Review of the Graduate Programs

in the

College of Engineering

University of Hawaii at Manoa

Prepared by:

Graduate Program Review Committee

Marc Donohue, Professor
Department of Chemical and Biomolecular Engineering
Johns Hopkins University

Pui Lam, Professor and Chair
Department of Physics and Astronomy
University of Hawaii, Manoa

Sheryl Nojima, President
Gray, Hong, Nojima and Associates, Inc.
Consulting Engineers
Honolulu, Hawaii

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Executive Summary

This report presents the findings and recommendations of the ad hoc Review Committee’s assessment of the graduate programs in the College of Engineering at the University of Hawaii, Manoa (UHM), pursuant to the University of Hawaii’s Executive Policy E5.202. The Review Committee is pleased to report that despite the University’s severe budget constraints, the graduate programs in the UHM College of Engineering remain strong and continue to fulfill a definite need. Two key strengths are the quality of the faculty and the graduates of the respective programs:

- Industrial and government employers find the College’s graduates to be well trained and as capable as students from the top engineering schools in the country.
- Most faculty members are actively engaged in research and are supervising graduate students.

Though parts of this report are critical, the Review Committee is impressed with the overall quality of the programs and provides these criticisms as constructive suggestions for how to make the College even stronger than it currently is. The following is a summary of the Committee’s recommendations that were also shared with the Dean and the Department Chairs during the Committee’s campus visit in March 2012:

- Continue efforts to increase research productivity, including the Dean’s plan to enhance the College research by emphasizing eight research clusters where the College has unique strengths.
- Review faculty workload policies to provide more distinction between the lowest and highest levels of teaching, research, and service contributions.
- Shift the enrollments in the graduate programs from Master’s students to Doctoral students such that the ratio of Master’s to Doctoral students is more balanced.
- Re-examine the structure and Plan A/Plan B requirements of the M.S. program to enable more reasonable completion times and to better accommodate working professionals.
- Increase graduate student stipends so that recruitment and retention can be improved.
- Provide more graduate-level courses.
- Update graduate program brochures and improve student advising/mentorship.
- Develop an overall space plan that considers existing space inventory and usage in Holmes Hall as well as projected requirements to accommodate future faculty hires and equipment needs.
- Provide sufficient administrative staff for each department.
Introduction and Purpose

Pursuant to the University of Hawaii’s Executive Policy E5.202, periodic review and evaluation of established academic programs is to be conducted. This report presents the findings of the ad hoc Review Committee asked to review the graduate programs in the College of Engineering at the University of Hawaii, Manoa (UHM). The Review Committee was appointed by Patricia Cooper, Dean of the Graduate Division, and arrangements for the review were made by Kenneth Tokuno, Associate Graduate Dean.

The Review Committee was asked to identify the strengths and weaknesses of each program and make recommendations regarding any facet of the College’s degree programs as a whole or by program that the Review Committee felt important.

College of Engineering at the University of Hawaii, Manoa

The College of Engineering has three departments: Civil and Environmental Engineering, Electrical Engineering, and Mechanical Engineering. The College has 53 faculty (51.5 FTE), about 60 Doctoral students, 144 Master’s students, and 816 undergraduate students. The following data are reported by the respective departments for the 2011-12 academic year:

- The Department of Civil and Environmental Engineering has a total of 17 faculty (9 full professors, 6 associate professors, and 2 assistant professors), of which one full professor is at 0.5 FTE and one associate professor is at 0.5 FTE. For AY 2011, there are 19 Doctoral students, 62 Master’s students, and 292 undergraduate students. Professor Papacostas is the Department Chair and Professor Babcock is the Graduate Program Chair. The Department has 5 staff: a departmental secretary, a graduate secretary, two technicians, and an Environmental Engineering research support staff.

- The Department of Electrical Engineering has a total of 21 faculty (9 full professors, 8 associate professors, and 4 assistant professors), of which one associate professor is at 0.5 FTE. Furthermore, one full professor, Vassilis Syrmos, is currently the Associate Vice-Chancellor of Research and Graduate Education, and one full professor, Peter Crouch, is the Dean of the College. For AY 2011, there are 30 Doctoral students, 38 Master’s students, and 284 undergraduate students. Professor Kuh is the Department Chair and Professor Kavcic is the Graduate Program Chair. The Department has 4.5 staff: a department secretary, an IT support person, two technicians, and half a secretary who is shared with the Department of Mechanical Engineering but resides in the Dean’s Office. The Hawaii Center for Advanced Communications (HCAC) was part of the EE Department but has since become an independent research unit. The HCAC is headed by Magdy Iskander, a tenured full-professor in Electrical Engineering.
The Department of Mechanical Engineering has a total of 15 faculty (5 full professors, 3 associate professors, and 7 assistant professors). One associate professor, Bruce Liebert, is the Interim Associate Dean for Academic Affairs. For AY 2011, there are 11 Doctoral students, 44 Master’s students, and 240 undergraduate students. Professor Nejhad is the Department Chair and Professor Chao is the Graduate Program Chair. The Department has 3.5 staff: a department secretary, two technicians, and half a secretary who is shared with the Department of Electrical Engineering but resides in the Dean’s Office.

