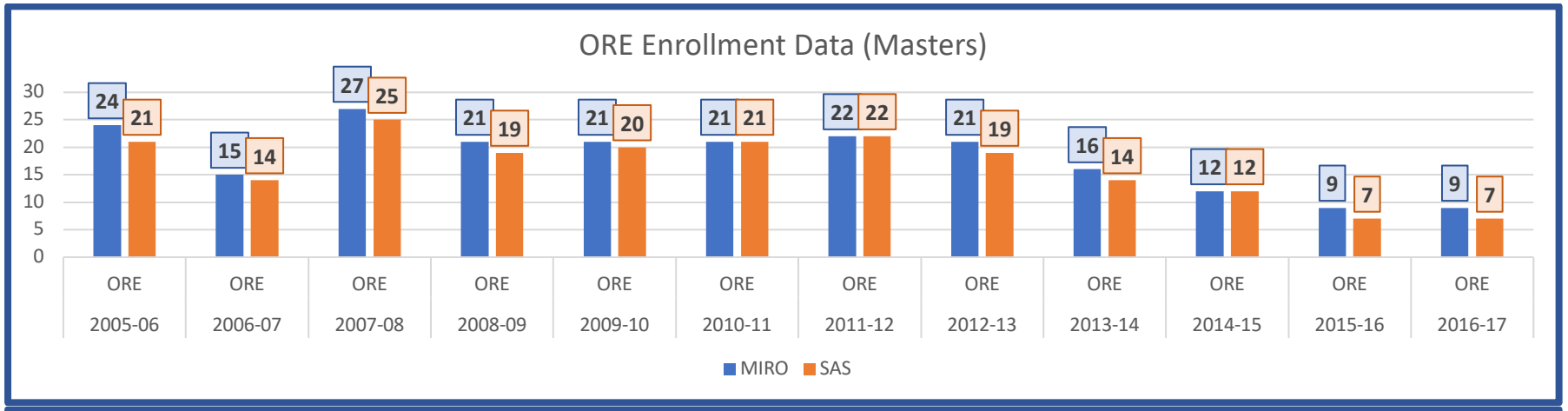
Appendix – Student Data in Ocean and Resources Engineering, Enrollment

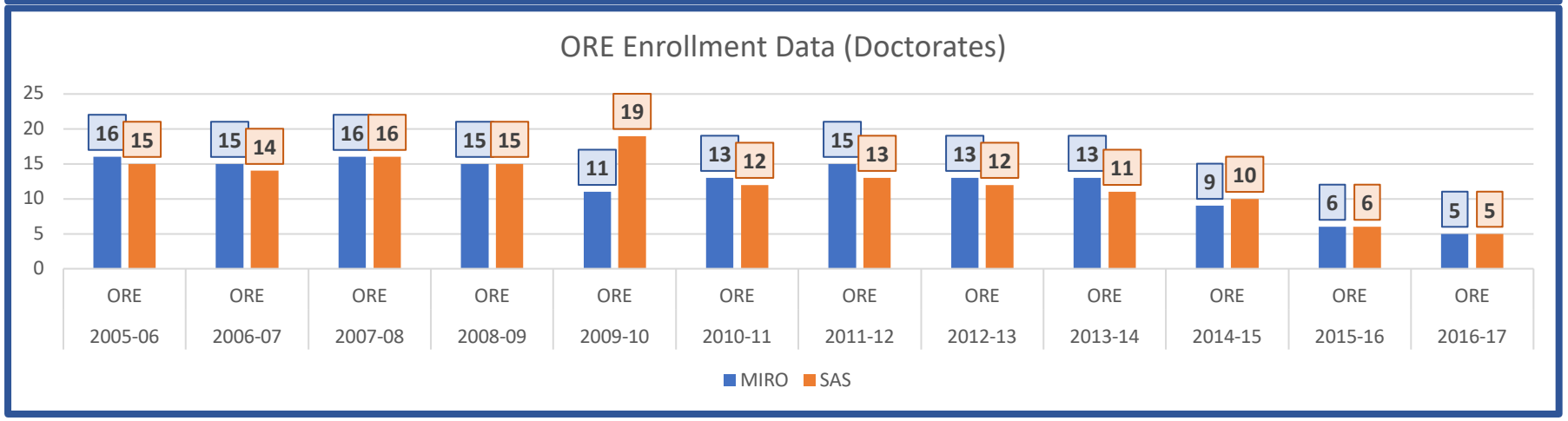
Note - There are 2 sources for student data: SAS = SOEST data; MIRO = UH data

Academic Year	Department	Bachelors	SAS Bachelors	Masters	SAS Masters	Doctorate	SAS Docs
2005-06	ORE	0	0	24	21	16	15
2006-07	ORE	0	0	15	14	15	14
2007-08	ORE	0	0	27	25	16	16
2008-09	ORE	0	0	21	19	15	15
2009-10	ORE	0	0	21	20	11	19
2010-11	ORE	0	0	21	21	13	12
2011-12	ORE	0	0	22	22	15	13
2012-13	ORE	0	0	21	19	13	12
2013-14	ORE	0	0	16	14	13	11
2014-15	ORE	0	0	12	12	9	10
2015-16	ORE	0	0	9	7	6	6
2016-17	ORE	0	0	9	7	5	5

Appendix – Student Data in Ocean and Resources Engineering, Enrollment (cont.)

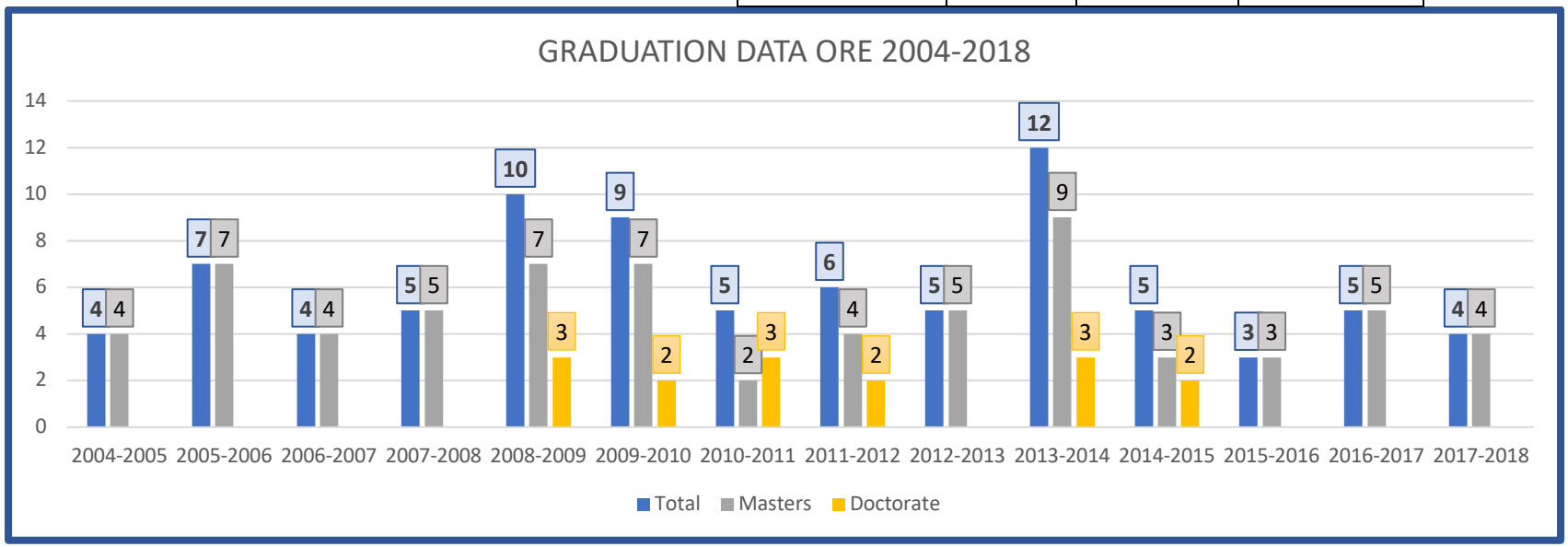
Note - There are 2 sources for student data: SAS = SOEST data; MIRO = UH data





