

2013 PROGRAM REVIEW OF THE SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY UNIVERSITY OF HAWAII AT MANOA

INTRODUCTION

This report provides a program review of the School of Ocean and Earth Science and Technology (SOEST) and identifies strengths, challenges, and areas for improvement. The review took place at the University of Hawaii at Manoa (UHM) from April 16-19, 2013. The review team consisted of:

Dr. Peter Betzer, St. Petersburg Downtown Partnership
Dr. Robert Duce, Texas A&M University
Dr. Ian MacGregor, Smithsonian Institution
Dr. Roberta Marinelli, University of Southern California
Dr. Harry McSween, University of Tennessee
Dr. Steve Scott, University of Toronto
Dr. John Wallace, University of Washington

Dr. Jefferson Tester, Cornell University, was unable to participate due to illness.



*Left to right: Peter Betzer, Harry McSween, Ian MacGregor, Steve Scott,
Roberta Marinelli, John Wallace and Bob Duce*

The committee met in plenary at different times with Chancellor Thomas Apple, Dean/Interim Vice Chancellor for Research Brian Taylor, Vice Chancellor for

Academic Affairs Reed Dasenbrook, Associate Vice Chancellor for Academic Affairs Krystyna Aune, Academic Affairs Program Officer Wendy Pearson, the SOEST Executive Committee, the SOEST advisors and student support staff, and the SOEST administrative and research support staff. The committee met as smaller interdisciplinary teams with all of the academic departments, research institutes, and research centers, as well as their respective chairs and directors, in SOEST. The smaller interdisciplinary teams also met with undergraduate and graduate students as well as the academic advisors who are involved in SOEST's academic programs. The committee appreciated the extensive time these individuals and groups spent in preparing the material for the committee to examine before the review and for the time taken with the committee during the review itself. The committee also appreciated all the help and support provided by Holli Kihara and Wendy Pearson both before and during the review.

FINDINGS AND RECOMMENDATIONS

University-Wide Issues Affecting SOEST

- 1) SOEST is uniquely positioned to provide opportunities to learn about Hawaii's natural environment (geology, oceanography, meteorology, water and natural resources, and natural hazards) for all UHM undergraduates. Their courses encourage cross-disciplinary approaches to complex problems, provide a holistic view of the interactions in natural systems, and are highly relevant to major societal and economic issues facing the modern world. However, this extraordinary capacity is underutilized. The course requirements for undergraduates in the College of Arts and Sciences (they represent roughly half the undergraduate population at UHM) make it difficult for their students to take courses in Meteorology and Geology and Geophysics. As a result, only a single oceanography course (201) enrolls large numbers of students from the College of Arts & Sciences.

Recommendation: UHM should encourage the College of Arts and Sciences to recommend that their undergraduates consider taking advantage of the introductory geology and meteorology courses offered in SOEST. This will potentially have a cascade of beneficial effects

- The faculties in Geology & Geophysics (G&G) and Meteorology (M) have underused teaching capacity that can be utilized to good effect.

- The number of undergraduate majors in these disciplines will likely increase as many students are excited by their exposure to introductory courses.
 - More GTA positions (augmenting the currently insufficient 5 in G&G and 2 in Meteorology) will be required, allowing larger graduate programs, which will in turn help address an important problem - insufficient numbers of students populating graduate courses.
 - More graduate students will gain teaching experience, which will provide a competitive advantage if they end up applying for an academic position.
- 2) The maintenance of buildings and facilities is a source of great frustration to faculty, staff and students and clearly an impediment to the robust research programs in SOEST. Some researchers are expected to carry out cutting-edge projects in decrepit and overcrowded facilities and almost every group pointed to the inordinate delays associated with basic repairs.

For example, we observed a water fountain that has been nonfunctional for six years and a door in POST (image below) that has been broken more than seven years. We spoke with a senior faculty member who waited five months



for a response to repeated pleas to eliminate the fiberglass-containing particulate matter coming from the vents in her office ceiling. She became concerned enough about potential side effects that she moved out of her office. We were also made aware of a new faculty member with an active research program having to wait more than a year to use a laboratory that she was told would be completed and ready for her when she arrived at UHM.

We were also provided with additional examples in the HIG building that include labs occupied by HNEI where requests for maintenance and repairs go unheeded for excessively long times.



Researchers are also challenged to get new equipment installed. An especially impressive example is a \$150,000 battery testing machine (adjacent image) and associated chiller that sit unused. Remarkably, the initial request regarding installation of a 3-phase electrical circuit was made over one year ago. Other examples included fume hoods - complete with the necessary

vents and fans – awaiting installation in other HNEI labs.

These examples are in sharp contrast with the installation of HNEI's large fuel cell research facility that required renovation of an off-campus warehouse. Remarkably that renovation project was completed **by HNEI personnel** in six months.

Several members of our outside panel have headed active academic research programs and faced similar challenges involving facilities, repairs, equipment installations and preparing laboratory spaces for newly-hired faculty. None of us have ever encountered such extensive problems. It is important to note that the review team recognizes there are dedicated professionals who really care about SOEST and do everything they can to facilitate activities at SOEST. The problem seems to be tied up in a highly restrictive culture at UHM where state/union regulations dictate what different support groups are allowed to do. The result is a group of disillusioned and unhappy researchers who are spending an inordinate amount of time trying to complete their research. In one case 59 e-mails involving a single problem were exchanged. Suffice to say these activities are hindering progress and wasting valuable time in SOEST. Suffice it to say that bold action is needed.

Recommendation: There is a pressing need for active communication between the administration of UHM and SOEST administrators and faculty/staff regarding building maintenance, equipment installation and the establishment of a more supportive culture at UHM (see #10 under SOEST-Specific Issues). At the very least requests by senior faculty should be dealt with in a period of days not months, and commitments to incoming faculty should be honored. Failure to do so is squandering the considerable investment in intellectual capital; i.e. faculty. In short, the review team felt there was a real need to try to establish a sense of community in SOEST and

that a productive start could focus on the shared challenges and responsibilities involving facilities.

