UW

UNIVERSITY OF WASHINGTON

Department of Electrical Engineering

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Professor and Chair

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To: Marsha Landolt
Dean of the Graduate School and Vice Provost

From: Howard Jay Chizeck

Re: Response to the Electrical Engineering Review Report

On behalf of the faculty, staff and students of the Department of Electrical Engineering, I wish to thank the members of the Review Committee for the careful, insightful and detailed analysis. Their time, energy and effort are truly appreciated. We are pleased that the committee has recognized the "dramatic progress" of the Electrical Engineering Department over the past few years.

This response letter describes changes that have occurred in the department since the site visit and Self-Study Report. Plans for many of these changes were discussed during the site visit, and others were motivated by input from the Review Committee. This document includes feedback from our faculty, staff and students as well as that off the Department's Operating Committee (faculty and staff leadership).

The Review Committee's report made a large number of suggestions. Our response is organized in the same structure as their report. For the convenience of the reader, specific recommendations of the Review Committee are displayed in a different font.

Undergraduate program

We are very proud of undergraduate program. We pleased to report that we had a successful accreditation (ABET) review of it during the first week of November 2001. No deficiencies, weakness or concerns observed.

Our responses to the comments of the Review Committee regarding the Undergraduate Program are as follows:

- Examine the size of the program to ensure that it is in line with resources. In view of rapidly increasing demand, the program should become more selective in its admissions policy so that it can continue to improve in quality and in attention paid to individual students.

We agree that our undergraduate program size is excessive relative to the available resources. Reduction through increased admission selectivity is already underway. Within the

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next year, we will limit the number of undergraduate majors (juniors and seniors) to 428 (the last officially authorized level—in 1992).

EE majors are admitted twice a year (Autumn and Spring). For the Spring 2002 admission, we cut our acceptance rate to 55% of qualified applicants. We anticipate that for the Autumn 2002, we will admit less than 45% of qualified applicants. Budgetary limitations may require further reductions in the number of EE majors and credit hours taught.

- Correct the misalignment between course offerings and demand. Encourage faculty to occasionally teach outside their own areas of specialization.

A major revision of the undergraduate curriculum, now in the planning phase, may help to address this problem. We do encourage faculty to occasionally teach outside their areas of specialization (particularly for entry level courses). However the limiting factor for meeting course demand is not faculty availability—but rather teaching laboratory capacity and too few Teaching Assistants.

- Develop medium and long range plans for course offerings and staffing so that students can plan their course schedules and are not held up in their progress due to unavailability of courses.

A two year teaching schedule for 2002-2004 has been developed. We wish to note that there is little evidence to support the suggestion that students are held up in their progress by the unavailability of courses. Courses on the published schedule have almost always been taught (unless there is inadequate registration). Overflow problems for core courses are generally resolved by adding extra sections.

- Introduce lab fees to help fund improvement of the undergraduate labs.

Through generous industrial gifts, as well as grants from Student Technology Fee funds, much of our educational laboratory equipment has recently been replaced. There is no significant lack of necessary software for any course. However funds for replacement, maintenance and upgrades are generally unavailable within our state budget.

We have analyzed the costs of equipment, maintenance, software and supplies for each course and laboratory (excluding faculty costs), and have prepared a request for lab/course fees that will be submitted for approval within the next month. We are hoping to institute lab fees for Autumn 2002 or Winter 2003. However, it is unrealistic to fully cover all laboratory costs from these fees, especially for courses that require expensive equipment or software and those which have intensive TA or technician needs.

- Establishment of a stronger training program for laboratory TAs.

We are aware that this need, and are exploring ways to accomplish it (see discussion of TAs in the *Graduate Program* section).

- Continue to expand research opportunities for undergraduates.

As the Review Committee noted, the recent appointment of an Undergraduate Research Coordinator is an important step in this direction. Their suggestion of having qualified undergraduates help to design and coordinate laboratory and instructional materials for lower level students is a good idea that we will pursue, as resources permit.