In addition to the Master’s and Doctoral graduate programs, each of the departments offers an undergraduate engineering degree program accredited by ABET, Inc. It should be noted that the Department of Electrical Engineering recently added a second baccalaureate program in Computer Engineering for which they will be seeking ABET accreditation.

The College is led by Dean Peter E. Crouch. Professor Bruce Liebert is Interim Associate Dean for Academic Affairs. Dr. Song Choi is Assistant Dean (Outreach – K12, Industry, and International). The College’s administrative staff in the Dean’s Office includes Isaac Fujioka (Senior Administrative Officer), Linda Uyeda (Account Clerk), Danielle Wong (Administrative officer), Sheree Hashimoto (Extramural research), Gail Yamamoto (Administrative Support – fiscal support for EE and ME), Alan Nakamura (Personnel Clerk) and Lori Yuu (Secretary - undergraduate students).

The number of faculty in the three departments is relatively small compared to those of peer institutions. A compiled data for 2010 by ASEE is shown in the Appendix, Table 1. It should be noted that these headcounts may differ slightly from that reported above by the departments for the 2011-12 academic year due to recent hiring, resignations, promotions, etc.

**Review Process**

In preparation for this report, the members of the Review Committee received and studied information provided by the College and Departments including each department’s self-study as well as faculty CVs. The Review Committee members met with the Dean and Interim Associate Dean, Department Chairs, Department Graduate Chairs, members of the faculty, graduate students, and a group of corporate and government representatives. These meetings took place on March 20 and 21, 2012. Finally, the members of the Review Committee requested additional information from the departments and College that they felt important in providing this evaluation.

Before presenting our results, there is one issue that should be mentioned as we believe it colored several of the discussions the Review Committee had with the College’s constituents. This issue concerns the rather severe budget constraints that the College and the University have faced in recent years. While the members of the Review Committee recognize that these issues are beyond the control of the Dean and University Administration, it is not clear that the faculty in the College of Engineering understand
this. Consequently, it has led to a fair amount of discontent amongst the faculty, which, in some cases, is detracting from both the teaching and research missions of the College as indicated in this report. It will take considerable leadership on the part of the Dean and University Administration to remedy this situation. While this report makes several recommendations that will require additional funds to implement, we recognize that current fiscal realities may prevent this from happening in the immediate future; nonetheless, we make these recommendations to help put the College’s needs into context.

Review Committee Findings

This report is divided into seven sections: Graduate Programs, Graduate Student Quality, Faculty Quality, Research Funding and Research Clusters, Communication Issues, Resource Issues, and Conclusion.

I. Graduate Programs

It is evident that the Master’s and Doctoral programs in all three departments of the College of Engineering are of high quality and are serving the needs of the State of Hawaii and the Country. All three departments (Civil and Environmental Engineering, Electrical Engineering, and Mechanical Engineering) have robust graduate curricula and are doing innovative and important research.

The Review Committee met with a group of about 20 representatives from local engineering firms, corporations, and government agencies (including the Naval Pearl Harbor Shipyard and the U.S. Army Corps of Engineers). The group both affirmed the importance of the College’s graduates to Hawaii’s economy and indicated that they had strong preferences to hire UHM graduates over graduates from mainland universities. They also indicated that the on-the-job performance of the College’s graduates is comparable to those of the Country’s top engineering schools including MIT, Stanford, and UCLA.

In addition, the relatively high enrollment of local students in the Master’s programs demonstrates that there is a demand for the College’s programs by the State’s population. Since the UHM College of Engineering is the only school in Hawaii to offer degrees in these three disciplines, without it the State’s engineering students would have to go out of state to receive graduate training and quite possibly would not return to Hawaii. Such a “brain drain” (particularly in the field of civil engineering) would have a significant negative impact on the State’s construction industry and economy.