Recommendation: If UHM cannot provide maintenance and installation services in a timely manner, it should consider either outsourcing them or permitting units that have the necessary funding to use outside contractors.

3) The issuance of a purchase order for new equipment in excess of \$25,000 by UHM can take months for items put out for bid and longer for sole-sourced items that require a justification. The problem seems to be understaffing of the campus Procurement Office.

Recommendation: Increase staffing in the Procurement Office to reduce delays.

4) Considering Hawaii's high cost of living, UHM's compensation of graduate students is not competitive with top-ranked peer institutions and some SOEST departments are losing their top ranked recruits to lower ranked graduate programs. Furthermore, there is significant variance in pay among students at similar degree stages.

Recommendation: To attract and retain the most promising graduate students it is necessary to increase both the minimum and maximum stipend levels.

5) Postdoctoral employees are vital to SOEST's research success. Postdocs on stipends currently do not receive health insurance as part of their compensation, a policy that puts them and their families at risk and/or imposes a significant additional financial burden, especially for foreign postdocs whose visa requires them to have health insurance. The fact that HIGP post-docs are not UH employees creates an additional financial hardship because they are unable to qualify for travel advances.

Recommendation: To attract the best postdocs, it is necessary to include health benefits as part of their compensation packages. Further, UHM should consider a modification to their policies that will allow all post-doctoral fellows in SOEST to secure travel advances.

6) Graduate students are generally enthusiastic about their mentors, courses and the research opportunities available to them. However, there are examples of harassment that have prompted concern and reduced morale.

Recommendation: Regular and mandatory training for faculty and staff should be instituted throughout SOEST so that inappropriate behavior can be identified and reported. Graduate student handbooks should specify the procedures for dealing with harassment and a respected ombudsperson should be installed in SOEST.

7) A shortcoming for SOEST is the lack of an adequate endowment, which at present (~ \$6 million) covers a single endowed chair and two endowed graduate fellowships, including the recently created Denise B. Evans Fellowships in oceanography, that are administered by HIGP. For an internationally-acclaimed school this endowment is not only inadequate but far less than much smaller and less prominent programs in the United States. SOEST's research is directly relevant to almost every aspect of life on the Hawaiian Islands and thus provides an excellent opportunity for the school to begin building a more substantial endowment. It is also pertinent that many of their excellent outreach activities (C-MORE, HIMB, JIMAR, Sea Grant and Space Grant) with minority populations would interest foundations that could contribute substantially to SOEST programs.

Recommendation: In consultation with all 12 units, SOEST should develop a fundraising plan that addresses the needs of all their departments and research units. The University of Hawaii Foundation should provide at least one full-time development officer who will work with each of SOEST's Departments/Organized Research Units to build endowments that are critical for their respective units.

8) One of the great challenges for ocean and earth sciences is attracting, training and retaining a diverse group of researchers. In most graduate degree programs great strides have been made in entraining talented women, but there is still a need to have more women participating on university faculties. An especially daunting challenge for ocean and earth sciences involves the participation of minorities. Indeed there are a vanishingly small number of minority candidates participating in graduate degree programs throughout the United States and even smaller numbers of minority faculty in earth and ocean science. The lack of minority participation was evident in all of the departments that are part of SOEST, and it is obvious this is an area that needs to be addressed. The external review committee recognizes that effectively addressing the lack of native Hawaiians and Pacific Islanders in their graduate education programs represents an additional challenge for SOEST.

In light of what is an almost universal challenge to earth and ocean sciences, the review committee was impressed with the recent results of a cluster hire involving new faculty that will bring three new minority faculty to UHM. This is a significant start to addressing a glaring need, and we were impressed that the new faculty resulted from a collaborative effort among Hawaii Sea Grant, the College of Social Science, the College of Engineering, the College of Tropical Agriculture and Human Resources, the School of Architecture, C-MORE, the Department of Oceanography, the Department of Natural Resources and Environmental Management and the Department of Urban and Regional Planning. The committee thinks this extensive collaboration involving both academic and research units is an excellent model for moving this university forward. Clearly the new minority faculty will be important role models and mentors for young people at UHM. Creating a group of endowed fellowships for minority graduate students (see below) will provide SOEST faculty with some additional leverage to encourage some of the best and brightest young scientists to pursue an advanced degree at UHM.

Recommendation: A committee of interested faculty/personnel from each of SOEST's departments/ORUs should be appointed to focus on developing a plan to attract talented minority students to SOEST's graduate programs. The committee should also help develop a fundraising plan to endow several graduate fellowships to attract minority candidates. The hope is that this focused effort will not only attract minority students but also help position SOEST to capture multi-year funding from programs like NSF's Bridge to the Doctorate, that focus on minority graduate students. It is important to note that building endowments to support minority students will also position Hawaii to eventually attract long-term funding from the Sloan Foundation's minority program.

SOEST - SPECIFIC ISSUES

- 1) The research being carried out by SOEST faculty is truly excellent, and some of the facilities available to SOEST faculty and students rival those of the world's best universities and research institutes.
- 2) C-MORE, HIGP and HNEI are visionary, entrepreneurial institutes that are extending technological boundaries and significantly advancing research in their disciplines. Sea Grant and HIMB are highly collaborative, forward-looking units that have leveraged assets to build bridges across the UHM campus and into the community. Collectively these Organized Research

Units (ORU's) provide significant capacity and visibility for SOEST and could provide significant economic advancement to the State.

- 3) In view of an increasingly competitive federal funding environment, it is impressive that most ORUs are holding their own. Remarkably, one unit in SOEST is experiencing rapid growth (e.g. HNEI) but two (IPRC and HURL) are facing the possibility of serious cutbacks due to the loss of core funding.
- 4) The undergraduate programs in SOEST's three departments range from exemplary (Global Environmental Science in Oceanography) to very good (Geology & Geophysics) to struggling (Meteorology). In some cases insufficient attention has been devoted to SOEST's academic programs as manifested in:
 - A lack of a programmatic set of undergraduate course opportunities to attract majors and limited opportunities for SOEST to publicize its academic programs and become more integrated as part of UHM's educational programs.
 - A lack of coherence in the design, scheduling and delivery of departmental courses offered to majors.
 - Insufficient effort to ensure that core courses are regularly taught by the department's most effective instructors.
 - Uneven quality of student advising.