Appendix – Student Data in Ocean and Resources Engineering, Graduation

Fiscal year	Total	Masters	Doctorate
2004-2005	4	4	
2005-2006	7	7	
2006-2007	4	4	
2007-2008	5	5	
2008-2009	10	7	3
2009-2010	9	7	2
2010-2011	5	2	3
2011-2012	6	4	2
2012-2013	5	5	
2013-2014	12	9	3
2014-2015	5	3	2
2015-2016	3	3	
2016-2017	5	5	
2017-2018	4	4	



Appendix – Quantitative Indicators in Ocean and Resources Engineering

		2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
		F13	F14	F15	F16	F17
	HEADCOUNT MAJORS	**25**	**21**	**13**	**12**	**14**
	Masters (MS)	14	12	7	7	10
	Doctorate (PhD)	11	9	6	5	4
		F13	**F14**	**F15**	**F16**	**F17**
	COURSE DATA					
	Graduate Division SSH	**130**	**151**	**90**	**93**	**79**
	Headcount of Students Taking courses	35	50	26	29	28
1/	Percent of Own Majors	88.6%	90.0%	88.5%	93.1%	92.9%
	Percent of Majors Within College	0.0%	2.0%	3.8%	0.0%	0.0%
	Percent of Majors From Other Colleges	11.4%	8.0%	7.7%	6.9%	7.1%
		F13	**F14**	**F15**	**F16**	**F17**
2/	**COURSE FTE ENROLLMENT**					
	Graduate Level	11	13	8	8	7
		F13	**F14**	**F15**	**F16**	**F17**
3/	**NUMBER OF CLASSES**					
	Graduate Level	7	9	7	8	7
		F13	**F14**	**F15**	**F16**	**F17**
4/	**AVERAGE CLASS SIZE**					
	Graduate Level	3	4	3	3	3
5/	**GRADUATE FACULTY HEADCOUNT (2018.8)**					
	Regular Faculty (home-based)	**department decides what to use from the grad faculty data**				
6/	**GRADUATE STUDENT-FACULTY RATIO**	**Department decides what to use from the grad faculty data and grad student enrollment**				
7/	**YEAR-TO-YEAR DEPARTMENT LEVEL PERSISTENCE RATE (%)**	**F12 cohort**	**F13 cohort**	**F14 cohort**	**F15 cohort**	**F16 cohort**
	Masters (MS)	88.9%	92.9%	75.0%	85.7%	100.0%
	All UHM MS for Comparison	91.5%	89.9%	91.3%	93.8%	90.4%
	Doctorate (PhD)	84.6%	100.0%	88.9%	100.0%	100.0%
	All UHM PhD for Comparison	91.8%	91%	90.8%	91.9%	93.3%

		FY14	FY15	FY16	FY17	FY18
8/	**DEGREES AWARDED (FY)**	**12**	**5**	**3**	**5**	**4**
	Masters (MS)	9	3	3	5	4
	Doctorate (PhD)	3	2	0	0	0
9/	**MEDIAN TIME TO DEGREE (FY)**	**F13 cohort**	**F14 cohort**	**F15 cohort**	**F16 cohort**	**F17 cohort**
	Masters (MS)	2.72	3.33	2.33	1.97	1.32
	All UHM Masters for Comparison	1.98	1.98	1.97	1.93	1.97
	Doctorate (PhD)	N/A	6.34	4.83	N/A	N/A
	All UHM PhD for Comparison	5.99	5.73	5.32	5.32	4.73
10/	**AVERAGE CREDITS EARNED AT GRADUATION**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**
	Masters (MS)	51	42	54	35	50
	All UHM MS for Comparison	54	53	55	53	56
	Doctorate (PhD)	130	70	N/A	N/A	N/A
	All UHM PhD for Comparison	88	87	83	85	81
10/	**AVERAGE CUMULATIVE GPA**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**
	Masters (MS)	3.73	3.8	3.52	3.63	3.87
	All UHM MS for Comparison	3.73	3.75	3.77	3.79	3.77
	Doctorate (PhD)	3.79	3.58	N/A	N/A	N/A
	All UHM PhD for Comparison	3.88	3.85	3.86	3.89	3.89

1/	Percent of Students taken courses disaggregated by own majors, non-majors within college and non-majors from other colleges.
2/	FTE course enrollment (SSH divided by 15 for undergraduate-level and by 12 for graduate-level courses). Sourse: IRAO Course Registration Report.
3/	Number of Class data sourse: IRAO Course Registration Report.
4/	Average class size (total student registrations divided by number of classes offered). Sourse: IRAO Course Registration Report.
5/	Graduate faculty headcount are self-reported data from departments to the grad division. This report only inlude regular faculty whose home department is the one being reviewed.
6/	Department decides what to use from the grad faculty data and grad student enrollment
7/	Year-to-Year persistence numbers are generated by the persistence report through MIRO's decision support system. Cohorts are fall semesters' degree-seeking students. Department level persistence rates are used to reflect % of students left the department within a year.
8/	Graduate faculty headcount are self-reported data from departments to the grad division. This report only inlude regular faculty whose home department is the one being reviewed.
9/	Undergraduate time to degree data (Median) are generated by the MIRO TTD web app (first time full time freshmen cohort), graduate TTD data (Median) are provided by the Grad Division.
10/	Average Credits Earned and average GPA data are generated by the degree web app through MIRO's decision support system.
11/	"F" refers to fall semester, "FY" refers to Fiscal Year.

Appendix – Extramural Awards in Ocean and Resources Engineering

SOEST - Department of Ocean and Resources Engineering (ORE) - Extramural Awards
Between July 1, 2012 and June 30, 2018

PI Name	Award Fiscal Year	Title	Award Sponsor	Sponsor Type	Award Amount	Award Type	Award Start Date	Award End Date	Research and Non-Research
Bruce M. Howe	2013	ALOHA Cabled Observatory: Operations and Maintenance	NATIONAL SCIENCE FOUNDATION	National Science Foundation	437,115	Initial	8/15/2012	7/31/2015	Research
Bruce M. Howe	2013	Acoustic Seaglider: PhilSea10 Data Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	100,000	Initial	2/1/2013	1/31/2016	Research
Bruce M. Howe	2013	Acoustic Seaglider: Philippine Sea Experiment	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	23,000	Time & Cost Extension	2/1/2010	1/31/2014	Research
Eugene Pawlak	2013	Hydrodynamic Controls on Acoustical and Optical Water Properties in Tropical Reefs	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	47,077	Term & Condition	2/1/2012	12/31/2013	Research
Eva-Marie Nosal	2013	Improvements to Passive Acoustic Tracking Methods for Marine Mammal Monitoring	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	77,524	Increment	1/1/2012	12/31/2014	Research
Kwok Fai Cheung	2013	Coupling of Coastal Wave Transformation and Computational Fluid Dynamics Models for Seakeeping Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	25,000	Increment	7/1/2012	9/30/2015	Research
Kwok Fai Cheung	2013	Coupling of Coastal Wave Transformation and Computational Fluid Dynamics Models for Seakeeping Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	22,000	Increment	7/1/2012	9/30/2015	Research
Kwok Fai Cheung	2013	Shoreline Evolution and Coastal Resiliency at Two Military Installations: Modeling of Hurricane Surge, Waves, and Overwash	WOODS HOLE OCEANOGRAPHIC INSTITUTION	Mainland-Business and Other	98,260	Increment	8/24/2009	7/31/2013	Research
Kwok Fai Cheung	2013	Tsunami Inundation Mapping for American Samoa	HOMELAND SECURITY, DEPT-AMERICAN SAMOA	Federal Agencies	150,000	Initial	7/1/2012	5/30/2014	Non-Research
Bruce M. Howe	2014	Acoustic Seaglider: PhilSea10 Data Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	48,423	Increment	2/1/2013	1/31/2016	Research