Finally, as with other research universities, having a graduate program enables the faculty to actively engage in research and helps them to keep current with advances in their fields and cutting edge technologies. Such continuous updating and upgrading of the faculty’s skills and knowledge is essential to providing a relevant education to students in a rapidly evolving field such as engineering and helps the University of Hawaii fulfill its mission.
as a Research 1 university. The following are findings and recommendations specific to degree programs:

- **Proportion of Master's and Doctoral Students**

It was noted by the Review Committee that the number of Master’s students is much larger than the number of Doctoral students, especially in Civil Engineering and Mechanical Engineering. Civil Engineering currently has 62 Master’s students and 19 Doctoral students while Mechanical Engineering has 44 Master’s students and 11 Doctoral students. Electrical Engineering currently has 38 Master’s students and 30 Doctoral students.

The Review Committee recommends that the ratio of Master’s to Doctoral students in the College should be shifted from such a strong emphasis on Master’s education to one that is more balanced. The Review Committee believes that this would improve the research productivity of the faculty without increasing the costs to research grants and contracts because Doctoral students devote a much larger fraction of their program toward research than do Master’s students. Electrical Engineering has begun to move in this direction. We suggest that Mechanical Engineering consider examining this approach as well. Civil and Environmental Engineering has a different profile of funded and unfunded projects, but increasing the fraction of their research funds devoted to Doctoral students versus Master’s students also would be beneficial.

- **Types of Master’s Programs Offered and Time-to-Degree**

Another issue concerns the types of Master’s degree plans in the College of Engineering. The Review Committee interviewed a number of Master’s students from each department, and found that there are confusions among some students on what was being expected from students who were in Plan A from those who were in Plan B. The Committee also found that the programs do not distinguish those who were working full-time on their Master’s degree from those who were working only part-time on their degree while they simultaneously were working full-time as professionals.

In talking with the students, the Review Committee found that many Master’s students take 3 to 4 (or more) years to complete their degree requirements, which is consistent with the data reported by the departments and the Graduate Division. Although the graduate students offered a partial explanation that required courses are not offered frequently enough, we found that many are attending school on a part-time basis and working part-time, and in a few cases full-time to support themselves. The Review Committee further speculates that the departments have not actively encouraged students to graduate on time nor discouraged them from taking too long.

The students told the Review Committee that they did not understand the degree requirements, and that they do not believe the degree requirements are being applied consistently. The students suggested that much of this confusion could be alleviated by an updated program brochure. Given current constraints, this appears to be a
responsibility of the graduate program chairs, but it equally well could be done by an administrative person in either the departments or the Dean’s office. The students of one department offered to take on this responsibility, but were rebuffed by the graduate program chair. The Review Committee feels that either the graduate program chairs should be required to provide this by the end of the Fall semester 2012 (and update annually thereafter) or the students should be allowed to prepare a draft for departmental review. In fact, the Review Committee thinks that the students should be encouraged to take this on even if it is supplemental to a formal brochure prepared by the graduate program chairs. Enclosed in the Supplementary Material are copies of the graduate guide of the Mechanical Engineering Department at Johns Hopkins University (JHU), as well as the graduate guide prepared by the JHU Graduate Representative Organization. Both are excellent and could be examples for Departments in the College of Engineering.

Part of this confusion over Master’s degree requirements also may have to do with the fact that UHM has three different plans for their Master’s students and that the College of Engineering uses two of these. Master’s Plan A requires 30 credits with at least 18 credits of course work and between 6 and 12 credits of thesis work. Of the courses taken, at least 12 credits must be numbered 600 or above (excluding 699 and 700). Master’s Plan B also requires 30 credits with at least 18 credits of course work. However, rather than a thesis, Plan B requires a “culminating experience”. In Engineering, this typically appears to be a project that is not expected to be the equivalent of a thesis (i.e. is not original research), but nonetheless is a substantial body of work. However, it is not clear to the students what appropriate topics are for either the thesis or the culminating project; they also are unclear about the amount of effort required for each.

While it is true that the web sites for each department in the College of Engineering defines the Master’s requirements fairly well, it is not clear that actual practices are consistent even within departments. The Committee recommends that the College of Engineering (or each department) defines clearly what is expected in the thesis and culminating experience and finds appropriate ways to disseminate this information to the students. For example, in many engineering programs, the Master’s thesis is thought of as being the equivalent of one “typical” peer reviewed paper whether it actually is published or not (whereas a Doctoral dissertation usually is thought to be the equivalent of three or four peer-reviewed publications and it usually is required that at least part of the dissertation actually be published). Since a significant number of full-time and an even larger fraction of part-time students do Plan B rather than Plan A, it is crucial that the requirements and expectations for the culminating experience in Plan B be defined clearly.