Graduate Program

We thank the Review Committee for their statement that "The Department deserves accolades for these [graduate program] improvements." The positive trends that we reported in Self-Study are continuing. We have evidence of increasing external recognition of our graduate program. We also see increasing numbers of our PhDs going to academic positions (although this may be reflective of the current economic weakness of industry—which generally has a significantly higher pay scale than academia).

- Define clear rules governing the transition of students from the MS to the PhD program.

We agree with this suggestion. We are working on a new MS/PhD transition process, which will hopefully be in place early in the coming academic year. One issue that has been generated by this examination is whether the MS degree should be encouraged or required for those students who are admitted directly to the PhD program.

- Reduce the large discrepancy between TA and RA salaries, for example by creating mixed TA/RA positions.

This is very difficult, as the Review Committee recognized. The crux of the problem is our relatively small number of TA positions. This makes it difficult to cover courses adequately, and it greatly complicates educationally effective TA assignments. It also makes the "mixed RA/TA position" idea infeasible. We have 275-300 graduate students and 33 TA positions in any given quarter. We are working hard to obtain gift funds and fellowships, to supplement the UW-mandated stipend of TAs to the level of our RAs.

- The review committee recommends that the Department consider adopting a TA requirement for its graduate students.

This is an interesting idea. One way would be to have most (or all) EE graduate student teaching effort become part of a required graduate course—complete with instructional mentorship, training in teaching techniques, public speaking, use of instructional technology and curriculum development—in addition to teaching duties and evaluation of performance. This requirement might be spread out over several quarters, to reduce the students' time commitment each quarter to a level that would allows for full performance of RA activities.

This strategy may not mitigate the pay discrepancy problems, but it would give graduate students the valuable experience of teaching. It would also generate more Teaching Assistant effort, allowing for better coverage of our undergraduate courses. Our small budget for TAs means that student teaching could only be partially compensated (perhaps only for first year Teaching Assistants, who have not yet secured a Research Assistantship or fellowship). Also, implementation of this idea raises questions with regards to the ongoing process of graduate assistant unionization.

- In general, the Department needs to improve the mentoring of graduate students.

We agree that there is room for improvement. We are working with graduate students and the curriculum committee to draft a concise "set of principles" for graduate student/faculty advisor interactions, to be adopted by the faculty and the Graduate Student Association. These principles will address expectations and obligations regarding the research and mentoring process, intellectual property, publication, availability for meetings, and other issues.

With regards to professional mentorship, we are investigating the possibility of one or more courses on "professional practices" (*i.e.*, being a professor, being a corporate researcher, being an entrepreneur). For the latter topic, this might be done in cooperation with the new *Center for Technology Entrepreneurship* in the Business School.

- *Educational outreach / EDGE:* Consider abandoning EDGE - the benefits to the Department seem small and not worth the effort.

We have taken action to suspend admission of new graduate students to the "distance learning" MSEE program. We will continue to work with EDGE to offer certain courses by video and video streaming—but only for those courses that are also offered live for regularly enrolled students.

Research

The growth of the department's research activity is continuing at an accelerating rate. Grant and Contract Awards (a leading indicator of research activity) were $14.4M for the first half of 2001-2002, which exceeds our total for all of 2000-2001. We anticipate a four-fold growth between 1998-1999 and 2001-2002. In addition to peer-reviewed selection for these competitive projects, other indicators of research excellence and external reputation are very positive.

We agree with the Review Committee that our strategic research area in *Genomics, Proteomics, and Health Care Diagnostics* is most promising and exciting. An important factor in its future development will be the interaction of this research with the department's outstanding VLSI, "mixed signals" and "systems-on-a-chip" research activities. The combination of these research strengths is unique to the UW EE department.

To be a top department, we need to be the very best in one or more research areas. We appreciate the Review Committee's support of our research strategic planning exercise and their point that strategic planning serves two goals: leveraging existing strengths and driving hiring (and other) decisions. We also want to reiterate that the development of strategic research concentrations will not prevent the continued growth and development of single investigator and small group research efforts.

- Rethink the strategic research areas, *Signal Processing for Information Technology* and *Complex Networks*.

Since two of our candidate "research thrusts" had not yet been well developed at the time of the site visit, we were particularly interested in feedback of the Review Committee, which is informing the renewed development and assessment of these strategic research areas.