Recommendation: In view of its tremendous popularity with students, the Global Environmental Sciences (GES) program could serve as a model for enhancing the quality of other degree programs in the school and perhaps serve as a building block for designing an innovative five-year program leading to an MS that would provide students with a broad-based knowledge of environmental sciences, more specialized professional training and an individualized research experience in a supportive environment. Alternatively, an abridged version of the same curriculum might be offered as an undergraduate minor or as a basis for awarding a graduate certificate.

Recommendation: We support the department's efforts to expand the appeal of both its undergraduate and graduate degree program in Meteorology, by changing the name from "Meteorology" to "Atmospheric Sciences." This would provide a means of encompassing topics in the arenas

of weather and climate variability and enlisting the help of climate-oriented faculty in Oceanography who could share in the teaching of dynamics courses and the coverage of core climate-oriented topics.

- 5) The four graduate programs in SOEST offer wonderful research opportunities for students and in general these programs are very strong. The panel offers two specific recommendations to improve graduate education at SOEST.

Recommendation: Graduate programs in oceanography, meteorology, ocean and resources engineering, and geophysics often accept students with diverse academic backgrounds. The coursework for integrating such students into the discipline varies widely, but in general the review committee has concerns about the effectiveness of remedial courses. The department faculties are encouraged to weigh carefully how best to handle these transitions, judiciously ensuring that the students acquire the background needed for a career in the discipline while not overburdening them with extraneous coursework.

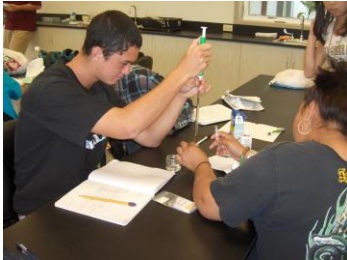
Recommendation: SOEST should require its departments to develop and subsequently publish course schedules at least one year in advance, paying attention to the cadence of courses needed for timely graduation and that they adhere to the schedules to the extent possible. Course scheduling is an especially critical issue for graduate courses.

- 6) The review committee noted that when being reimbursed for domestic travel to a scientific meeting, more than one graduate student found that the travel reimbursement funds were filed with the IRS on a 1099 form as “other income” and were thus taxable. At least one student apparently paid as much as \$1,000 in taxes on these travel reimbursement funds. The committee does not know the details of why the University reimburses students for legitimate travel in this way. The stipends for graduate students are already very low, and students should not have to pay unnecessary taxes on travel to scientific meetings.

Recommendation: Clear guidelines should be given to students who travel to professional meetings as to the procedures they should follow to avoid paying taxes on the legitimate reimbursements they receive for this travel.

- 7) SOEST’s impressive outreach programs (C-MORE, HIMB, JIMAR, Sea Grant, Space Grant) are well run, highly effective, involve extensive participation of k-12 students and teachers and have the potential to generate a life-long interest in science. An especially significant example involves C-MORE

where students from 46 Hawaiian middle schools (57% of all Hawaiian middle schools) have been exposed to ocean/earth science. At HIMB three members of the outside review panel witnessed a participatory laboratory exercise in ocean acidification that involved students and teachers from the St. Francis School. The images below involve earlier laboratory experiments at HIMB by Castle and Hakipu'u High Schools.



It is especially pertinent that each of the outreach programs adhere to the Hawaii Content and Performance Standards (HCPS III). The participation of underrepresented minorities in these outreach programs is especially important to our society and provides the University of Hawaii Manoa with a wonderful opportunity to become known for its ability to successfully stimulate a long-term interest in science and subsequently integrate minorities into its undergraduate and graduate programs. In short, the productive linkages that SOEST has had established by C-MORE, by HIMB, by JIMAR, by Sea Grant and by Space Grant with k-12 science programs throughout Hawaii provide a competitive advantage for all of SOEST's academic programs; undergraduate and graduate.

Recommendation: Given the competitive and challenging funding environment that exists at this university, it is important that these educational outreach programs are highlighted and marketed to legislators. Further, there should be a coordinated effort in SOEST to approach foundations that could offer financial support for these excellent outreach programs. The third part to moving these efforts toward sustainability involves raising both private and corporate funds that are used to build an endowment that can provide long-term support for these distinctive programs.

8) Departments should examine the tradition of selecting short-term rotating Chairs to lead a department. This is not intended as a comment on recent or existing chairs but rather a generic question on the efficacy of the style of management. The short tenure does not allow an individual to develop the political maturity to lead the department and protect its interests within SOEST and the administration as a whole. Because of the short-term

and minimal expectations, duties tend to be perfunctory rather than substantive or visionary. Reduced authority can lead to loss of stature for the department in SOEST or in University-wide negotiations or competitions. Short-term appointments also reduce the stimulus to engage individuals interested in a leadership commitment. In contrast, the directors of SOEST's research units typically serve in those positions for a decade or longer. Longer terms of service encourage stronger leadership by offering more time for acquiring on-the-job experience and helping units develop a vision. They also provide better continuity of leadership and a larger return on investments in recruitments and searches.

Recommendation: Departmental faculty should consider the option of making longer-term appointments of individuals with leadership potential within SOEST management and subsequently develop a set of goals for a person's tenure as chair

9) There is apparently no overall strategic planning for SOEST, and the strategic plans for many individual units, if they exist, are generally out of date. HIMB, HIGP and Sea Grant were the three units that actually had a current plan that was regularly used to benchmark progress. The lack of regular strategic planning at the SOEST level is unfortunate. An updated strategic plan that includes priorities would provide valuable guidance when deciding how new fiscal resources could be most effectively applied across SOEST and, perhaps even more importantly, would give fiscal guidance when there are funding shortfalls or rescissions. An integrated SOEST strategic plan should take into consideration the strategic plans of the individual units, leading to increased communication and collaboration among the departments, centers, and institutes within SOEST.