PI Name	Award Fiscal Year	Title	Award Sponsor	Sponsor Type	Award Amount	Award Type	Award Start Date	Award End Date	Research and Non-Research
Bruce M. Howe	2014	Acoustic Seaglider: PhilSea10 Data Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	192,653	Increment	2/1/2013	1/31/2016	Research
Bruce M. Howe	2014	ALOHA Cabled Observatory: Operations and Maintenance	NATIONAL SCIENCE FOUNDATION	National Science Foundation	393,000	Increment	8/15/2012	7/31/2015	Research
Bruce M. Howe	2014	ALOHA Cabled Observatory: Operations and Maintenance	NATIONAL SCIENCE FOUNDATION	National Science Foundation	393,000	Increment	8/15/2012	7/31/2015	Research
Eva-Marie Nosal	2014	Improvements to Passive Acoustic Tracking Methods for Marine Mammal Monitoring	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	40,000	Increment	1/1/2012	12/31/2014	Research
Kwok Fai Cheung	2014	Tsunami Inundation Maps for Hawaii	DEFENSE, DEPT-HI-Hawaii Emergency Mgmt Agency	Hawaii-Government Agencies	187,000	Initial	1/1/2012	7/31/2013	Research
Kwok Fai Cheung	2014	Tsunami Inundation Maps for Hawaii	DEFENSE, DEPT-HI-Hawaii Emergency Mgmt Agency	Hawaii-Government Agencies	165,701	Increment	1/1/2012	6/15/2014	Research
Kwok Fai Cheung	2014	Coupling of Coastal Wave Transformation and Computational Fluid Dynamics Models for Seakeeping Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	57,302	Increment	7/1/2012	9/30/2015	Research
R Ertekin	2014	Offshore Mechanics and Arctic Engineering Research	UNIVERSITY HAWAII FOUNDATION	Hawaii- Non-Profit Organizations	38,892	Initial	4/1/2014	7/31/2015	Research
Bruce Howe	2015	From Space to the Deep Seafloor: Using "Green" Submarine Cable Systems in the Ocean Observing System	NATIONAL AERONAUT & SPACE ADM	National Aeronautics and Space Administration	80,000	Initial	8/5/2014	8/4/2015	Research
Bruce Howe	2015	From Space to the Deep Seafloor: Using "Green" Submarine Cable Systems in the Ocean Observing System	NATIONAL AERONAUT & SPACE ADM	National Aeronautics and Space Administration	64,247	Increment	8/5/2014	8/4/2015	Research

PI Name	Award Fiscal Year	Title	Award Sponsor	Sponsor Type	Award Amount	Award Type	Award Start Date	Award End Date	Research and Non-Research
Bruce Howe	2015	Acoustics at Station ALOHA: RAP Tomography	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	139,000	Initial	3/1/2015	2/28/2018	Research
Bruce M. Howe	2015	Acoustic Seaglider: PhilSea10 Data Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	71,941	Increment	2/1/2013	1/31/2016	Research
Eva-Marie Nosal	2015	Improvements to Passive Acoustic Tracking Methods for Marine Mammal Monitoring	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	38,329	Increment	1/1/2012	12/31/2015	Research
Kwok Fai Cheung	2015	Ocean Engineering Internship	NAVATEK LTD	Hawaii-Business and Other	34,321	Non-Competing Cont.	9/1/2011	7/31/2015	Non-Research
Kwok Fai Cheung	2015	Coupling of Coastal Wave Transformation and Computational Fluid Dynamics Models for Seakeeping Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	30,000	Increment	7/1/2012	9/30/2015	Research
Kwok Fai Cheung	2015	Tsunami Safety Products for the Maritime Community in Hawaii	DEFENSE, DEPT-HI-Hawaii Emergency Mgmt Agency	Hawaii-Government Agencies	165,017	Initial	12/1/2014	7/31/2015	Non-Research
Kwok Fai Cheung	2015	Ocean Engineering Internship	SEA ENGINEERING, INC.	Hawaii-Business and Other	34,321	Initial	8/1/2014	7/31/2015	Non-Research
Kwok Fai Cheung	2015	Ocean Engineering Internship	NAVATEK LTD	Hawaii-Business and Other	36,079	Time & Cost Extension	9/1/2011	7/31/2016	Non-Research
Lora Van Uffelen	2015	Acoustic Timefront Scattering Due to Internal Waves in PHILSEA10	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	110,000	Increment	2/6/2015	1/31/2018	Research
Lora Van Uffelen	2015	Improving Cetacean Stock Assessment with Acoustic Techniques and Technologies	COMMERCE, DEPT-NOAA/NATL MARINE FISHERIES SVC	DOC-Dept of Commerce	125,243	Initial	9/1/2014	8/31/2015	Research
Lora Van Uffelen	2015	Acoustic Timefront Scattering Due to Internal Waves in PHILSEA10	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	10,616	Initial	2/6/2015	1/31/2018	Research

PI Name	Award Fiscal Year	Title	Award Sponsor	Sponsor Type	Award Amount	Award Type	Award Start Date	Award End Date	Research and Non-Research
Bruce Howe	2016	ALOHA Cabled Observatory Continuing Operations and Maintenance	NATIONAL SCIENCE FOUNDATION	National Science Foundation	493,000	Initial	10/1/2015	9/30/2017	Research
Bruce Howe	2016	Workshop: Ocean observing infrastructure and sensing - Technical lessons learned and best practices	NATIONAL SCIENCE FOUNDATION	National Science Foundation	49,998	Initial	7/1/2016	6/30/2017	Research
Bruce Howe	2016	Acoustics at Station ALOHA: RAP Tomography	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	60,000	Increment	3/1/2015	2/28/2018	Research
Eva-marie Nosal	2016	Single sensor and compact array localization methods	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	68,770	Initial	5/1/2016	4/30/2019	Research
Kwok Fai Cheung	2016	Coupling of Coastal Wave Transformation and Computational Fluid Dynamics Models for Seakeeping Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	60,024	Increment	7/1/2012	9/30/2016	Research
Kwok Fai Cheung	2016	Tsunami Safety Products for the Maritime Community on Oahu	DEFENSE, DEPT-HI-Hawaii Emergency Mgmt Agency	Hawaii-Government Agencies	188,281	Initial	10/1/2015	7/31/2016	Non-Research
Lora Van Uffelen	2016	Acoustic Timefront Scattering Due to Internal Waves in PHILSEA10	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	60,000	Increment	2/6/2015	1/31/2018	Research
Lora Van Uffelen	2016	Canada Basin Acoustic Glider Experiment (CABAGE)	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	5,000	Initial	1/1/2016	12/31/2018	Research
Bruce Howe	2017	Using SMART Submarine Cables for Satellite-Measurement Validation	JET PROPULSION LAB-JPL	Mainland-Business and Other	88,000	Time & Cost Extension	10/31/2016	9/30/2018	Research
Bruce Howe	2017	Using SMART Submarine Cables for Satellite-Measurement Validation	JET PROPULSION LAB-JPL	Mainland-Business and Other	87,000	Initial	10/31/2016	9/30/2017	Research
Bruce Howe	2017	ALOHA Cabled Observatory Continuing Operations and Maintenance	NATIONAL SCIENCE FOUNDATION	National Science Foundation	493,000	Increment	10/1/2015	9/30/2017	Research