- The area of photonics or optics is considered an important one in most EE departments ... It would be good for the Department to at least talk seriously about establishing a presence in this area.

The department currently has two faculty members (one tenure track and one research track) with active research in a particular subspecialty of photonics. We have been able to offer a small number of courses in photonics because of the efforts of these and other faculty. However for various reasons, we do not have a significant presence in photonics.

To address this problem, we participated in a UIF proposal last year (which was not funded), and in a State of Washington *Advanced Technology Initiative* (ATI) proposal (which

was partially funded). The UW is rapidly becoming the national leader in the next generation of photonics, involving polymer-based electro-optic modulators and switches. This was confirmed with the NSF Science and Technology Center (STC) in this topic area, which was awarded to UW this month.

We plan to hire one new faculty member in photonics for 2002-2003 (as part of the ATI), as we will replace our existing tenure track photonics faculty member upon his upcoming retirement in 2003. We will also allocate an additional faculty slot (which becomes available in 2004) for the photonics area. One of the latter two new faculty will probably be at the senior level, and he/she will work directly with the new NSF Center.

Research infrastructure

Our rapid growth in research activity is straining the department infrastructure. Addressing this problem is a high priority for the department leadership. We recognize the importance of taking full advantage of economies of scale, both in administrative and computer support. However, we have found that the faculty who are most satisfied with their infrastructure support are those working in small groups.

In order to have the advantages of cross-training and back-up of a centralized system with the personalized attention of decentralized support, we are building a system of "centralized coordination" of staff. Both administrative and computing staff have department level meetings to discuss common concerns and share best practices and expertise, and we are working towards a model where all staff have a portion of their time allocated to centralized activities.

- Generate funds for improvement of the research infrastructure by increasing the cost of course buyout, centrally retaining RCR instead of passing it on to investigators, and starting a computing recharge center.

Course Buy-Out: We agree with the Review Committee that finding ways to increase release funds is critical. Because the department's operating budget is negligible, we must use open faculty lines, leaves and buyouts to cover educational expenditures. Our current "buy out" policy for course buyout is 45% of salary (in the quarter of teaching release). We will increase this to 55% in Fall 2002, 60% in Winter 2003 and 65% in Spring 2003. At that time we will evaluate whether this change in policy increases or decreases release income—after coverage of teaching. A previous experiment of a 100% buyout cost resulted in no buyouts whatsoever. We are advising faculty that all new proposals should plan on a 75% buyout level.

RCR Allocation: We have increased the proportion of RCR that is allocated centrally. The department now receives 6% of RCR that we generated in 1996-1997, and 14% of all RCR that we generated above that base level during the previous year. The entire "14% portion" is now used centrally by the department—paying only for costs associated with research (including grant management, equipment, facilities and communications). Of the "6% portion," half is given to the PI's who generated it, to cover research costs that cannot be legally charged to grants and contracts as direct costs. The remaining 3% is also given to these same faculty—but they are constrained to spend it on research-related staff (administrative, computing, technical).

Role of research faculty

The department has had a recent growth in the number of Research Faculty. This has allowed us to use external funds to rapidly grow in new "hot" research areas, despite the limitation on tenure track positions.

- Reduce the number of research faculty and make sure that research appointments follow the same process and undergo the same scrutiny as tenure track appointments. Research faculty vote, advise students, and represent the Department towards the outside, and thus have a significant impact on the actual or perceived quality.

We agree that with the Review Committee that there is a potentially serious problem with the mismatch between the rights and responsibilities of research faculty, now that the UW Faculty Senate has endowed them with voting rights. After the initial debriefing from the Review Committee, we took immediate steps to address this set of issues.

1. Research faculty in Electrical Engineering are now strongly encouraged to attend all faculty meetings, are expected to serve on faculty committees, and are now represented on the department's Faculty Advisory Board (an elected body).
2. The same hiring process and standards are now used for research faculty and for tenure-track faculty. This includes participation of faculty and students from all research specialties in the department.
3. Research faculty are now included in the annual Merit Review process in the same way as tenure track faculty. We are also working to improve the mentoring of junior level research faculty.
4. We have identified several current research professors who might not require (nor want) the full responsibilities of the new research faculty role, because they have a primary appointment elsewhere in the university (*e.g.*, the Applied Physics Lab). Some of these individuals have chosen to become full participants in department; others are in the process of changing to an adjunct status, retaining the ability to advise Electrical Engineering graduate students.