Recommendation: To maintain viable academic and research programs in the face of declining resources, SOEST faculty and other researchers will need to learn to work together as a team to a much greater extent than they have in the past. To this end, the Committee believes it is vital that SOEST faculty and staff undertake strategic planning activities centered around:

- Development of overall research priorities for SOEST;
- Curricular innovations designed to enhance the quality and attractiveness of SOEST's graduate and undergraduate degree programs and course offerings, cutting across departmental boundaries as needed to match disciplinary expertise with program needs and to ensure strong leadership; and

- New administrative arrangements designed to support and optimize the use of specialized facilities and technical staff.

10) A substantial challenge for every academic unit is effective communication within the unit. The challenges associated with adequately communicating between several university departments and schools are even more difficult. In light of the extensive number of interdisciplinary units (12) that are part of SOEST and their distinctive missions and physical separation, it is no surprise that these impediments have led to some groups feeling disconnected or unassociated.

Recommendation: There are a number of approaches to generating more extensive communication in SOEST and the committee does not pretend to know the best ways to facilitate this important process. The Executive Committee of SOEST should initiate a SOEST-wide discussion that addresses this knotty issue. One example of a modest start to improving things would include presentations by each of the unit leaders during the biannual meetings the SOEST Dean calls to provide updates.

11) Impending funding threats to SOEST include the costs of moving ship operations to a new and smaller harbor site, the costs of shifting fringe benefits for temporary faculty from G- to R-accounts, the impending loss of core NOAA funding to HURL, the loss of core funding for IPRC and the need to provide bridge funds to support Space Flight Lab personnel after the first launch.

12) The workload for administrative support has increased greatly, but the number of positions has not. Areas of frustration include hiring, facilities (see 2 under University-wide issues affecting SOEST, above) and processing of contracts. In addition to the hiring process being unacceptably slow, the administrative staff appears to be unaware of what salaries are in industry from which a high-powered research organization like HNEI needs to attract talent. The university's Broad Band System assumes that all new hires should start at minimum salary (Designated New Hiring Rate). An example is an offer turned down by a skilled potential employee who could earn more working in a bicycle shop. SOEST's administrative staff complained that they do not receive enough fiscal training, which may be an important contributor to the bottlenecks associated with processing financial transactions.

Recommendation: In order to facilitate the flow of hiring and contracts more personnel should be added in the realm of administrative support. The use of

paper files should be reduced by applying digital technology. The SOEST units that have their own funds should be allowed to negotiate salaries themselves.

Recommendation: Make training readily available for members of SOEST's financial staff, especially when procedures are changed. Technical personnel should be afforded opportunities for career advancement.

UNIT SUMMARIES

The review panel acquired substantive data for each of SOEST's twelve units by splitting the team into smaller focus groups, usually two, to review each unit. In each case the review groups met with members of the departments, research teams, their students and team leader. While the initial write-ups were largely developed from the meetings of our two-member review teams, the final detailed summaries that follow were developed after an extended discussion with our entire team.

- Center for Microbial Oceanography Research and Education
- Department of Geology and Geophysics
- Department of Meteorology
- Department of Oceanography
- Department of Ocean and Resources Engineering
- Hawaii Institute of Geophysics and Planetology
- Hawaii Institute of Marine Biology
- Hawaii Natural Energy Institute
- Hawaii Sea Grant Program
- Hawaii Undersea Research Laboratory
- International Pacific Research Center
- Joint Institute for Marine and Atmospheric Research

Center for Microbial Oceanography: Research and Education

The C-MORE is a stellar, nationally-prominent program at every level.

Director David Karl is a visionary and collegial leader who seeks and encourages collaboration both within and outside the center. He has successfully leveraged cross-cutting projects and positions that elevate the University's teaching and research profile. C-MORE faculty and post docs are well-aligned with the C-MORE mission and successfully compete for external funds that dramatically enhance C-MORE's intellectual and educational reach.

C-MORE undergraduate and graduate students are deeply engaged in C-MORE science and the C-MORE scholars program has successfully recruited underrepresented students into the biological sciences, motivating some to pursue advanced STEM degrees. This is an important accomplishment.

C-MORE outreach programs extend well into the community at the local and national level. Education director Bruno has excelled in developing activities and materials that conform to educational standards and attract students at all levels. The team is poised to develop new and creative modules and is highly motivated to pursue external funding to support them.

The C-MORE hale is an architecturally-distinctive tribute to smart architecture and energy design, and proof that construction projects, if well managed, can be successful on the UHM Campus.

The combination of high-profile science and an impressive record of accomplishment suggests that C-MORE can successfully attract private donors, foundation and corporate funds and this center should be highlighted as an asset in an expanded SOEST-wide development effort.

Recommendation: SOEST, the UHM, and the UH Foundation should make every effort to support the continuation of C-MORE, particularly as NSF support sunsets.

Department of Geology & Geophysics

G&G continues to retain its position as one of the leading earth science departments in the nation and this program of excellence extends over an unusually broad range of topics. The competitive success in gaining support and recognition on a national scale has helped G&G remain a magnet for high quality students. Further, the policy of providing student support from research grants allows the students to maintain a privileged position of participating as research partners during their graduate program. The intellectual strength is supported by an exceptional complement of laboratory facilities that is surpassed by few other earth science departments. The additional intellectual strength, disciplinary diversity and ready access to facilities with capable technical support provided by the close collaborations with HIGP colleagues makes for an unusually rich educational environment. The combination of a high quality faculty, comprehensive laboratory facilities and long-term support explains why G&G is able to select the best graduate students from a pool of high-quality candidates.

While the educational opportunities related to students' research were deemed excellent, there is not an effective graduate curriculum in place to strengthen the broader educational needs. The current offerings do not encourage students to become competent in the broad fundamentals of earth science. Course offerings tend to be based more on ad hoc needs that are decided by research advisors rather than a comprehensive curriculum that has been negotiated with full faculty participation. Advance scheduling and a reasonable cadence of courses would be of great help.

Recommendation: The faculty should reconsider the graduate curriculum with an emphasis on ensuring some breadth in the fundamentals of the earth sciences and a regular cadence of courses.