PI Name	Award Fiscal Year	Title	Award Sponsor	Sponsor Type	Award Amount	Award Type	Award Start Date	Award End Date	Research and Non-Research
Eva-marie Nosal	2017	Single sensor and compact array localization methods	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	25,000	Increment	5/1/2016	4/30/2019	Research
Eva-marie Nosal	2017	Single sensor and compact array localization methods	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	41,469	Increment	5/1/2016	4/30/2019	Research
Kwok Fai Cheung	2017	Ocean Engineering Internship	SEA ENGINEERING, INC.	Hawaii-Business and Other	33,505	Initial	5/15/2017	12/15/2017	Non-Research
Kwok Fai Cheung	2017	Tsunami Safety Products for the Maritime Community in Hawaii - Hilo, Kawaihae, and Kahului Harbors	DEFENSE, DEPT-HI-Hawaii Emergency Mgmt Agency	Hawaii-Government Agencies	195,280	Initial	11/1/2016	8/11/2017	Non-Research
Bruce Howe	2018	Acoustics at Station ALOHA: RAP Tomography	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	208,730	Increment	3/1/2015	2/28/2019	Research
Bruce Howe	2018	Acoustics at Station ALOHA: RAP Tomography	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	110,000	Increment	3/1/2015	2/28/2018	Research
Bruce Howe	2018	ALOHA Cabled Observatory Continuing Operations and Maintenance	NATIONAL SCIENCE FOUNDATION	National Science Foundation	426,345	Initial	12/1/2017	11/30/2019	Research
Eva-marie Nosal	2018	Single sensor and compact array localization methods	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	41,469	Increment	5/1/2016	4/30/2019	Research
Eva-marie Nosal	2018	Single sensor and compact array localization methods	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	112,474	Increment	5/1/2016	4/30/2019	Research
Kwok Fai Cheung	2018	Tsunami Safety Products for the Maritime Community in American Samoa	HOMELAND SECURITY, DEPT-AMERICAN SAMOA	Federal Agencies	-	Initial	2/6/2017	8/31/2018	Non-Research
Kwok Fai Cheung	2018	Ocean Engineering Internship	NAVATEK LTD	Hawaii-Business and Other	37,989	Initial	8/1/2017	7/31/2018	Non-Research

PI Name	Award Fiscal Year	Title	Award Sponsor	Sponsor Type	Award Amount	Award Type	Award Start Date	Award End Date	Research and Non-Research
Kwok Fai Cheung	2018	Link Foundation Fellowship	Link Foundation	Mainland- Non-Profit Organizations	29,000	Initial	7/1/2018	6/30/2019	Non-Research
Kwok Fai Cheung	2018	Ocean Engineering Internship	NAVATEK LTD	Hawaii-Business and Other	43,156	Time & Cost Extension	8/1/2017	7/31/2019	Non-Research
Kwok Fai Cheung	2018	Guam Tsunami Program FY16	GUAM, GOVERNMENT - Guam Homeland Security	Foreign	66,814	Initial	12/5/2017	8/31/2018	Non-Research
Kwok Fai Cheung	2018	Guam Tsunami Program FY16	GUAM, GOVERNMENT - Guam Homeland Security	Foreign	-	Initial	12/5/2017	12/4/2018	Non-Research
Kwok Fai Cheung	2018	Coupling of Coastal Wave Transformation and Computational Fluid Dynamics Models for Seakeeping Analysis	DEFENSE, DEPT-NAVY OFC OF NAVAL RSCH	DOD-Department of Defense	(79)	Deobligation	7/1/2012	9/30/2016	Research
Kwok Fai Cheung	2018	Tsunami Safety Products for Nawiliwili Harbor and Port Allen, Kauai	DEFENSE, DEPT-HI-Hawaii Emergency Mgmt Agency	Hawaii-Government Agencies	197,837	Initial	10/31/2017	8/31/2018	Non-Research
Kwok Fai Cheung	2018	Tsunami Safety Products for the Maritime Community in American Samoa	HOMELAND SECURITY, DEPT-AMERICAN SAMOA	Federal Agencies	68,456	Initial	8/31/2017	8/31/2018	Non-Research
Yoshiki Yamazaki	2018	Tsunami Mapping of the southern portion of the Island of Hawaii	DEFENSE, DEPT-HI-Hawaii Emergency Mgmt Agency	Hawaii-Government Agencies	41,000	Initial	4/1/2018	8/31/2018	Non-Research
Zhenhua Huang	2018	Controlling Cross-shore Sediment Transport by Integrating Pile Breakwaters with Wave Energy Converters for Sustainable Coastal Management	NATIONAL SCIENCE FOUNDATION	National Science Foundation	276,822	Initial	8/1/2017	7/31/2020	Research

SOEST - Department of Ocean and Resources Engineering (ORE) - Extramural Awards
Between July 1, 2012 and June 30, 2018

PI Name	Award Fiscal Year	Title	Award Sponsor	Sponsor Type	Award Amount	Award Type	Award Start Date	Award End Date	Research and Non-Research
					7,043,401				

Fiscal year				
2013				979,976
2014				1,515,971
2015				939,114
2016				985,073
2017				963,254
2018				1,660,013
Total				**7,043,401**

ORE END

Appendix – Publications in Ocean and Resources Engineering

Kwok Fai Cheung

Probabilistic, Stochastic, and Risk Analysis

1. Li, N., ‡Yamazaki, Y., Roeber, V., Cheung, K.F., and Chock, G. (2018). Probabilistic mapping of storm-induced coastal inundation for climate change adaption. Coastal Engineering, 133, 126-141.
2. Taflanidis, A.A., Kennedy, A.B., Westerink, J.J., Smith, J.M., Cheung, K.F., Hope, M., and Tanaka, S. (2013). A comprehensive theoretical and computational framework for probabilistic hurricane-risk assessment. Journal of Waterway, Port, Coastal, and Ocean Engineering, 139(3),171-182.

Tsunami Source Mechanism

3. ‡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.
4. Lay, T., Ye, L., ‡Bai, Y., Cheung, K.F., Kanamori, H., Freymueller, J., Steblov, G.M., and Kogan, M.G. (2017). Rupture along 400 km of the Bering Fracture Zone in the Komandorsky Islands Earthquake (Mw 7.8) of 17 July 2017. Geophysical Research Letters, 44(24), 12,161–12,169.
5. Ye, L., Lay, T., ‡Bai, Y., Cheung, K.F., and Kanamori, H. (2017). The 2017 Mw 8.1 Chiapas, Mexico earthquake: energetic slab detachment. Geophysical Research Letters, 44(23), 11,824–11,832.
6. 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.
7. †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(21), 11182-11191.
8. †Li, L., Lay, T., Cheung, K.F., and Ye, L. (2016). Joint modeling of teleseismic and tsunami wave observations to constrain the 16 September 2015 Illapel, Chile Mw 8.3 earthquake rupture process. Geophysical Research Letters, 43(9), 4303-4312.
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 re-rupture of the 1906 Ms 8.6 Colombia-Ecuador earthquake. Earth and Planetary Science Letters, 454, 248-258.
10. Yue, H., Lay, T., †Li, L., ‡Yamazaki, Y., Cheung, K.F., Rivera, L., Hill, E.M., Sieh, K., Kongko, W., and Muhari, A. (2015). Validation of linearity assumptions for using tsunami waveforms in joint inversion of kinematic rupture models: Application to the 2010 Mw 7.8 Mentawai tsunami earthquake. Journal of Geophysical Research: Solid Earth, 120(3), 1728-1747.
11. ‡Bai, Y., Cheung, K.F., ‡Yamazaki, Y., Lay, T., and Ye, L. (2014). Surges around the Hawaiian Islands from the 1 April 2014 North Chile Mw 8.1 earthquake. Geophysical Research Letters, 41(23), Doi: 10.1002/2014GL061686
12. Yue, H., Lay, T., Rivera, L.A., ‡Bai, Y., ‡Yamazaki, Y., Cheung, K.F., Hill, E.M., Sieh, K.E., Kongko, W., and Muhari, A. (2014). Rupture process of the 2010 Mw 7.8 Mentawai tsunami earthquake from joint inversion of near-field hr-GPS and teleseismic body wave recordings constrained by tsunami observations. Journal of Geophysical Research: Solid Earth, 119(7), 5574-5593.
13. Lay, T., Ye, L., Kanamori, H., ‡Yamazaki, Y., Cheung, K.F., and Ammon, C.J. (2013). The February 6, 2013 Mw 8.0 Santa Cruz Islands earthquake and tsunami. Tectonophysics, 608, 1109-1121.
14. Lay, T., Ye, L., Kanamori, H., ‡Yamazaki, Y., Cheung, K.F., Kwong, K., and Koper, K.D. (2013). The October 28, 2012 Mw 7.8 Haida Gwaii underthrusting earthquake and tsunami: Slip partitioning along the Queen Charlotte Fault transpressional plate boundary. Earth and Planetary Science Letters, 375, 57-70.

