IV. Responses to change

A. Overview

We hope that the material in Section II of this document has made it clear that the University of Washington Department of Computer Science & Engineering is not only a unit that responds to change, but also a unit that *anticipates* change and that *leads* change, in what is likely the fastest changing discipline today.

In this section, we will comment upon the key "change issues" that we expect to be the focus of our attention for the next few years.

B. Critical issues and opportunities

Faculty retention

During the past three years, we were authorized to grow from 29 tenure-line faculty members to 34. Despite recruiting at full speed, departures and retirements have caused us to remain at 29 (now doing the work of 34, since we have fulfilled the commitments that we undertook to obtain these positions).

We now have committed to undertake additional high-priority responsibilities that have justified the allocation of 9 additional faculty positions – and we have begun irreversibly to assume this workload (e.g., the doubling of our Computer Engineering undergraduate major program is underway).

Not only are the 29 of us facing a 34-person workload today, with a 43-person workload bearing down on us inexorably, but we have several strong faculty members who continue to waver about whether to remain in academia. And in late January, one of last year's outstanding hires, Narayanan Shivakumar, reneged on his commitment to join us in order to remain at a Bay Area startup derived from his thesis research. (This defection occurred too late to be reflected in all parts of this document.)

We must focus intensively on retention of our highly productive faculty members. In particular:

- The proportion of time that our faculty members devote to peripheral activities increases relentlessly, with a corresponding decrease in our sense of personal effectiveness. At the same time, our field is *unique* in the availability of non-UW jobs in the Seattle area where people with faculty credentials can be highly effective (as well as broadly respected and handsomely compensated). *We must struggle ever-harder to create a low-bs environment for UW CSE faculty – an environment where faculty members feel highly effective. This will require changes at the highest levels of the University, as well as continued internal efforts.*
- Universities *do* have competitive advantages relative to startups and industrial research. First, universities have students. Second, universities are inherently interdisciplinary. Third, university research programs are uniquely charged to focus on the long term. Fourth, university jobs offer tremendous flexibility – education, research, leadership, and entrepreneurship. *Individually and collectively, we must aggressively seize each of these competitive advantages. Every level of the University must strive to convey their fundamental value.*

- Faculty salaries are a continual issue at the University of Washington. Strong support from the UW administration has elevated our average Full Professor salary to 7.5% behind the average of our peers. But 7.5% is … well … 7.5%. *And even this position will quickly erode without continual attention*, since full professor salaries at the top dozen departments have been increasing steadily at 5% per year. Furthermore, our *highest* Full Professor salary is 15% behind the peer average. (Appendix R includes this data, along with other departmental financial information.) *Keeping CSE salaries competitive must be a top priority for the University of Washington.*
- Increasing the number of Endowed Professorships and Endowed Chairs also is essential, both for pragmatic and for psychological reasons. *Superior faculty need recognition. Creating Endowed Professorships and Endowed Chairs in CSE, must be top priorities for the University of Washington.*
- *Overall, a strong sense of institutional support – a sense that UW recognizes the centrality and the accomplishments of CSE and is doing all that it can do to preserve and enhance our strength – is absolutely essential.* One thorn in our sides at present relates to the failure to reinvest at the unit level the proceeds from entrepreneurship; this is addressed below. Another is our dismal space situation – short-term as well as long-term; this also is addressed below.

The bottom line, as noted at the start of this document, is that we feel ourselves under tremendous pressure today – pulled every which way and stretched way too thin. Part of this is the nature of the field – overwhelming opportunities and overwhelming demands. Part of it is our own nature – wanting to do everything that's worthwhile, and wanting to do it as well as it possibly can be done. Part of it is that, today, the University of Washington seems to many of us to be characterized by constant unnecessary struggle – it's just plain hard to get things done, leading to feelings of ineffectiveness. *This is a change* – a change to which all of us must respond aggressively.

Faculty recruiting

We placed "recruiting strategy" on the agenda for our External Advisory Committee last spring, in order to be reminded of the importance of being "forward-looking" and "outward-looking" in our recruiting. Our field is increasingly closely related to an increasingly large number of other fields and activities. This represents a wealth of opportunities for us as computer scientists and computer engineers – and also for the University of Washington and for our region. We embrace these opportunities – it is our top departmental priority to capitalize on them for ourselves, for UW, and for our region.

Our track record is already strong in this regard. Ten years ago, the list of areas of expertise on our graduate student recruiting poster was relatively narrow and traditional:

- Architecture & VLSI
- Computer Systems and Computer System Performance
- Programming Systems
- Graphics & Computer Vision
- Artificial Intelligence
- Theory

Today our list of areas of expertise is far more diverse – matched by a broad range of collaborations across the campus. (Areas that are entirely new for us are italicized.)