Departmental culture

We are pleased that the Review Committee recognized that

There are some very positive aspects to the department culture. There seems to be an almost universal perception that, thanks to strong leadership and group efforts, the Department is improving steadily as an intellectual and pedagogical center. Also outstanding is the degree to which women and members of national and ethnic minority groups participate in and/or lead department activities at all levels.

However we take partial issue with the comment that there is

an effective balkanization of the department; it functions largely as a collection of research groups, rather than as a cohesive unit.

This statement is correct regarding the many of the department's research activities (although not the cross-disciplinary ones), and it is somewhat accurate regarding the graduate program. However, it is less appropriate regarding many other aspects of the department.

Because the Electrical Engineering department is very large (over 800 students and over 100 faculty and staff), there is a natural tendency for subgroups develop. However we are working hard to build mechanisms to increase departmental cohesiveness. This began with a change in the organizational structure of the department. Prior to 1998-1999, faculty groups that exactly coincided with research groups determined departmental educational issues. To partially decouple educational and research decision making, the structure of the department leadership was changed to have *two* Associate Chairs (an Associate Chair for Research, and an Associate Chair for Education). Membership in the curriculum groups was changed to allow individual faculty to participate in more than one group, and the role of the Associate Chair for Education in course assignment was strengthened. In addition, a faculty "Research Committee" was created to address cross-specialty topics of interest (such as development of the department's research strategic plan, and advice regarding research infrastructure policy issues).

In the Autumn of 1998, a weekly "social" for graduate students/staff/faculty in all areas was established, to provide an opportunity for everyone to meet socially at least once per week. Other parties and special events (*e.g.*, "research day," a formal departmental graduation/awards ceremony) were introduced to strengthen departmental cohesiveness.

Three department-wide student organizations have developed wonderfully during the past few years. The *UW IEEE student chapter* involves both undergraduates and graduates. Their main goal is to help students prepare for the transition to working professionals, by providing insight into the corporate world through technical sessions, seminars, tours and networking opportunities. With department support, they organize events to provide opportunities for students to interact with professors and try to provide various amenities to make student life a little easier.

The *Graduate Student Association* provides special activities for all Electrical Engineering graduate students. They also have a direct role in departmental activities, through participation in the new faculty interview process, new graduate student recruitment, and special events such as the annual Engineering Open House.

The UW chapter of the national honor society *HKN* has taken on a critical role in the department, by providing tutoring services for undergraduate courses. In addition, they have developed and provided a series of workshops and tutorials for students in the use of various computer languages and computer-aided design tools.

The Review Committee suggested a number of steps that could further strengthen cohesiveness in the department:

- Create a shared course for all entering graduate students, along the lines of "Introduction to the Profession of Electrical Engineering" ... Such a course could introduce students to the Department, how it works, who's in it, and what they do.

This course already exists (EE 592). It is now required for MS and PhD students (*i.e.*, it must be taken at least once).

- Institute common instead of group specific qualifying exams.

The qualifying exam has not been designed to increase cohesiveness. Rather, it has solely been concerned with determination of student qualifications to succeed in the PhD program. The

Review Committee has suggested a new way to look at the qualifying exam. We will certainly consider this idea.

- Start a departmental colloquium series and explore other ways to break down barriers between research groups.

The initiation of both a *Department Colloquium* and *Distinguished Lecturer Series* is planned for Autumn 2002. This will be coordinated with changes to the existing department-wide graduate seminar series, which serves incoming graduate students. The colloquium will be for the department as a whole. We anticipate that other departmental seminar series (organized by research specialties) will also continue to thrive.

- Organize a more uniform mentoring process for junior faculty.

We agree that we need to improve our faculty mentoring program. We plan to improve the monitoring of our mentoring program.