The Review Committee recommends that the College of Engineering try to standardize these Master’s degrees by making time to degree and the expectations for a thesis and “culminating project” more uniform. It also suggests that the College make clearer distinctions between the full-time programs and the part-time programs so the students know what will be expected of them. For full-time students, it is suggested that the norm for a Plan A and B Master’s degree be no more than 24 months. Students should be encouraged to complete their Master’s degrees in less than 24 months and only in
exceptional circumstances should a full-time Master’s student be allowed to stay beyond 24 months. This could be enforced at the College level by not allowing either TA or RA support for a Master’s student after 2 years. It should be noted that having full-time Master’s students take 3 to 4 years to complete their degree is doing them a severe disservice, particularly in light of prospective future employment opportunities.

- **Part-time Master’s Students**

As mentioned above, it is suggested that the College create a more well-defined program for part-time Master’s students. For example, the College could adopt a policy that all part-time Master’s students will take 24 credit hours of courses and have a “culminating experience” that is the equivalent of 6 credit hours, with the additional constraints that the entire program take no more than 2 years and that the culminating experience be completed in one year or less. The College should attempt to offer courses at times (and locations) that are convenient for working professionals (including real-time and asynchronous course delivery online) to help them graduate on time. This, in turn, should also increase the part-time Master’s enrollment.

- **Course Availability and Offerings**

The students indicated that part of the reason it takes so long to finish their Master’s degree is that required course(s) often are not available in the right sequence. The Review Committee also discovered that the departments require Master’s students to take specific required courses for each sub-discipline. The Review Committee recommends that each department have a set of core courses as the major requirement for all Master’s students within the same department and one or two courses specific to the sub-discipline. This will reduce the number of graduate courses that need to be offered and hence the courses could be offered more frequently. This may not solve the problem completely; additional teaching by existing faculty or additional instructional personnel still may be needed.

A related issue is that there is a consensus among both students and faculty that there are not enough graduate courses offered (or at least that some of the courses are not offered frequently enough). The Review Committee suggests that the Dean and the Chairs develop a solution to this problem by redistributing current resources, seeking additional resources, examining the current departmental workload policies, and re-defining core requirement for degrees.

- **Workload Policies**

As mentioned above, the limited availability graduate course offerings could be related to departmental teaching load requirements established in their specific workload policies. Thus, the Review Committee applauds the departments’ efforts to define faculty workload policies. Often, such efforts are viewed as a way to reward or punish certain faculty. However, despite this impression, there are important reasons for establishing workload policies in a Research 1 University. The first has to do with the fact that there
is a natural evolution to the careers of most faculty. Junior faculty are expected to develop independent scholarly research programs and to secure research funding so that they can purchase equipment and support graduate students. They also are expected to learn the art of being an effective teacher and expand their intellectual breadth and depth so they are better at conveying complex concepts to their students more effectively. By mid career, most faculty have established research programs and have developed effective teaching styles and have mastered many of the subjects in their field so they are capable of teaching a wide variety of courses. At this point, it is expected that they will begin to take on leadership roles in the department, college, university, professional societies, and community. Finally, as faculty approach retirement, most (though not all) wind down their research programs and devote more of their time to service. They take on senior leadership roles in professional societies, spend increasing amounts of time mentoring junior colleagues at their university (and other universities), and provide their wisdom to their department, college, and university. It also is a time for them “step up” and voluntarily take on more demanding teaching responsibilities. Though this may mean teaching more courses, this is not necessarily the case. It may mean teaching the more “demanding” courses in the program (often the introductory courses, laboratory, courses and capstone courses). Having a good workload policy helps faculty to recognize this normal evolution of their careers and think about how they can continue to be highly productive contributors to the university even after their research programs have ended.

A second important reason for having an effective workload policy is that it is a way for a department or college to collectively set standards for themselves. While there are some faculty who are entirely self motivated, most faculty respond to a combination of self motivation, peer pressure, and the encouragement of their Department Chair. An effective workload policy helps a department to articulate the peer pressure component in a way that doesn’t involve personal attacks on one another.

On the flip side, a lack of such policies may lead to an overall deterioration of faculty morale if there are unfair practices based on favoritism or the misguided practice of having equal teaching loads for all faculty independent of the extent to which the faculty are active and productive in research or service. The reality is that Research 1 Universities are, of necessity, research-based meritocracies and, as such, the teaching loads must be unequal in order to promote active research programs and to have an entrepreneurial, productive environment. Though the establishment of effective workload policies is not an easy task and may generate anxiety and opposition initially, in the long run, the University, College, and Departments will benefit greatly.