15. ‡Yamazaki, Y., Cheung, K.F., and Lay, T. (2013). Modeling of the 2011 Tohoku near-field tsunami from finite-fault inversion of seismic waves. Bulletin of the Seismological Society of America, 103(2b),1444-1455.

Tsunami Impact Assessment

16. Lynett, P.J., Gately, K., Wilson, R., Montoya, L., Arcas, D., Aytore, B., ‡Bai, Y., Bricker, J.D., Castro, M.J., Cheung, K.F., David, C.G., Dogan, G.G., Escalante, C., González-Vida, J.M., Grilli, S.T., †Heitmann, T.W., Horrillo, J., Kânoğlu, U., Kian, R., Kirby, J.T., Li , W., Macías, J., Nicolsky, D.J., Ortega, S., Pampell-Manis, A., Park, Y.S., Roeber, V., Sharghivand, N., Shelby, M., Shi, F., Tehranirad, B., Tolkova, E., Thio, H.K., Velioğlu, D., Yalçıner, A.C., ‡Yamazaki, Y., Zaytsev, A., Zhang, Y.J. (2017). Inter-model analysis of tsunami-induced coastal current. Ocean Modelling, 114, 14-32.
17. ‡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, 32-43.
18. Benjamin, L.R., Flament, P., Cheung, K.F., and Luther, D.S. (2016). The 2011 Tohoku tsunami south of Oahu: high-frequency Doppler radio observations and model simulations of currents. Journal of Geophysical Research: Oceans, 121(2), 1133-1144.
19. ‡Bai, Y., ‡Yamazaki, Y., and Cheung, K.F. (2015). Interconnection of multi-scale standing waves across the Pacific from the 2011 Tohoku tsunami. Ocean Modelling, 92, 183-197
20. Yim, S.C., Olsen, M.J., Cheung, K.F., and Azadbahkt, M. (2014). Tsunami modeling, structural load simulation, and validation using geospatial field data. Journal of Structural Engineering, 140(8), A4014012.
21. Cheung, K.F., ‡Bai, Y., and ‡Yamazaki, Y. (2013). Surges around the Hawaiian Islands from the 2011 Tohoku tsunami. Journal of Geophysical Research: Oceans, 118(10), 5703-5719, doi: 10.1002/jgrc.20413.
22. Olsen, M.J., Cheung, K.F., ‡Yamazaki, Y., Butcher, S., Garlock, M., Yim, S., McGarity, S., Robertson, I.N., Burgos, L., and Young, Y.L. (2012). Damage assessment of the 2010 Chile earthquake and tsunami using ground-based LiDAR. Earthquake Spectra, 28(S1), 179-197.
23. ‡Yamazaki, Y., Cheung, K.F., Pawlak, G., and Lay, T. (2012). Surges along the Honolulu coast from the 2010 Tohoku tsunami. Geophysical Research Letters, 39(9), L09604, Doi: 10.1029/2012GL051624.

Wind Waves Modeling

24. Li, N., Cheung, K.F., Stopa, J.E., Chen, Y.-L., Hsiao, F., Vega, L., and Cross, P. (2016). Thirty-four years of Hawaii wave hindcast from downscaling of Climate Forecast System Reanalysis. Ocean Modelling, 100, 78-95.
25. Foster, J., ‡Li, N., and Cheung, K.F. (2014). Sea state determination from ship-based geodetic GPS. Journal of Atmospheric and Oceanic Technology, 31(11), 2556-2564.
26. †Stopa, J.E. and Cheung, K.F. (2014). Periodicity and pattern of ocean wind and wave climate. Journal of Geophysical Research: Oceans, 119(8), 5563–5584.
27. †Stopa, J.E. and Cheung, K.F. (2014). Intercomparison of wind and wave data from the ECMWF Reanalysis Interim and NCEP Climate Forecast System Reanalysis. Ocean Modelling, 75, 65-83
28. †Stopa, J.E., Cheung, K.F., Tolman, H.L., and Chawla, A. (2013). Patterns and cycles in the Climate Forecast System Reanalysis wind and wave data. Ocean Modelling, 70, 207-220. .
29. †Stopa, J.E., ‡Filipot, J.-F., ‡Li, N., Cheung, K.F., Chen, Y.-L., and Vega, L. (2013). Wave energy resources along the Hawaiian Islands chain. Renewable Energy, 55, 305-321.
30. †Arinaga, R.A. and Cheung, K.F. (2012). Atlas of global wave energy from 10 years of reanalysis and hindcast data. Renewable Energy, 39,49-64.
31. ‡Filipot, J.-F. and Cheung, K.F. (2012). Spectral wave modeling for fringing reef environment. Coastal Engineering, 67, 67-79.
32. †Stopa, J.E., Cheung, K.F., Garcé, M.A., and Badger, N. (2012). Atmospheric Infrasound from nonlinear wave interactions during Hurricanes Felicia and Neki of 2009. Journal of Geophysical Research: Oceans, 117(12), C12017, Doi: 10.1029/2012JC008257.

Storm-induced Coastal Flooding

33. ‡Li, N., ‡Roeber, V., ‡Yamazaki, Y., †Heitmann, T.W., ‡Bai, Y., and Cheung, K.F. (2014). Integration of coastal inundation modeling from storm tides to individual waves. Ocean Modelling, 83, 26-42.
34. Kennedy, A.B., Westerink, J.J., Smith, J.M., Hope, M.E., Hartman, M., Taflanidis, A.A., Tanaka, S., Westerink, H, Cheung, K.F., Smith, T., Hamann, M., Minamide, M., and Ota, A. (2012). Tropical cyclone inundation potential on the Hawaiian Islands of Oahu and Kauai. Ocean Modelling, 52, 54-68.

Mathematical and Numerical Analysis

35. ‡Bai, Y. and Cheung, K.F. (2016). Linear and nonlinear properties of reduced two-layer models for non-hydrostatic free surface flow. Ocean Modelling, 107, 64-81.
36. ‡Bai, Y. and Cheung, K.F. (2015). Dispersion and kinematics of multi-layer non-hydrostatic models. Ocean Modelling, 92, 11-27.
37. †Bai, Y. and Cheung, K.F. (2013). Dispersion and nonlinearity of multi-layer non-hydrostatic free-surface flows. Journal of Fluid Mechanics, 726, 226-260.

Nonlinear Long-wave Models

38. †Wesley, M.J. and Cheung, K.F. (2016). Modeling of wave overtopping on vertical structures with the HLLS Riemann solver. Coastal Engineering, 112, 28-43.

Hydroelasticity

39. †Das, S. and Cheung, K.F. (2012). Hydroelasticity of marine vessels advancing in a seaway. Journal of Fluids and Structures, 34, 271-290.