The undergraduate geology major is proceeding satisfactorily. However, the current low enrollment reduces opportunities to interest students in the earth sciences, isolates G&G from students in other science departments, and makes G&G less competitive in the allocation of teaching assistantships.

Recommendation: There should be a focused effort to develop introductory course offerings that would attract more students from the College of Arts & Sciences.

Department of Meteorology

The Department of Meteorology is a faculty of 12 and although they have recently hired two active young faculty members, the remaining faculty members are quite senior. Within a few years the department will be facing decisions about focal areas for new faculty so this is an important time to begin strategic planning and thinking for the future. Indeed strategic planning is particularly important at present because the department is in the process of changing its name from Meteorology to Atmospheric Sciences, thus implying a broadening of research and teaching emphases in the future. We note with dismay that there appear to be few, if any, faculty members within the department who are able and willing to take on the responsibilities of chair.

The department currently has only 12 undergraduate majors, and these numbers have been decreasing in recent years. There is concern that this undergraduate program may not be sustainable unless additional students can be enrolled. There are roughly 15 M.S. students and 15 Ph.D. students, and these numbers appear to be stable and sustainable though smaller than optimal.

In discussions with the students it is evident that they clearly respect the scientific expertise of the faculty and believe that many of them are involved in cutting edge research. Students at all levels believe that faculty are generally respectful, accessible and want them to succeed. There is concern among the faculty that the students do not come to the faculty for advice in course selection and program development. For some students, this important function is apparently being carried out by SOEST professional staff rather than by Meteorology faculty, and the students and faculty were not happy about this.

At both the undergraduate and graduate level there is general concern that the curriculum available to students is very thin. The undergraduate program is marginal in satisfying requirements for National Weather Service certification, and core courses in areas such as atmospheric dynamics are limited. Further, there are no courses in atmospheric chemistry. Students are sufficiently dissatisfied with one or two of the instructors that they are unwilling to register for those instructors; even for core courses. A few of the undergraduate students also reported problems in understanding the diction of several of the instructors. On the other hand, many of the same students also cited examples of excellence in departmental instruction. Despite their reluctance to register for undergraduate thesis credit, most of the

undergraduates interviewed by the committee indicated that they would like more opportunity to undertake research.

Graduate students also indicated a need for more courses in some areas. For example, there is no advanced synoptic meteorology course that is taught regularly. Students felt the statistics course should place greater emphasis on meteorological problems and less on the mathematical background. Meetings of graduate students with their committees appeared to be relatively few in number and irregular. Students cited several instances in which insufficient attention is given to the scheduling of courses. In particular, there is insufficient notice given as to what courses will be offered in subsequent semesters. Students also indicated a concern about a lack of coherence in courses that are being taught by more than one instructor.

In geoscience departments at leading research universities prioritizing research and teaching is a delicate balancing act. Based on student comments, the program review committee believes that many of the faculty in the Meteorology Department are not devoting sufficient time to the academic program. A number of the Ph.D. students indicated their desire to get experience in teaching through teaching assistantships. However, there are only two such assistantships available, and these go to M.S. students.

Recommendation: The faculty should hold a retreat to discuss:

- 1) Strategic planning for the future research and hiring priorities of the department;
- 2) Curriculum issues that focus on developing an up-to-date and coherent curriculum for both undergraduate and graduate programs; and
- 3) Departmental procedures that address student concerns about the scheduling of courses and the quality and continuity of academic guidance for students.
 - Discussions should be initiated with physical oceanographers in the Department of Oceanography to explore synergies with regard to curricula and academic program implementation, especially in the climate area.

Department of Oceanography

The Department of Oceanography consists of 37 faculty representing physical, biological and geological oceanography, and marine geochemistry. The faculty are recognized internationally and are part of important research initiatives such as GEOTRACES, HOTS, CLIVAR, C-MORE, etc. The department is also home for the Global Environmental Science Program that regularly attracts a number of talented undergraduates. The head of the undergraduate program is a dedicated and excellent mentor.

The department has a stellar cadre of graduate students and has graduated a number of eminent alums. Most graduate students are satisfied with their advisors, and feel that the environment is rich and stimulating. However, the time to degree completion is a source of frustration. Several students felt that the burden of coursework is excessive and that the Department does not give credit for relevant courses or experiences elsewhere. Given the number of required courses for a M.S. degree (at least 8) and the thesis requirement, it's not surprising that M.S. students take 3-4 years to finish. Students also indicated that some advisors are lax with respect to the frequency of committee meeting requirements (once per semester).

Recommendation: Review the course load for graduate students and consider a waiver of requirements when disciplinary competence is evident. Ensure that students meet with committees as required so that adequate progress toward a degree is made.

Unfortunately, the recent retirement of key faculty in atmospheric chemistry and chemical oceanography has left critical gaps in the department's graduate education program that need to be addressed. Especially troubling is the loss of two atmospheric chemistry faculty members, a field where Hawaii has had a long history of leadership at the national and international level. The state's central Pacific location is ideal for studying many of the critical global scale issues where atmospheric chemistry plays a central role, including global climate, the oxidizing capacity of the atmosphere, long range intercontinental transport of anthropogenic and natural material and their deposition to the ocean, volcanism as a source for atmospheric chemicals, etc. Faculty in both the IPRC and the Meteorology Department have indicated a strong need for atmospheric chemists who will interact with their programs.

Recommendation: We recommend that replacements for these faculty in atmospheric chemistry be found as soon as possible.

The uncertainty of gaining new positions, the poor condition of buildings, and lack of janitorial services have contributed to low morale among the Oceanography faculty. Further, there is a sense of isolation and lack of transparency in how funds and positions are allocated. In fact, it was clear during our review that frustration is mounting and may result in loss of key faculty members. This is a serious issue that must be addressed on multiple fronts:

Recommendations:

- 1) Upgrade and repair facilities as quickly as possible.
- 2) Develop a vision and strategic planning process that cuts across the research divisions and provides a realistic road map for the department's future.
- 3) Request that the chair engage the Dean in the planning process so that administrative efforts are not viewed as "time wasted."