- *Embedded Systems,* VLSI systems, *and Reconfigurable Computing*
- Computer Architecture
- *Networking*
- Operating Systems and Distributed Systems
- Programming Systems
- *Information Retrieval, Database Systems, and Intelligent Internet Systems*
- *Software Engineering*
- Computer Graphics, Computer Vision, and *Animation*
- *Human Interface to Computing*
- Artificial Intelligence
- Theory of Computation
- *Computing and Biology*

The availability of a significant number of faculty positions should further increase our inclination to invest in "outward looking" computer scientists and computer engineers. So at this point, we feel that the issues related to "recruiting strategy" are less related to our "departmental psychology," and more related to factors over which we unfortunately have less control, including:

- Competition for the nation's strongest Ph.D. graduates in computer science and computer engineering is extraordinary – from established industry (e.g., Microsoft Research), from startups, and from other top universities, all of which are seeking to dramatically expand their computer science programs.
- Our department's success – and our unique and much-admired culture – has largely arisen from having a very high bar for hiring, and a huge investment in mentoring, maximizing the likelihood of success. This makes bringing in new faculty a very "expensive" proposition. It's not obvious that we would be well-served in the long run by changing strategies – moving to a "lower bar for hiring, lower investment in mentoring, sink-or-swim at tenure-time" model.
- Further, to be honest, our success with senior hires simply hasn't been as great as our success with junior hires. Of course, there have been some tremendous successes, but there have been conspicuous non-successes, too. We will continue to hire very selectively at the senior level, but it doesn't strike us as a panacea.
- Our physical facilities are an *enormous* impediment. We desperately need interim space, prior to the completion of the CSE Building. This is addressed below.

We must continue to be "forward-looking" and "outward-looking" in our recruiting, and to aggressively seek creative solutions to the factors that limit our rate of growth. The University must contribute in areas including the points mentioned under "Faculty retention" above, the points mentioned under "Space" below, and startup packages, which have been removed from our direct control by the failure to provide our full permanent and one-time budgets during the 1999-01 biennium.

Entrepreneurship

Entrepreneurship is a fact of life in our field. We in the Department of Computer Science & Engineering share a common objective: to have, at the University of Washington, the strongest possible program of research and education in computer science and computer engineering, recognizing that our role as faculty is first and foremost to help our students reach their full potential. While research and education are our core activities, commercial activities – which range from industrial research agreements to consulting to licensing to company creation – can be a natural offshoot of these core activities. Indeed, the University of Washington has an *obligation* to commercialize in some circumstances. When conducted appropriately, commercial activities can enhance our strength, and positively impact the region, the economy, and society. However, commercial activities add tremendous complexity and stress to the academic environment:

- Innovation occurs at the department level, and the burdens related to entrepreneurship are borne there – management overhead, leaves of absence, conflict of commitment, graduate student issues, and so forth. But current UW policies do not allow departments to benefit significantly from the entrepreneurial activities of their members – the lion's share of the benefits are centrally retained. *We must fight for changes in UW policies related to entrepreneurship. We must persuade UW to re-invest where the innovation occurs and where the burdens of entrepreneurship are borne. And we must encourage those among us who found companies to recognize the contributions that our environment makes to their success.*
- Entrepreneurship creates the problem of *conflict of commitment* – a struggle between extraordinary internal and external demands. *We must continue to clarify our expectations for one another in this regard.*
- We must ensure that our culture and our policies continue to encourage and support faculty who wish to have impact in ways that are more traditional than leaving for startups. We must strongly encourage and reward "academic entrepreneurship" – entrepreneurship within the academic community, and externally-directed entrepreneurship that allows the faculty member to remain in the department and continue to be highly productive in that context. *We must find ways to support all forms of entrepreneurial activity, especially those that minimize disruption to our core mission.*

We placed the subset of these issues that we can control on the agenda for our External Advisory Committee last spring in order to raise the degree of focus on them. We feel we have made considerable progress on those issues since then; we refer you to our "Commercialization" web pages (http://www.cs.washington.edu/general/misc/commercialization.html) and particularly to the *Departmental Principles Regarding Commercial Activities*, which we include as Appendix P. But the internal issues will require continued attention, and we are up against the wall on the University-level issues.

Space

We are now 15 to 20 years behind our peer departments in the quality and quantity of our space – debilitated by the need to operate with roughly 1/3 of the average space of our peers, and facing the daunting task of raising $40 million privately to solve the long-term problem. *The CSE Building must continue to be unequivocally the University's top funding priority, and we must*

obtain incremental space with minimal hassle over the next few years in order to survive until its completion.

All aspects of our operations are impacted by the restricted nature and scope of our space. We have only a few thousand ASF of research laboratory space. We can't accommodate the visitors and postdocs needed to keep us vibrant, or the staff members needed to make the faculty more productive. We have difficulty recruiting not just faculty, but also graduate students. (We handed out chunks of the building to last year's visiting prospective students, to good effect; see http://www.cs.washington.edu/homes/lazowska/sieg/.) Our introductory course is hobbled by its laboratory environment, which appears about to take a further nosedive. Our undergraduate program is similarly hobbled. And because of the tight constraints under which we operate, every change consumes an enormous amount of faculty and staff time – it's like one of those 4x4 puzzles with 15 squares that need to be shoved around *ad nauseum* in order to achieve a new configuration.