Coastal and Surf-zone Processes

40. †Quiroga, P.D. and Cheung, K.F. (2013). Laboratory study of wave transformation over bed-form roughness on fringing reefs. Coastal Engineering, 80, 35-48.
41. †Bai, Y. and Cheung, K.F. (2013) Depth-integrated free surface flow with parameterized non-hydrostatic pressure. International Journal for Numerical Methods in Fluids, 71(4), 403-421.
42. †Bai, Y. and Cheung, K.F. (2012). Depth-integrated free-surface flow with a two-layer non-hydrostatic formulation. International Journal for Numerical Methods in Fluids, 69(2), 411-429.
43. ‡Roeber, V. and Cheung, K.F. (2012) Boussinesq-type model for wave transformation over fringing reefs. Coastal Engineering, 70, 1-20. Offshore and Marine Hydrodynamics
44. †Das, S. and Cheung, KF. (2012). Scattered waves and motions of a vessel advancing in a seaway. Wave Motion, 49(1), 181-197.

Bruce Howe

1. Van Uffelen, L. J., E H Roth, B. M Howe, E. M. Oleson, and Y. Barkley, A Seaglider-Integrated Digital Monitor for Bioacoustic Sensing, IEEE J. Ocean. Eng., doi:10.1109/JOE.2016.2637199, 2017.
2. Andrew, R. K., B. M Howe, and J. A. Mercer, Decadal trends in low-frequency ambient ocean noise for seven sites in the North Pacific Ocean, J. Underwater Acoustics., 66, pp 1-27, October, 2016.
3. Zhang, C., A. Kaneko, X.-H. Zhu, Howe, B. M., and N. Gohda, Acoustic measurement of the net transport through the Seto Inland Sea, Acoust. Sci. Tech., 37, 10–20, doi:10.1250/ast.37.10, 2016.
4. Alford, M. A., T. McGinnis, and Howe, B. M., An inductive charging and real-time communications system for profiling moorings, J. Atmos. Oceanic Technology, doi:10.1175/JTECH-D-15-0103.1, 2015.
5. Van Uffelen, L.J., Howe, B. M., E.M. Nosal, G.S. Carter, P.F. Worcester, and M.A. Dzieciuch, Localization and subsurface position error estimation of gliders using broadband acoustic signals at long range, IEEE J. Ocean. Eng., doi: 10.1109/JOE.2015.2479016, 2015.
6. Chen, Y., B. M. Howe, and C. Yang, Actively Controllable Switching for Tree Topology Seafloor Observation Networks, IEEE J. Oceanic Engineering, 10.1109/JOE.2014.2362830, 2014.
7. M. Howe, A Deep Cabled Observatory: Biology and Physics in the Abyss, Eos, Trans. AGU, 95(47), 429-430, 2014. DOI: 10.1002/2014EO470001

8. Song, H. C., B. M. Howe, M. G. Brown, and R. K. Andrew, Diversity-based acoustic communication with a glider in deep water, J. Acoust. Soc. Am. Express Letters, 135, 1023–1026, (2014), DOI:http://dx.doi.org/10.1121/1.4864299
9. Ardhuin, F., T. Lavanant, M. Obrebski, L. Marie, J. Y. Royer, J. F. d'Eu, B. M. Howe, R. Lukas, and J. Aucan, A numerical model for ocean ultra low frequency (UFL) noise: wave-generated acoustic-gravity and Rayleigh modes, J. Acoust. Soc. Am.,134, 3242-3259 (2013), DOI:http://dx.doi.org/10.1121/1.4818840.
10. Chandrayadula, T. K., K. E. Wage, P. F. Worcester, M. A. Dzieciuch, J. A. Mercer, R. K. Andrew, and B. M. Howe, Reduced rank models for travel time estimation of low mode signals, J. Acoust. Soc. Am., 134, 3332-3346 (2013), DOI:http://dx.doi.org/10.1121/1.4818847.
11. Chandrayadula, T. K., J. A. Colosi, P. F. Worcester, M. A. Dzieciuch, J. A. Mercer, R. K. Andrew, and B. M. Howe, Observations and transport theory analysis of low frequency, acoustic mode propagation in the Eastern North Pacific Ocean, J. Acoust. Soc. of Am., 134, 3144-3160 (2013), DOI:http://dx.doi.org/10.1121/1.4818883.
12. Stephen, R. A., S. T. Bolmer, M. A. Dzieciuch, P. F. Worcester, R. Andrew, J. A. Mercer, J. A. Colosi, and B. M. Howe, Deep seafloor arrivals in long range ocean acoustic propagation, J. Acoust. Soc. Am., 134, 3307-3317 (2013), DOI:http://dx.doi.org/10.1121/1.4818845.
13. Taniguchi, N., C.-F. Huang, A. Kaneko, C.-T. Liu, B. M. Howe, Y.-H. Wang, Y. Yang, J. Lin, X.-H. Zhu, and N. Gohda, Measuring the Kuroshio current with ocean acoustic tomography, J. Acoust. Soc. Am., 134, 3272-3281 (2013), DOI:http://dx.doi.org/10.1121/1.4818842
14. Udovydchenkov, I. A., M. G. Brown, T. F. Duda, P. F. Worcester, M. A. Dzieciuch, J. A. Mercer, Rex K. Andrew, B. M. Howe, J. A. Colosi, Weakly dispersive modal pulse propagation in the North Pacifi c Ocean, J. Acoust. Soc. Am., 134, 3386-3394 (2013), DOI:http://dx.doi.org/10.1121/1.4820882.
15. Van Uffelen, L. J., E. M. Nosal, B. M. Howe, and G. S. Carter, P. F. Worcester, M. A. Dzieciuch, K. D. Heaney, R. L. Campbell, and P. S. Cross, Estimating uncertainty in subsurface glider position using transmissions from fixed acoustic tomography sources, J. Acoust. Soc. Am.,134, 3260-3271 (2013), DOI:http://dx.doi.org/10.1121/1.4818841.
16. Worcester, P. F., R. K. Andrew, A. B. Baggeroer, J. A. Colosi, G. L. D'Spain, M. A. Dzieciuch, K. D. Heaney, B. M. Howe, J. N. Kemp, J. A. Mercer, R. A. Stephen, and L. J. Van Uffelen, The North Pacific Acoustic Laboratory (NPAL) deep-water acoustic propagation experiments in the Philippine Sea, J. Acoust. Soc. Am., 134, 3359-3375 (2013), DOI:http://dx.doi.org/10.1121/1.4818887.
17. Udovydchenkov, I. A., R. A. Stephen, T. F. Duda. S. T. Bolmer, P. F. Worcester, M. A. Dzieciuch, J. A. Mercer, R. K. Andrew, and B. M. Howe, Bottom interacting sound at 50 km range in a deep ocean environment, J. Acoust. Soc. Am.,132(4):2224-31, 2012.
18. Udovydchenkov, I. A., M. G. Brown, T. F. Duda, J. A. Mercer, R. K. Andrew, P. F. Worcester, M. A. Dzieciuch, B. M. Howe, and J. A. Colosi, Modal analysis of the range evolution of broadband wavefields in the North Pacific Ocean: low mode numbers. J. Acoust. Soc. Am., 131(6):4409-27, 2012.
19. Howe, B. M., F. K. Duennebier, R. Butler, R. B. Lukas, Scientific uses of submarine cables: Evolutionary development leading to the ALOHA Cabled Observatory, Mains'l Haul, J. Pacific Maritime History, 48, 100-119, 2012.
20. Bingham, B., N. Kraus, B. M. Howe, L. Freitag, K. Ball, P. Koski, and E. Gallimore, Passive and active acoustics using an autonomous wave glider, J. of Field Robotics, DOI: 10.1002/rob.21424, 2012.

Zhenhua Huang

1. Cao, D.P., Huang, Z.H., He, F., Jian, W. & Lo, E.Y.M. (2017). An Improved Prediction for Wave Runup on a Circular Cylinder. Coastal Engineering Journal 59(3):1750013. doi:10.1142/S0578563417500139.