Department of Ocean and Resources Engineering

ORE is a small, graduate-only department of seven faculty members. An offer has been made to a coastal engineer to replace a highly productive person who accepted a position on the mainland. There are 13 cooperating faculty members in other research and academic units. Faculty expertise within ORE itself is broad within ocean engineering and resources. Only one of them is a registered Professional Engineer in the State of Hawaii. The faculty members are doing interesting research of value to Hawaii and have an adequate record of research publications.

There are currently 21 M.S. and 12 Ph.D. students in ORE. Nearly half of the graduate students are foreign, from eight countries. The department boasts 100% job placement for its graduates.

The most recent (2010) review of the Accreditation Board of Engineering and Technology (ABET) gave ORE its highest level of accreditation. This was the highest of any of the five engineering programs at UHM. The ABET accreditation will be done again in 2015 for which the department will prepare a new strategic plan. The department will also be preparing for its 50th anniversary celebration in 2016. ORE anticipates about 20% growth over ten years and they are planning for 10 faculty, 60 students and 20 staff.

Because the department lacks an undergraduate program, there is only one MS and one PhD GTA so there is little opportunity for graduate students to have teaching experience. If the department had an undergraduate program, it would be a feeder into the graduate program, create opportunities for more GTAs and create an opportunity to expand the department's coverage in a field that is vital to the state of Hawaii.

Since the Look Lab was closed in the late 1990s, the department has lacked an experimental hydraulics lab (e.g., wave flume) that is integral to teaching and research. As a result, students and faculty have to travel elsewhere to test their computer-created models. Remarkably, ORE is the only ocean engineering department in the country without an experimental laboratory. One Ph.D. student observed that "We are ocean engineers but don't have ocean engineering equipment." The university also lacks a High-Bay Staging Area on campus for assembling and testing large pieces of equipment that are being prepared for deployment at sea. Significantly, both facilities (wave flume and High-Bay Staging Area) could be shared with the College of Engineering. It is recommended that the department work with the Deans of SOEST and the College of Engineering to establish these laboratory facilities.

The insufficient mathematics background of incoming graduate students has been a perpetual problem. Starting in September, the department will have a required math course taught by one of its own faculty members who is an applied mathematician. The courses in the Department of Mathematics are deemed too theoretical.

The graduate students considered the faculty to be good to excellent although some internal conflicts were noted. Many complained of a lack of interdepartmental interaction. The lack of experimental facilities restricts research projects and most of the students are involved in modeling. To compound things the computers used for modeling are old and slow. Further, the library system is inadequate with limited hours of operation. Faculty and students are plagued with poor holdings of electronic subscriptions which restricts their online access to important journals. The graduate students complained that their physical space is poor: no meeting room; no student lounge and crowded offices with very old furniture and no windows. Further, a number of students are scattered about the Manoa Campus, which inhibits interaction with other students and their faculty.

Recommendation: Efforts 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.

Hawaii Institute of Geophysics and Planetology

HIGP is an unusual example of a research institution that successfully expands its base of excellence through entrepreneurial vision. The style reflects the earlier successful expansion of the development of new tools and facilities for marine geophysics. Such an approach promises exceptional new opportunities for research, support of a highly trained and capable technical and specialist staff, and the nucleation of new business opportunities in Hawaii.

HIGP has retained a leading role in a number of research areas, spanning from the deep interior of our own planet, its volcanic, oceanic and atmospheric veneer, to other bodies in the solar system. Its remarkable success is based on an exceptional research faculty supported by truly excellent facilities and the support of talented technical specialists. Moreover, the Hawaii Space Grant program, which is administered by HIGP, is a national model for effectiveness. HIGP is a jewel among SOEST's many fine programs.

The primary concerns are programmatic and result from threats to continued financial support from SOEST and UHM. Current politically mandated plans to convert support for "temporary" faculty from G accounts into R accounts that do not include benefits would transfer a significant financial burden onto HIGP. The UHM administration needs to ensure that this burden is not solely borne by the institute. HIGP is preparing for the first launch by its Space Flight Lab. This potentially will provide exceptional research and educational opportunities to UHM, an infusion of funds to UHM and a new industry for the State. However, in the gaps between subsequent launches bridging funds will be necessary to support research and technical staff. Cecily Wolf, who has played a major public role as an expert in local seismic hazards, will be leaving HIGP to help lead the USGS' earthquake hazards program. It will be essential to find a replacement for this position.

A question was raised about clarifying the role of marine geology in an oceanography institute. While the review team appreciates the important role of this discipline, it is our understanding that the HIGP strategic plan focuses on developing new instrumentation and methods for conducting marine geology studies, and that the marine geology research may be more properly focused in G&G.

Comment must be made on the mutual support provided by HIGP and G&G. The complementary emphases in research and education make the combined

G&G and HIGP capabilities at SOEST among the very best in the nation. This complementarity is important, although HIGP faculty should continue to cooperate in teaching and mentoring graduate students and G&G should continue to produce excellent research. In short, this is a flourishing partnership that warrants continued support.

Hawaii Institute of Marine Biology

The Hawaii Institute of Marine Biology is a unique field and research facility that offers unparalleled access to compelling natural environments and organisms that inhabit both coastal and deep environments. The faculty are highly motivated and collegial, and the intellectual environment is both collaborative and cooperative. HIMB graduate students are highly accomplished, and the alums include several NSF graduate fellows and one MacArthur fellow. Unfortunately, HIMB faculty have restricted 'affiliate' privileges at other UHM units, precluding full participation in SOEST graduate education.

Recommendation: Consider elevating the privileges of affiliate status of HIMB faculty within SOEST.

HIMB research topics are locally and nationally prominent, with significant implications for environmental sustainability. HIMB leverages this with compelling outreach programs. From ocean acidification to aquaculture, coral disease, and marine food webs, students of all ages can learn about their environment and its relationship to human health and well-being. HIMB's efforts to engage local communities are commendable and likely to have significant, positive downstream impacts.

Recommendation: HIMB is a significant asset that has considerable possibilities for donor cultivation and philanthropy. It should receive considerable attention from the UHM development office.