The Review Committee has read the current workload policies of the departments in the College of Engineering and believes that all of them do not distinguish sufficiently between marginally productive faculty, moderately productive faculty, highly productive faculty, and superstars. Although Electrical Engineering created a metric defining teaching load in terms of quantitative measures of research activity and service activity, the Committee believes that the distinctions between the lowest and highest levels of research productivity are too small. It may be that three levels of research activity are too
few. We also believe that the definitions are not sufficiently flexible. For example, rather than defining a Research Level 2 faculty as one meeting a list of criteria, that a point system be devised such that a faculty member can achieve this distinction by achieving a set number of points for activities in those areas.

It is the Committee’s opinion that all three departments should strive to develop workload policies that provide a more meaningful distinction between a faculty who are only marginally engaged in research and those who are heavily engaged in research. It should be noted that other universities have established metrics that help in rating (or ranking) the research productivity of faculty members based on the number of refereed journal publications, number of advisees, total research funding, etc. A sample algorithm based on these metrics can be made available upon request.

There are three additional recommendations for consideration in assigning teaching loads. The first is that new assistant professors are assigned a reduced teaching load during their first two years to help them establish their research programs (this is already in the current policy, for example, see ME Workload Policy). These new faculty typically will teach two courses per year for their first two years. The second is that it often takes faculty considerable additional time to develop a new course or to teach a course they have never taught before. Therefore, at the discretion of the Department Chair, faculty can be credited with up to twice the course credit hours for teaching new courses. Finally, some courses (senior lab and senior design may be examples) require considerably more contact time than normal lecture courses. At the discretion of the Department Chair, faculty can be credited with up to twice the course credit hours for teaching these courses.

- **Lack of Career Mentoring**

Many students commented that they did not receive any meaningful career mentoring or assistance with job placement from the faculty. While the Manoa Career Center offers programs and services for students and alumni, engineering graduate students look first to the faculty for guidance and career counseling. Some faculty indicated to the Review Committee that they did not feel this was part of their jobs. The Review Committee disagrees with those faculty on this point and believes that career guidance is an essential part of graduate student mentoring within a professional school. The Review Committee believes that the departments should address this student concern.

- **Lack of Accessibility to Advising**

Some students commented on a lack of accessibility to advising. This is most likely due to the fact that structured mandatory academic advising is not built into the College’s graduate programs as it is with the ABET-accredited undergraduate programs. In general, incoming graduate students first meet with the Graduate Chair who advises them on M.S. or Ph.D. program requirements. According to the students, the assignment of advisors often is a self-directed process that relies on the student’s initiative in seeking out a faculty member to serve as his or her advisor. It is their opinion that the Graduate Chair should assist the student in finding or assigning an initial faculty advisor who will
assist with degree planning and progress checks. In one department, the students even complained that the Graduate Chair only would meet with them one day per week and often was difficult to work with.

As mentioned previously, the recommended development of formal program brochures and updates of graduate student handbooks will facilitate the advising process. However, the College and Departments must ensure that Graduate Chairs understand their roles and responsibilities to the students. This is imperative since the Graduate Chair serves a key role in the initial welcoming of the student into the program giving the first impression of the department once the student arrives at Manoa.

II. Graduate Student Quality

Overall, it appears that the quality of College’s graduate students is good. As noted above, the group of corporate and government employers assembled to meet with the Review Committee were eager to hire the College’s graduates and indicated that the on-the-job performance of UHM alumni are comparable to those of the Country’s top engineering schools including MIT, Stanford, and UCLA.

For the Doctoral programs, several faculty recruit their own students from colleagues and universities they know well. Though this informal practice is not uncommon at other universities, it is not the norm. Nonetheless, it seems to be working well for those who do this. However, it is worth considering whether the reputation of the graduate programs could be improved if the College increased its advertising. In particular, advertisements or announcements (either by mail or email) that showcase accomplishments of current and past graduate students might be particularly effective in attracting prospective students. A large fraction of graduate programs send out posters and brochures to other universities and prospective students. At least one engineering school (Columbia University) has a very effective broadcast email system announcing the school’s news and accomplishments that could be used as a model. The apparent lack of any systematic effort at advertising may be contributing to the College’s lack of visibility among prospective graduate students and, hence, to the relatively low application rates by mainland U.S. students.

The Review Committee believes strongly that departments could attract higher quality students and increase retention if stipends were raised. Graduate stipends in engineering at other comparable universities range from $12,650 to $30,000 according to a survey done by Oklahoma State University (www.cas.usf.edu/business-services/data/2011-2012GAST.pdf). It is clear that current stipends for both Teaching Assistants and Research Assistants in the College of Engineering are considerably below peer institutions and not competitive with top-tier institutions.