Said bluntly, we feel that the University could – *and must* – do more than it has in this regard, based upon the allocation of space to other units whose situation just doesn't seem to be as dire as ours. The crumbling exterior of Sieg Hall is of significance merely as a visible symbol of the University's true neglect of our space needs.

Workforce pressures

Student demand and employer demand continue to soar. We are in the spotlight – worse, we are under the microscope and under the gun.

Regional pressure – from the Legislature, from certain industry associations, from citizens – focuses heavily on "cranking out students." As a top program at a top research university, though, we have a diverse mission. We understand full-well the balance that must be maintained, but it would be a constant challenge to maintain this balance even in the absence of strong external pressures.

We see several areas in which we must be even more active in the future than we have been in the past:

- *We must continue to clearly and forcefully articulate the diverse roles and contributions of a research institution. Every study of successful high tech economies points to the presence of strong research institutions as the #1 factor* – even ahead of the availability of a skilled/educated workforce. The success of Route 128 (Harvard and MIT), Research Triangle Park (Duke, UNC, and NC State are the corners of the triangle), Austin (the University of Texas), and the Bay Area (Berkeley and Stanford) speak volumes. Our field has roles and contributions even beyond those of other fields, because of the broad and deep impact of our field, both within the academy and in society at large.
- *We must continue to perform at the highest level in each of these roles, and to ensure that our contributions are recognized.*
- *We must partner even more extensively with others at the University of Washington in responding to student and employer demand* – with Educational Outreach, with Educational Partnerships, with UW-Bothell and UW-Tacoma, with the other participants in the Applied and Computational Mathematical Sciences program, with the School of Information, with the School of Business, with Electrical Engineering, and with others. *We must continue to lead*

the University of Washington in responding to student and employer demand, through a variety of creative strategies other than the continual enlargement of our existing degree programs.

- *We must become even more aggressive in providing statewide leadership* – helping to meet student and employer demand by continuing to lead in the development of educational opportunities that allow others to be more effective in helping to meet these demands.

We cannot be all things to all people, but we must continue to perform at the highest level in each of our appropriate roles, to partner and lead even more extensively within the University of Washington, to become even more aggressive in providing statewide leadership, and to tend to the strength of our political base, which allows us to politely decline demands that would severely distort our balance to the long-term detriment of the University of Washington and the state.

Educational efficiency

As the data in Section III shows, the past decade has seen our introductory course enrollment increase by a factor of five, our undergraduate major enrollment increase by more than a factor of two, our (non-research) Professional Masters Program grow from nothing to an enrollment of 120 students, and our Extension Certificate Programs grow from nothing to more than 3,500 course enrollments and 600 certificates awarded per year.

Additional faculty resources have been allocated, but there has been an enormous shift in how we spend our educational time – less and less full-time graduate education, more and more other education. The fact that actual faculty growth lags the allocation of slots exacerbates this problem.

We must be far more creative in responding to this entirely appropriate change. One key issue is that we have toed the line on attempting to cap enrollment in majors courses at 40 students. The result is an enormous amount of faculty effort devoted to teaching multiple sections of our core courses. This in turn leads to a relatively small number of undergraduate electives, and to a relatively small number of advanced graduate offerings. We placed this issue on the agenda for our External Advisory Committee (report in Appendix H) to stimulate thought; they argued that 40 is a lousy size both from the point of view of students and from the point of view of faculty.

We are in the early stages of responding to this advice. We must follow through. As part of this, we will need to introduce a differential reward structure for teaching various courses, depending upon factors such as size and nature. This will be a major transition for us.

Department culture

We have referred many times in this document to the unique "culture" of UW CSE. Changes in our environment are forcing re-evaluation of various aspects of this culture. This is a major challenge facing us. The environmental changes – many of which have been noted elsewhere – include:

- A 50% growth in faculty size
- The need to consider significantly different approaches to faculty recruiting
- The extraordinary pressures of entrepreneurship

- The need to provide far greater incentives and rewards for academic entrepreneurship and contributions to the department
- Dramatically increasing demands/opportunities for participation and leadership in campus-wide and regional initiatives
- A shift federally towards larger-scale research efforts
- Soaring student demand and soaring employer demand
- The need to institute a differential reward structure for teaching various courses
- More broadly, the need to reconsider our traditional "one size fits all" model of faculty duties

We walk a tightrope, responding to these changes while preserving the collaborative environment that makes us so special among academic departments and gives us a competitive edge that has been a key to our success.

New department chair

Ed Lazowska's term as chair ends on June 30 2001. A major task next year will be to choose a successor. This person will face a number of very significant challenges, as well as a number of very significant opportunities. The direction of the department for the majority of this critical decade is at stake.

This transition will be a key one for the department, and a key one for the University of Washington as well. The President and the Provost will need to be integrally involved. The importance of the department dictates this. Additionally, though, the commitments that will be required transcend the abilities even of our excellent Dean of Engineering: reaffirmation or fulfillment of commitments made to Lazowska, as well as new and essential commitments (in space and other areas) that have been beyond Lazowska's ability to extract.