HIMB faculty and staff have high confidence in Director Leong. Her efforts to build consensus, to operate in an open, transparent manner, and to be decisive are broadly appreciated. She effectively works with the legislature. Her efforts to build a strategic plan and include input from faculty and staff provide a compass for HIMB. Dr. Leong is an effective leader and can serve as a role model for others within SOEST.

Unfortunately, HIMB's aging facilities and infrastructure are in a significant state of disrepair. Unlike other organized research units, HIMB bears the financial burden of facilities maintenance, janitorial duties, transportation, and landscaping. Funds from overhead return are used to meet these significant responsibilities. As a result, HIMB cannot use overhead funds to increase its research, education or outreach capacity. While Director Leong has been able to secure funds for some repair and renovation, significant

additional challenges remain. The run-down state of facilities is not conducive to attracting the support of donors or foundations.

Recommendation: HIMB should receive immediate additional support for repair and renovation.

Recommendation: HIMB should receive facility support from main campus, as it is a UHM unit.

Hawaii Natural Energy Institute

HNEI is an Organized Research Unit in SOEST conducting research into alternative energy sources. This highly innovative and motivated group is led by Dr. Richard (Rick) Rocheleau, a chemical engineer. Their research provides an essential service to the state and country as Hawaii struggles to contain its energy costs and the United States strives to reduce its use of fossil fuels.

Extramural funding is excellent; in excess of \$25 million per year for the past couple of years and rising. It comes from a variety of sources: DOE, ONR, NSF, a \$0.10 Barrel Tax on imported oil and others. Several grants are in the multi-million dollar range. Significantly, a \$19 million grant for fuel cell research was received this April. The institute has a number of public-private partnerships that benefit the university and small local businesses.

HNEI occupies scattered spaces on and off campus. The off-campus facility (in Honolulu) for fuel cell research is of moderately high quality. The labs in the POST building are adequate. The labs in the older HIG building are generally in poor condition and crowded. The scattering of the research personnel among the three buildings is not conducive to effective interaction.

Recommendation: Work with the Dean to consolidate labs into a single building with, if necessary, renovated space.

HNEI is unusual in that their seven tenured faculty have appointments within the institute and not in a department. An additional 22 temporary faculty, two senior staff and nine APT researchers are funded by external grants. The graduate students considered the faculty to be well informed and helpful. Several of the HNEI tenured faculty are chemical engineers and yet there is no chemical engineering department within the College of Engineering, a seeming anomaly for a university. The three attempts to institute a Department of Chemical Engineering have failed seemingly because of "turf" issues.

Recommendation: Try again to create a Department of Chemical Engineering, perhaps within an existing engineering department.

There is severe frustration among the HNEI researchers with the bottlenecks created by the Office of Technology Transfer and Economic Development (OTTED) with patenting, with the Office of Research Services in processing grants, with the Campus Procurement Office for the purchase of expensive items of equipment and with the UH Broad Band System in hiring research

staff. Hiring of APT personnel is particularly difficult. Chancellor Apple is addressing this latter issue.

HNEI is not taking full advantage of patenting their discoveries.

Recommendation: Be more diligent in applying for patents. If the university cannot accommodate an increased demand, HNEI should consider hiring its own patent officer.

Recommendation: As a means of generating additional funding, HNEI should consider spinning off businesses from mature projects with high societal relevance/demand.

Hawaii Sea Grant Program

The Hawaii Sea Grant Program is outstanding, clearly one of the top two Sea Grant programs in the nation. The organization of Sea Grant into five Centers of Excellence (Center for Smart Building and Community Design, Center for Sustainable Coastal Tourism, Center for Marine Science Education, Center for Island Climate Adaptation and Policy, and the Center for Sustainable Aquaculture) is unique within Sea Grant, and this has been designated a National Best Management Practice by the National Sea Grant Office. These centers have developed partnerships across schools and colleges throughout the University, thus enabling the resources and expertise of the University's broadly based faculty, students and staff to focus on these multi-dimensional issues that are of such importance to the people of Hawaii. In addition, Hawaii Sea Grant has partnered with state and local governments as well as private groups in the development of their outreach programs. Sea Grant is highly visible and appreciated by the citizens of Hawaii, with outreach programs on almost all of the islands. The leadership of Hawaii Sea Grant has been tremendously successful in leveraging the Sea Grant's federal funding by almost threefold in recent years, thus significantly expanding their capabilities and programs. The University has recently recognized the excellence of Sea Grant and its programs by awarding it seven new general-funded faculty positions in a competition with 17 other departmental proposals. Sea Grant serves as a model for collaboration across school and college boundaries with this joint effort among C-MORE, the Department of Oceanography, the Department of Urban and Regional Planning, the Department of Natural Resources and Environmental Management, the School of Architecture, the College of Social Science, the College of Engineering and the College of Tropical Agriculture and Human Resources.

Recommendation: Hawaii Sea Grant is outstanding, and we recommend that it continue its very effective cooperative and collaborative programs in coastal sustainability in the future.

Hawaii Undersea Research Laboratory

HURL operates an ocean-going ship, Kaimikai-o-Kanaloa, from which are deployed two 2000 meter-capable occupied Pisces submersibles. A 6000 meter-capable remotely operated vehicle (ROV) is soon to be delivered. The ROV will allow for 24 hour operations with Pisces dives during the day and ROV dives at night. It is anticipated that business will increase because of the ROV. HURL's submarine base during diving season is at the Makai Research Pier on the north side of Oahu. HURL also manages wet diving (snorkel, SCUBA rebreathers) research funded by NOAA's Coral Reef Conservation Program.

HURL Director, John Wiltshire, is a Professor and the Associate Chair of the Department of Ocean and Resources Engineering. He teaches resource engineering in ORE. HURL's Chief Engineer also does some teaching.

HURL is the only U.S. deep submergence facility on the Pacific Rim and currently the only one worldwide that can deploy two submersibles at the same time for film-making and special research projects. HURL also hosts an annotated benthic ecology database derived from 9,300 hours of in-house video logging 125,000 entries of 1,100 unique deep sea animals in Hawaiian and other waters. This Data Center provides an exceptional national service. There are 16 employees at HURL, some of whom started at SOEST as students so loyalty is strong. The work is exciting and the morale is good despite impending financial problems that are discussed below. There has been no turnover in personnel since 2002.