It is worth noting that the Department of Electrical Engineering has begun a practice of supplementing first-year teaching assistantships up to a level of $22,000 per year. However, it is the Review Committee’s understanding that this stipend level does not necessarily continue when the students are converted to research assistantships in their
second year. The Review Committee suggests that the Departments of Mechanical Engineering and Civil and Environmental Engineering increase their stipends similarly. The Committee also suggests that each department set a nominal stipend rate that is used for the majority of teaching and research assistants. Having such a nominal rate will improve student morale and prevent competition by faculty for students based on stipend levels. The one exception that should be allowed is the offering of a first-year supplement to exceptional students to help attract them to the program. Many other universities use first-year supplements and it appears to be a successful practice.

While it may be difficult to increase stipends dramatically in the short-term, the College’s faculty should be encouraged to request higher stipends and include summer overload in all future proposals. Funding agencies seldom question (or cut) funds requested for graduate student stipends, and so there is little downside to asking for stipends that would improve the recruitment and retention of better graduate students. However, stipends should be raised as much as possible even in the short-term. Since the quality of the graduate students is a key factor in improving the reputation of a department, we believe it is better to have fewer students of higher quality (and at a higher stipend) than to have more students of lower quality (and who are paid less).

III. Faculty Quality

Overall, the faculty are productive and dedicated. Teaching loads are not excessive and so most faculty have adequate time to devote to scholarly research. While the Review Committee does not have the data to do a robust benchmarking of the departments or College, the common criteria used for productivity are:

- Undergraduate student/faculty ratio
- Students and courses taught/year/faculty
- Refereed publications/year/faculty
- Research expenditures/year/faculty
- Master’s students/faculty
- Doctoral students/faculty

Obviously, most of these benchmarks depend greatly on faculty experience or seniority. Since, 20 of the 53 faculty in the College have been hired in the last 5 years, it is not particularly instructive to compare the College of Engineering at UHM with schools that have a flatter age distribution. Nonetheless, comparing these criteria for the senior faculty with peers will provide valuable insights.

The Committee has requested each department to supply the following information for each faculty member: teaching load, record of refereed publications, and research expenditures for the past 3 years in a spreadsheet. The Graduate Program Chair from each department supplied most of the information; however, some of the data was incomplete. For example, one department did not provide data on publications, while the publication data for the other departments seems to have counted non-refereed publications. In an attempt to get more consistent information, the Committee
supplemented the self-reported data with information available on Google Scholar. It should be noted that the Committee accepted teaching loads and research expenditures as provided by the Graduate Program Chairs. Tables 2 A, B, and C (refer to Appendix) provide the best available information that the Committee can gather within the short time frame. Entries that have been modified using data from Google Scholars are shown in italics. Each department and faculty members are welcome to verify the accuracy of the data.

The data clearly shows that the majority of faculty in the College have a reasonable level of research productivity. Furthermore, it should be noted that the College of Engineering has a number of world-class faculty that have exceptionally productive research programs which have made high impacts nationally, internationally, or in the State.

Despite the overall level of research in the College, the data in Tables 2A, B, and C points out a problematic situation - several of the senior faculty in the Department of Electrical Engineering and a similar number in the Department of Civil and Environmental Engineering have not published any papers and have not had any research funding in the last several years. In some case, this has led to the removal of their designation as graduate faculty.

As noted above (in the section on Workload Policies) having faculty who wind down their research programs nearing retirement is a normal part of the evolution in a faculty member’s career. However, it is not clear that these faculty have “stepped up” and increased their teaching and service activities to compensate for their decreased research productivity. It appears (from the outside) that there has been an environment where such low productivity has been condoned and perhaps even promoted by a lack of clear expectations. This is not healthy to the development of junior faculty and is detrimental to the advancement of the College and the morale of productive faculty. The University’s efforts to establish Workload Policies should help to correct this situation. The Review Committee hopes that the peer pressure associated with reasonable Workload Policies will help to change the culture in which this has been accepted.

While the recent hires of assistant professors appear to have been successful in attracting highly qualified faculty, the startup packages are well below national averages. The College typically provides about $100,000 in startup funds for equipment. Recently, these funds have been provided by the Vice Chancellor for Research and Graduate Education (25%), the Dean of Engineering (25%) and the Department Chair (50%). In addition, the Dean of Engineering has provided two months of summer salary (over the first two years), and the Department Chair typically provides 3 (or more) semesters of graduate student support with a teaching assistantship.