2. Liu, C.R., Huang, Z.H. & Chen, W.P. (2017). A numerical study of a submerged horizontal heaving plate as a breakwater. Journal of Coastal Research 33(4):917–930. doi:10.2112/JCOASTRES-D-16-00152.1
3. Zhao, X.Z., Chen, Y., Huang, Z.H., and Gao, Y. Y. (2017). A numerical study of tsunami wave run-up and impact on coastal cliffs using a CIP-based model. Natural Hazards and Earth System Sciences 17, 641-655. doi:10.5194/nhess-2017-37
4. He, F., and Huang, Z.H. (2017). Characteristics of orifices for modeling nonlinear power take-off in wave-flume tests of oscillating water column devices. Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering). 18(5),329-345. doi:10.1631/jzus.A1600769
5. Jian, W., Cao, D.P., Lo, E.Y.M., Huang, Z.H., Chen, X.B., Cheng, Z.P., Gu, H., and Li, B.B. (2017). Wave runup on a surging vertical cylinder in regular waves. Applied Ocean Research 63, 229-241. doi:10.1016/j.apor.2017.01.016
6. He, F., Dai, H.L.,Huang, Z.H., and and Wang, L. (2017). Nonlinear dynamics of a fluid-conveying pipe under the combined action of cross-flow and top-end excitation. Applied Ocean Research 62, 199-209. doi:10.1016/j.apor.2016.12.007
7. 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
8. Huang, G.X., Huang Z.H., and Law, A.W.K. (2016). Analytical Study on the Drift of Small Floating Objects under Regular Waves. Journal of Engineering Mechanics 142(6):06016002 . doi:10.1061/(ASCE)EM.1943-7889.0001067
9. Sim, S.Y.* and Huang, Z.H. (2016). An experimental study of tsunami amplification by a coastal cliff. Journal of Coastal Research 32(3):611-618. doi: 10.2112/JCOASTRES-D-15-00032.1
10. Xu, C.H.* Huang Z.H., and Deng Z.Z. (2016). Experimental and theoretical study of a cylindrical oscillating water column device with a quadratic power take-off model. Applied Ocean Research 57:19-29. doi:10.1016/j.apor.2016.02.003
11. He, F.* and Huang Z.H. (2016). Using an oscillating water column structure to reduce wave reflection from a vertical wall. Journal of Waterway, Port, Coastal, and Ocean Engineering 142(2):04015021. DOI: 10.1061/(ASCE)WW.1943-5460.0000320
12. Lee, C.H., Huang, Z.H. & Chiew, Y.M. (2015). A three-dimensional continuum model incorporating static and kinetic effects for granular flows with applications to collapse of a two-dimensional granular column. Physics of Fluids 27(11): 113303 .doi:10.1063/1.493562.
13. Lee, C.H. +, Huang Z.H., and Chiew,Y.M. (2015). A multi-dimensional model for granular flows and its application to collapse of granular columns. Physics of Fluids 27, 113303; doi: 10.1063/1.4935626
14. Yuan, Z.D.* and Huang, Z.H. (2015). Morison coefficients for a circular cylinder oscillating with dual frequency in still water: an analysis using independent-flow form of Morison's equation. Journal of Ocean Engineering and Marine Energy 1(4): 435-444. DOI 10.1007/s40722-015-0030-6.
15. Lee, C.H.+, Huang, Z.H., and Chiew, Y.M. (2015). A turbulent dispersion model for flows with suspended sediment. Advances in Water Resources 79:18-34. doi:10.1016/j.advwatres.2015.02.002
16. Zhang,Y.M.*, Ariffin, M.Z., Xiao, Z.M., Zhang, W.G., and Huang, Z.H. (2015). Nonlinear elastic–plastic stress investigation for two interacting 3-D cracks in offshore pipelines". Fatigue & Fracture of Engineering Materials & Structures. doi: 10.1111/ffe.12259.
17. Zhang,Y.M.*, Yi, D.K., Xiao, Z.M., and Huang, Z.H. (2015). Engineering critical assessment for offshore pipelines with 3-D elliptical embedded cracks. Engineering Failure Analysis 51: 37–54. doi:10.1016/j.engfailanal.2015.02.018.
18. Lee, C.H.+, Huang, Z.H., and Chiew, Y.M. (2015). An extrapolation-based boundary treatment for using lattice Boltzmann methods to simulate fluid-particle interaction near a wall. Engineering Applications of Computational Fluid Mechanics 9:1, 370-381, doi: 10.1080/19942060.2015.1061554 .
19. Li, L.L.+, Huang, Z.H., and Qiu, Q.& (2014). Numerical simulation of the erosion and deposition at the Thailand Khao Lak coast during the 2004 Indian Ocean Tsunami. Natural Hazards 74:2251–227. DOI:10.1007/s11069-014-1301-6.

20. Zhang, Y.M.*, Xiao, Z.M., Zhang, W.G., Huang, Z.H. (2014). Strain-based CTOD estimation formulations for fracture assessment of offshore pipelines subjected to large plastic deformation 91:64–72. doi:10.1016/j.oceaneng.2014.08.020.

21. He, F.* and Huang, Z.H. (2014). Hydrodynamic performance of pile-supported OWC-type structures as breakwaters: An experimental study. Ocean Engineering 88: 618-626. doi:10.1016/j.oceaneng.2014.04.023

22. Huang, Z.H., He, F.*, and Zhang, W.B.* (2014). A floating box-type breakwater with slotted barriers. Journal of Hydraulic Research 52(5): 720-727. doi: 10.1080/00221686.2014.888690

23. Yao, Y.*, Huang, Z.H., Lo, E.Y.M., and Sheng, H.T. (2014). A preliminary laboratory study of motion of floating debris generated by solitary waves running up a beach. Journal of Earthquake and Tsunami 8(3): 1440006. doi: 10.1142/S1793431114400065

24. Deng, Z.Z.*, Huang, Z.H. and Law, A.W.K. (2014). Wave power extraction from a bottom-mounted oscillating water column converter with a V-shaped channel. Proceedings of the Royal Society A 470 (2167). Article No. 20140074. doi: 10.1098/rspa.2014.0074

25. Zhao, K.F., Cheng, N.S., and Huang, Z.H. (2014). Experimental study of free-surface fluctuations in open channel flow in the presence of emergent rigid cylinders. Journal of Hydraulic Research 52(4): 465-475. doi: 10.1080/00221686.2014.880858

26. Chen, J.&, Huang, Z.H., Jiang, C.B., Deng, B., Long, Y.N. (2013). Tsunami scours at coastal roadways: a laboratory study. Natural Hazards 69(1): 655-674. doi: 10.1007/s11069-013-0727-6

27. Deng, Z.Z.*, Huang, Z.H., and Law, A.W.K. (2013). Wave power extraction by an oscillating water column device supported by a semi-circular structure. Applied Ocean Research 42,:114-123. doi: 10.1016/j.apor.2013.05.006

28. Huang, Z.H., Wu, T.R., Chen, T.Y. and Sim, S.Y.* and Yao Y.* (2013). A possible mechanism of destruction of coastal trees by tsunamis: A hydrodynamic study on effects of coastal steep hills. Journal of Hydro-Environment Research 7(2): 113-123. doi: 10.1016/j.jher.2012.06.004

29. Li, B.B.&, Huang, Z.H., Low, Y.M., and Ou, J.P. (2013), Experimental and numerical study of the effects of heave plates on the motion responses of a new type of deep-draft multi-spar platform. Journal of Marine Science and Technology 18(2): 229-246. doi: 10.1007/s00773-012-0203-0

30. He, F.*, Huang, Z.H., and Law, A.W.K. (2013). An experimental study of floating breakwater with asymmetric pneumatic chambers for wave energy extraction. Applied Energy 106:222-231. doi: 10.1016/j.apenergy.2013.01.013

31. Zhang, Y.M.*, Yi, D.K., Xiao, Z.M., Huang, Z.H., Kumar, S.B. (2013). Elastic-plastic fracture analyses for pipeline girth welds with 3D semi-elliptical surface cracks subjected to large plastic bending. International Journal of Pressure Vessels and Piping 105:90-102. doi: 10.1016/j.ijpvp.2013.03.009

32. Huang, Z.H., Wu,T.R., and Siyamsidik (2013). Recent research on tsunami hazards for Sumatra and the South China Sea area. Journal of Earthquake and Tsunami 7(1):1303001. doi:10.1142/S1793431113030012

33. Li, L.L.+ and Huang, Z.H. (2013). Modeling changes of beach profile under tsunami waves: a comparison of selected sediment transport models. Journal of Earthquake and Tsunami 7(1):1350001. doi:10.1142/S1793431113500012.