Relationship between Electrical Engineering and Computer Science & Engineering

In our Self-Study document, we paid particular attention to the Computer Science and Engineering department, for a variety of reasons. In particular, we suggested that the next program review of both departments be done jointly (roughly a decade from now). The response of the Review Committee is summarized by

... this overlap does not make the Electrical Engineering Department into a Computer Science Department. Electrical Engineering should measure itself primarily against Electrical Engineering Departments at peer Universities. Focusing too much on comparison (and competition) with Computer Science & Engineering can be counterproductive.

We most certainly do not wish to be a Computer Science department. However there are issues of concern involving the special relationship between Electrical Engineering and Computer Engineering at the University of Washington. These are of a fundamentally different nature than our strong collaborations with other units across the campus.

Nationally, most Electrical Engineering programs are now in departments that also are responsible for computer engineering. This is reflected by this year's name change of NEEDHA (National Electrical Engineering Department Heads Association) to ECEDHA (Electrical and Computer Engineering Department Heads Association). There is an increasing trend toward consolidation of our two fields. At the time of the Self Study, there were 100 *Electrical Engineering (EE)* departments, 136 *Electrical and Computer Engineering (ECE)* departments and 25 *Electrical Engineering and Computer Science (EECS)* departments on ECEDHA list [some with the ordering of names reversed]. Six months later, there are now only 90 EE departments, and 145 ECE and 28 EECS departments. Reflecting the convergence of the fields, there are new undergraduate combined "ECE" B.S. degrees at some schools.

As we measure our department "primarily against Electrical Engineering Departments at peer Universities" we find that the majority of other EE programs in the top 20 of the admittedly dubious **US News and World Report** "beauty contest" (we are now ranked 19) are in ECE or EECS departments. Because of the substantial salary differential at UW between

our EE and CSE departments, this is more than an issue of nomenclature. ECE departments elsewhere are the competition for our new graduate students and our new (and existing) faculty.

There is some risk that the UW organizational structure may impede the ability of both departments to develop at the exciting boundaries between traditional Electrical Engineering and Computer Engineering topics. However in the recent past, the two departments have cooperated well. There are collaborative projects and reciprocal adjunct courtesy appointments. The adjacent site of the new CSE building should increase cooperation through proximity.

We are well aware of the historical complications and sensitivities of this issue. The separation of Computer Engineering from Electrical Engineering around the time of the last Program Review left strong feelings among many faculty who were at the UW in 1989. Given national trends, we continue to suggest that it would be wise to jointly review both programs around 2011.

Principal recommendations to the University

- Conduct a thorough budget review to determine whether the Department's budget is in line with its instructional load.

  We strongly concur with this recommendation.

- Bring state salaries closer to the level at the peer institutions. The A/B salary plan is not a solution; it carries significant risks and has to be carefully monitored.

We strongly concur with this recommendation. Our low relative salary level is a critical problem, generating anger and resentment among faculty and representing a significant retention risk. The A/B plan provides a temporary way to address this problem, but as other institutions adopt a similar strategy, it will have a diminishing competitive effect. With increasing excellence and national recognition of the department, we become a target. Many of our best faculty are receiving frequent unsolicited offers.

We understand that this is a difficult financial year for the University of Washington, and that an immediate correction is unlikely. But failure to respond to this problem will create much larger financial difficulties for the university. The rapid improvement of the department can easily collapse if key faculty depart.

Consider the financial impact of losing one of our several faculty members who generates $1.5 million in external funding per year. This might yield $ 400k/year of indirect costs, of which $320k would go to the central administration of the university. If this individual were to depart the UW for want of $20k per year, the result is an immediate substantial financial loss to UW, the college, and the department. In addition to the loss of indirect costs, graduate student tuition and staff support, the hiring of a new faculty member will likely involve startup costs that are equivalent to perhaps ten years of the denied salary increase. More important is the damage to the intellectual strength of the department and the morale of the remaining faculty. This way leads to a plunge to mediocrity. We hope that the administration can find a way to address this issue, as they have done in the past for other programs, in response to their Program Reviews.

Once again, on behalf of the faulty, staff and students of the Department of Electrical Engineering, we thank the members of the Review Committee for their excellent work.