Though it appears that recently hired assistant professors have been able to establish active research programs despite the lack of infrastructure and low startup packages, it should be noted that UHM is not competitive with other Universities in its support for junior faculty. The Review Committee recognizes that startup packages for new faculty can vary considerably across disciplines and even across fields within a discipline. We
also applaud the Vice Chancellor’s efforts to set expectations for returns on UHM’s investments in new faculty. Nonetheless, we believe that the recent average startup packages may not be adequate to enable many junior faculty to establish robust research programs.

IV. Research Funding and Research Clusters

In the past, the College has received significant funding from Congressional appropriations. Currently, the research funding in all three departments are significantly less than those of their peer institutions, see a comparative data compiled by ASEE for 2010 in the Appendix, Table 3. In light of the loss of these Congressional funds, faculty need to seek funding from new sources. The identification of research clusters in the COE will help to encourage collaboration and to obtain new funding.

The funding world, particularly in Washington, has changed over the last several years. The major funding opportunities are no longer in the disciplinary problems that support single investigators, nor are they in “interdisciplinary” projects that involve sequential or parallel efforts by two investigators that involve a “hand off” of results or a merging of results. Rather, today, nearly all of the major funding opportunities are in trans-disciplinary projects that require teams of investigators in multiple disciplines who work hand-in-hand on a daily basis to solve major complex problems. The College’s efforts to establish research clusters will help the College to compete in the new funding environment and will encourage collaborations within the College and University. The eight research clusters identified are:

A. Autonomous, Unmanned Systems  
B. Bioengineering  
C. Coastal Infrastructure  
D. Communications, Radar and Cyber Physical Systems  
E. Computer Engineering and Computer Modeling & Simulation  
F. Recycling, Remanufacturing, and Corrosion  
G. Renewable Energy  
H. Water, Waste, and Environmental Engineering

The Dean deserves considerable credit for leading the effort to identify and champion these clusters. It already is clear that the focus on these research clusters is helping the College and it is expected that even greater benefits will follow.

A related issue concerns faculty hiring. In today’s world, top research institutions no longer hire in a way that they have a “flat” distribution of one or two or three faculty in each of the N areas of every discipline. The Review Committee strongly concurs with the philosophy at most top-ranked universities that a university’s success and reputation depends strongly on the presence of world-class clusters of faculty in strategic areas rather than on having its strength spread evenly across the board. Like other top universities, the College of Engineering and its Departments need to make it a priority to hire faculty in its strategic clusters. While there seems to be considerable resistance to
this approach amongst some of the faculty, the Dean and Department Chairs should provide the leadership needed to move the College in this direction.

Further, since hiring faculty who are going to develop into national and international researchers and highly effective teachers is the single most important role of departments and the University administration, the Dean interviews of faculty candidates are important to set the College’s expectations in terms of teaching and research and assess each candidate’s potential to meet those expectations.

Finally, though it appears fairly easy for faculty to collaborate across department and college boundaries, the University and University System need to ensure that policies encourage and facilitate collaborations. For example, it appears that in collaborations of COE faculty with the Department of Defense’s University Affiliated Research Center (UARC), the UARC retains all the indirect costs in the University’s Research and Training Revolving Fund (RTRF) even when the work is done by COE faculty in COE labs. This clearly is inappropriate and should be changed.

V. Communication Issues

From the interviews conducted by the Review Committee with the Dean, the faculty, and the students, it appears that there are problems in communication (both between faculty and students as well as between faculty and administration). This breakdown becomes more pronounced with the ongoing fiscal shortage faced by the University and has led to a lack of trust and collegiality to the point of animosity amongst some faculty members and a significant level of animosity by the faculty toward the College and University administrations. There seems to be a lack of understanding of what a department needs to do to make itself better in the eyes of the University Administration. All workers (not just faculty) need to know how their departments or units are being evaluated and how they will be rewarded if they do more or work harder. There also seems to be a lack of understanding by the faculty of the current fiscal realities in the University and College. The University Administration, Dean, and Department Chairs either need to develop uniform policies that explain how resources are allocated or to better disseminate those policies if they already exist. For example, how would the resources (space, number of faculty, administrative and technical support, TA’s, etc.) to a department change if that department were to increase its undergraduate enrollment by a factor of two and its research funding by a factor of two?