34. Garniner, E.I., Huang, Z.H., and Mei, C.C. (2012). Nonlinear long waves over a muddy beach. Journal of Fluid Mechanics 718:371 – 397. doi: 10.1017/jfm.2012.617

35. Yao Y.*, Huang, Z.H., Monismith, S.G., and Lo, E.Y.M. (2013). Characteristics of Monochromatic Waves Breaking over Fringing Reefs. Journal of Coastal Research 29(1):9-12. doi:10.2112/JCOASTRES-D-12-00021.1

36. Zhao, B., Law, A.W.K., Huang, Z.H., Adams, E.E., Lai,A. (2013). Behaviour of sediment clouds in waves. Journal of Waterway, Port, Coastal, and Ocean Engineering 139(1):24-33. doi: 10.1061/(ASCE)WW.1943-5460.0000167

37. Sim, S.Y.*, Huang, Z.H., and Adam D. Switzer,A.D. (2013). An experimental study on tsunami inundation over complex coastal topography. Theoretical & Applied Mechanics Letters. Vol. 3 (3), Article number 032006. doi: 10.1063/2.1303206
38. Li, L.L.+, Qiu, Q., and Huang, Z.H. (2012). Numerical modeling of morphological change in Lhok Nga, west Banda Aceh, during the 2004 Indian Ocean tsunami: understanding tsunami deposits using a forward modeling method. Natural Hazards 64(2): 549-1574. doi:10.1007/s11069-012-0325-z
39. Chen, J.&, Huang, Z.H., Jiang, C.B., Deng, B., Long, Y.N. (2012). An experimental study of changes of beach profile and sorting of sand grains by tsunami like waves. Journal of Coastal Research 28(5):1303-1312. doi: 10.2112/JCOASTRES-D-11-00180.1
40. He, F.*, Huang, Z.H., and Law, A.W.K. (2012). Hydrodynamic performance of a rectangular floating breakwater with and without pneumatic chambers: an experimental study. Ocean Engineering 51:16–27. doi:10.1016/j.oceaneng.2012.05.008
41. Hill, E.M., Borrero, J.C., Huang, Z.H., Qiu, Q.&, Banerjee, P., Natawidjaja, D.H., Elosegui, P., Fritz, H.M., Ryan, I., Lin, L.L., Macpherson, K.A., Skanavis, V., Synolakis, C.E., and Sieh,K. (2012). Very near-trench source of the October 2010 Mentawi tsunami earthquake. Journal of Geophysical Research 117: B06402. doi: 10.1029/2012JB009159.
42. Yao, Y.*, Huang, Z.H., Monismith, S.G. and Lo, E.Y.M. (2012). 1DH Boussinesq modeling of wave transformation over fringing reefs. Ocean Engineering 47: 30–42. doi: 10.1016/j.oceaneng.2012.03.010
43. Li, L.L.+, Huang, Z.H., Qiu, Q., Natawidjaja, D.H., Sieh, K. (2012). Tsunami-induced coastal changes: a scenario-based study for Painan, West Sumatra, Indonesia. Earth, Plants and Space 64(10): 799-816. doi: 10.5047/eps.2011.08.002.
44. Zhao, B., Law, A.W.K., Adams, E.E., Shao, D.D., Huang, Z.H. (2012). Effect of air release height on the formation of sediment thermal in water. Journal of Hydraulic Research 50(5): 532-540. doi: 10.1080/00221686.2012.715094

Gérard C. Nihous

1. Nihous, G.C., "Notes on hydrostatic pressure," Journal of Ocean Engineering and Marine Energy, 2, 105-109, 2016.
2. Nihous, G.C., "The Method of Imbedded Lagrangian Element to estimate wave power absorption by some submerged devices," Journal of Marine Science and Application, 13, 134-142, 2014.
3. Nihous, G.C., "Maximum wave power absorption by slender bodies of arbitrary cross sections in oblique seas," Applied Ocean Research, 47, 17-27, 2014.
4. Rajagopalan, K. and G.C. Nihous, "Predictions of water-column properties under widespread artificial upwelling scenarios in the North Pacific Subtropical Gyre using an ocean general circulation model," Journal of Marine Environmental Engineering, 9(4), 285-304, 2014.
5. Rajagopalan, K. and G.C. Nihous, "An assessment of global Ocean Thermal Energy Conversion resources under broad geographical constraints," Journal of Renewable and Sustainable Energy, 5, 063124, 11 p., 2013.
6. Nihous, G.C., "Maximum wave power absorption by flexible line attenuators," Applied Ocean Research, 43, 68-70, 2013.
7. Rajagopalan, K. and G.C. Nihous, "An assessment of global Ocean Thermal Energy Conversion (OTEC) resources with a high-resolution Ocean General Circulation Model," Journal of Energy Resources Technology, 135, 041202, 9 p., 2013.
8. Rajagopalan, K. and G.C. Nihous, "Estimates of global Ocean Thermal Energy Conversion (OTEC) resources using an Ocean General Circulation Model," Renewable Energy, 50, 532-540, 2013.
9. Jia, Y., G.C. Nihous and K.J. Richards, "Effects of Ocean Thermal Energy Conversion systems on near and far field seawater properties - A case study for Hawaii," Journal of Renewable and Sustainable Energy, 4, 063104, doi: 10.1063/1.4766820, 13 p., 2012.
10. Nihous, G.C., "Wave power extraction by arbitrary arrays of non-diffracting oscillating water columns," Ocean Engineering, 51, 94-105, 2012.

11. Nihous, G.C., “Assessment of the evolution of water-column stratification following the hypothetical implementation of widespread controlled upwelling in the North Pacific Subtropical Gyre,” Journal of Marine Environmental Engineering, 9(3), 175-189, 2012.

Eva-Marie Nosal

1. Gemba* K, Nosal E-M, Reed T (2017). Estimating and removing colorations from the deconvolved impulse response of an underwater acoustic channel. JASA 141 (1), EL 6-10.
2. Gemba* K, Nosal E-M (2016). Source characterization using recordings made in a reverberant underwater channel. Applied Acoustics 105, 24-34.
3. Van Uffelen LJ, Howe BM, Nosal E-M, Carter GS, Worcester PF, and Dzieciuch MA (2015). Localization and subsurface position error estimation of gliders using broadband acoustic signals at long range. IEEE J. Ocean. Eng. 99, 1-8.
4. Gemba* K, Nosal E-M, Reed T (2014). Partial dereverberation used to characterize open circuit scuba diver signatures. JASA 136(2), 623-633.
5. VanUffelen L, Nosal E-M, Howe B, Carter G, Worcester PF, Dzieciuch MA, Heaney KD, Campbell RL, Cross PS (2013). Estimating uncertainty in subsurface glider position using transmissions from fixed acoustic tomography sources. JASA 134(4) Pt.2, 3260-3271.
6. Nosal E-M (2013). Methods for tracking multiple marine mammals with wide-baseline passive acoustic arrays. JASA 134(3), 2383-2392.
7. Stimpert AK, Mattila D, Nosal E-M, Au WWL (2012). Tagging young humpback whale calves: Methodology, dive behavior, and acoustics. Endangered Species Res. 19, 11-17.
8. Duennebier F, Lukas R, Nosal E-M, Aucan J, Weller R (2012). Wind, waves, and acoustic background levels at Station ALOHA. Journal of Geophysical Research. 117, 21 pages, C03017.