HURL is heavily involved in local, national and international outreach. For example, Discovery Channel has filmed documentaries using the two Pisces submersibles for which they pay only the going day-rate and not base salaries.

Recommendation: This qualifies as too good a deal for a commercial venture like Discovery Channel. With HURL being the only group in the Pacific capable of two submersible operations the Discovery Channel should be charged the actual operational costs. To continue the current practice puts the University of Hawaii Manoa in the position of subsidizing an outside business.

HURL is refurbishing its 49-foot towed launch, recovery and transport (LRT) vehicle for deploying the Pisces submersibles. Its use will reduce dive costs substantially because much smaller vessels than the Kaimikai-o-Kanaloa can be used and dives can be made at higher sea state but its use limits diving

operations to near shore Hawaiian waters. The Kaimikai-o-Kanaloa will still be needed for long distance operations.

HURL faces a severe financial problem with NOAA's elimination of its National Underwater Research Program (NURP) that was providing about three quarters of HURL's base funding. The two last-standing NURPs, Mississippi and HURL, will share a \$4 million Senate appropriation within the Ocean Exploration and Research program in one-time-only funding this fiscal year but Hawaii's congressional delegation is making efforts to secure equivalent funding for FY 2014.

Recommendation: With its future so seriously compromised, it is imperative that HURL urgently develop a plan for its continued funding.

A second problem that HURL faces, together with other SOEST marine units, is the move from Pier 45 (Snug Harbor) to Pier 35 and all of the uncertainty surrounding this move. HURL requires permanent space for some of its people and temporary space for the dive team when out of season. UH senior administration is familiar with the Snug Harbor issue and is working with the State Department of Transportation to resolve the problems resulting from the enlargement of the port's container handling facility.

A third uncertainty in HURL's future is how it will conduct science. Previously, it has been a service organization providing dives for clients at the clients' or NOAA's expense. Henceforth, HURL will take the lead in proposing exploration missions. Whether this will improve HURL's lot or not, remains to be seen.

International Pacific Research Center

The IPRC provides a focal point for climate-related research within SOEST and a meeting place for scientists in the Meteorology and Oceanography departments. Its research program continues to be of the highest quality.

Since its establishment in 1997, the IPRC has fostered collaborative research between U.S. and Japanese scientists. It has provided UMH climate scientists with access to state of the art supercomputer facilities in Japan and it has hosted numerous Japanese scientists who come to UMH as postdocs and short term visitors. In recent years the IPRC has developed stronger ties with research programs in Korea, China, and other Asian nations. The IPRC was established on the basis of a generous grant from the Japanese government, and it has enjoyed generous ongoing block funding from that source matched, in part, by U.S. block funding administered through NASA and NOAA. With funding from these sources augmented by a growing number of competitive research grants, the IPRC has enjoyed steady growth and its presence has benefited the participating departments within SOEST.

As a consequence of the prolonged economic downturn and a shift in research priorities in Japan, IPRC's Japanese funding agency, JAMSTEC, has announced its intention to drastically reduce and perhaps eliminate the block funding that it provides to the IPRC. Coincidentally, the funding provided by NASA and NOAA is shifting from block grants to competitive grants. Given the present funding climate, these changes are likely to result in a substantial downsizing of the IPRC and they will require the University to take responsibility for increasing the funding of the eight remaining IPRC faculty from half time to full time. If the IPRC is to survive as a viable entity, funding mechanisms will also need to be identified to support key technical and administrative support staff.

The current IPRC Director has made a heroic effort to persuade JAMSTEC to continue to provide the equivalent of block funding for the IPRC, albeit at a reduced level, and to identify other potential funding sources. Increasing funding of IPRC scientists through competitive grants is taking up some of the slack and thus far the SOEST Dean as well as the Chancellor and President have been generous in providing bridge funding.

Recommendation: In view of the many ways in which the existence of the IPRC benefits SOEST, maintaining core staff in this time of budget stringency should be a high priority for SOEST. Over the course of the next few years, a

concerted effort should be made to identify sustainable block funding for core staff.

Joint Institute for Marine and Atmospheric Research

JIMAR continues to provide a mechanism for UH-NOAA research collaborations that are highly beneficial to both parties. The University benefits from core (Task I) funding for postdocs and visitors, by Task I contributions from cooperative NOAA-UHM (Task II) projects funded through JIMAR, and by the convenience of having NOAA-funded, Task III research projects of UHM faculty administered through JIMAR (which provides indirect cost return). JIMAR scientists conduct outreach programs involving variations in sea level, ENSO impacts, and monitoring the health of marine ecosystems, and tsunami preparedness that benefit the inhabitants of US territories throughout the tropical Pacific.

Within SOEST, most of the collaborative projects funded through JIMAR involve faculty and staff in the Meteorology and Oceanography departments. Thus far, NOAA's cooperative institutes have been largely spared from the impacts of funding cutbacks within NOAA and JIMAR's research funding has remained stable. The following recent developments regarding JIMAR are worthy of note:

- JIMAR's cooperative agreement has been renewed as a result of a recompetition process that was carried out in 2011. The terms of the new NOAA/UH memorandum of understanding are similar to those in the previous one.
- The newly established graduate program in Marine Biology, housed in the College of Natural Sciences at UHM, provides a much-needed linkage between UHM graduate students and NOAA and JIMAR scientists specializing in Fisheries Science and Marine Biology.
- Later this year, about 100 of the JIMAR staff in Fisheries Science that have been housed in the Pacific Islands Fisheries Science Center (PIFSC) Building on the UHM campus are scheduled to move to NOAA's Ford Island campus near HNL Airport.

Recommendation: To facilitate continuing interactions between JIMAR staff and NOAA scientists housed on the Ford Island campus and UHM faculty and graduate students it will be necessary to retain a suite of offices to house short term visitors, including some foreign nationals who will not be able to be housed at Ford Island.