VI. Resource Issues

The faculty of all three departments praised Isaac Fujioka, the College of Engineering business manager (Senior Administrative Officer) and Sheree Hashimoto, sponsored projects specialist (Research Officer) for providing good financial services and help with proposal preparation.
• **Administrative and Technical Support**

However, the Chairs and faculty of all three departments lamented the lack of administrative support at the departmental level. This issue was acknowledged by the Dean who explained that recent budget constraints had necessitated a reduction in the number of administrative staff in both Mechanical Engineering and Electrical Engineering from two to one. To help reduce the impact of this reduction, one person was added to the Dean’s office staff to provide administrative support to these two departments. While both departments acknowledged that this person does indeed provide useful assistance to them, the situation remains difficult. For example, it was reported to the Review Committee that when one of the department’s secretaries is sick or on vacation, the departmental office must be closed and there is no one to help either students or faculty. However, Interim Associate Dean, Bruce Liebert, pointed out that Charlene Sato from the Assoc. Dean’s office is assigned to cover any absences and the College has also hired a Junior Specialist who can help.

While this shortage of administrative (secretarial, financial, academic program) support for departments and faculty in the College of Engineering may be a financial necessity in the short term, in the long term staffing levels need to increase. A benchmark at many research universities is one staff person for every three faculty (1:3) with typical ranges from 1:2 to 1:5. With ratios of 1:4.3 (Civil and Environmental Engineering), 1:5.6 (Mechanical Engineering), and 1:7.6 (Electrical Engineering), it is clear that staffing levels within the departments are below other universities with whom they aspire to compete.

The Review Committee recommends that, in the short term, the secretaries in Electrical Engineering and Mechanical Engineering should coordinate their schedules so that both are not on vacation at the same time. In the longer term, the administrative staff in each of the three departments in the College of Engineering should be increased to at least three people; for example, one who handles academic matters, one who handles fiscal matters, and one general office assistant.

In addition, engineering programs (both at the undergraduate and graduate level) need to have both laboratory and computer support. While it may be possible for departments to share computer technicians, it is not likely that they can share laboratory technicians. While the COE undergraduate fee can be used to help support the technicians needed for the undergraduate laboratories, departments still need some level of laboratory technical support at the graduate level. Since this generally cannot be provided by direct charges to grants and contracts, it must be provided through general funds in some way.

• **Space Shortage**

All three departments have expressed their concerns regarding the shortage of laboratory space for both instructional and research purposes. This condition will only worsen as new engineering faculty are hired. One of the department chairs informed the Review Committee that the original master plan of Holmes Hall included a second building.
where the Pacific Ocean Science and Technology (POST) Building is now located. The second building of Holmes Hall was also intended to house engineering faculty and their laboratories to complete the College of Engineering. While the POST Building does include some engineering faculty offices and laboratories, the majority of the facility serves to house faculty in the Department of Information and Computer Science (ICS) as well as the School of Ocean, Earth Science and Technology (SOEST).

In particular, Mechanical Engineering has indicated that Holmes 140 is already overcrowded and does not accommodate the teaching and research activities for the Advanced Materials Manufacturing Lab and the Corrosion Research Lab. Holmes 140 is also used for undergraduate instruction in Introduction to Engineering Design (ME 213), Manufacturing Processes Lab (ME 342), and Design Project I/II (ME 481 & 482).

The Department of Civil and Environmental Engineering has had to use exterior lanai areas taking up the entire Ewa end of Holmes Hall to store materials and equipment for structures and asphalt pavement research. Fortunately there have not been any thefts or pilferage; however, the materials are subject to the environmental elements that can lead to more rapid degradation. Dr. Ian Robertson has discussed these matters with UHM Facilities Management and has worked on a preliminary design and layout of improvements to the lab in Holmes 101. Unfortunately the construction cost estimate for the improvements was much higher than anticipated, and University funds are not available at this time. Dr. Robertson and Department Chair Papacostas also have approached the Department’s Industrial Advisory Committee for suggestions and possible partnering with local industry to acquire donations for discounted/donated construction materials to reduce the overall cost.

The Review Committee recommends that the College develops an overall space plan that considers existing space inventory and usage in Holmes Hall, as well as projected space requirements to accommodate future faculty hires and equipment needs. Without a master plan for current and future space in Holmes Hall, the College will be even more hard pressed in meeting the instructional and research space needs of its faculty and students.

**VII. Conclusion**

Overall, the graduate programs in the UHM College of Engineering are healthy and strong. The faculty are, for the most part, productive, hard-working, and dedicated. The graduate students are high quality, but severely underpaid. The Dean of the College has a bold plan for how to move the College forward by emphasizing eight research clusters where the College has unique strengths. Though many parts of this report are critical, the Review Committee hopes that they are taken as constructive suggestions for how to make the College even stronger than it currently is.