March 15, 2001

JOHN SIMPSON
Campus Provost

Re: Baskin School of Engineering's Executive Summary and Highlights Document

Dear John:

I am pleased to forward the School's executive summary and highlights to our long-range plan. The document updates our plans for emerging initiatives and expands them to include events on our 10-year horizon.

Over the next 10 years, the School of Engineering plans to extend its interdisciplinary collaborations with departments and programs in the Arts, Humanities, Natural Sciences and Social Sciences. We are also committed to promoting the excellence of all UCSC students, providing them with the tools they need to be contributing citizens in our high technology society.

The School will play an important role in the Silicon Valley Center, and we are optimistic about the possibilities for collaboration and outreach that the Center represents. We will approach our role in year-round operations with an equal commitment, and we look forward to exploring compensation and support issues with the other divisions as the campus implements the expanded summer session.

Following our plans, in 2010, the Baskin School of Engineering will represent 15% of the campus, with 140 faculty and more than 2,800 majors. Recruiting senior leadership is a high priority for the School as we build reputable programs and meet our ambitious goals. Our long-range plan includes components that will ensure our success in becoming a distinctive School of Engineering.

Sincerely,

S. M. Kang
Dean

Attachment

cc: Department & Program Chairs
Associate Dean Ferguson
Assistant Dean Genes
Director Getting
Director Haussler
Director Mantey
Administrative Managers

LONG-RANGE PLAN: EXECUTIVE SUMMARY AND HIGHLIGHTS
BASKIN SCHOOL OF ENGINEERING, UC SANTA CRUZ

Now in its fourth year, the School of Engineering has reached a notable milestone: this year, the School will appoint its 50th faculty member. Over the next 10 years, the School will nearly triple in size. By 2010, the School plans to teach 15% of the campus's students, have 140 faculty and more than 2,800 majors. The mission of our School is to contribute to the excellent education of all UCSC students, independent of their majors, so that UCSC graduates are well equipped to be contributing citizens of a high technology society. In this vein, the School of Engineering will serve as the campus's information technology, applied mathematics, and statistics educator. At 140 faculty, the Baskin School of Engineering will remain relatively small compared to our counterparts at other UC campuses. However, we have a unique opportunity to develop a truly distinctive School of Engineering, one committed to excellence and uniquely tailored to promote technological innovation.

Our first three years have met with great success. Since the School's formation in 1997, we have introduced three new undergraduate programs: electrical engineering, information systems management, and bioinformatics (currently pending approval). Engineering majors have more than doubled since 1996-97, and we will exceed 1000 majors this year, another important milestone. The campus's commitment to the School has enabled our rapid growth, and we ask Chancellor Greenwood, Campus Provost Simpson and the Academic Senate to continue their commitment to the School's development. Your commitment to our vision is critical to our success in establishing a prominent and distinctive School of Engineering.

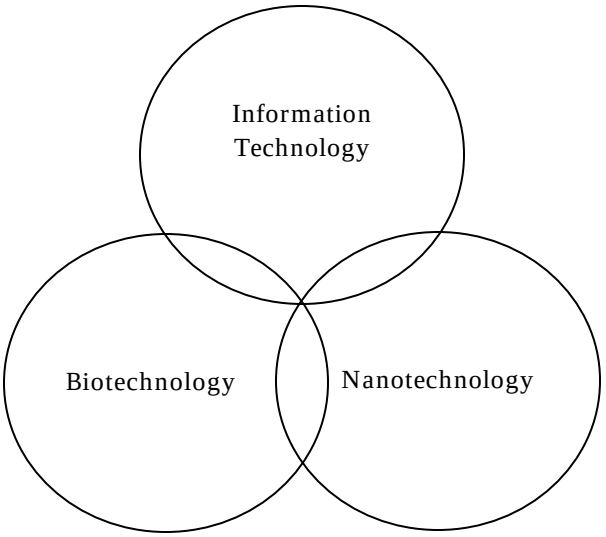
Our reputation is forming as we grow, and it is our goal to develop a School that stands above the rest in every aspect: teaching, research, and service to the profession. Our goal is to provide *Impact* of the highest *Quality* (IQ) with FIRST rate faculty, where FIRST stands for Forward-looking & frontiering, Innovative & impacting through excellence in Research, Service and Teaching. To achieve this goal, the School must hire excellent faculty and staff. Salaries and the lack of affordable housing continue to pose a difficult challenge to our recruitment efforts.

As we recruit faculty over the next 10 years, we will consider each appointment strategically and carefully and make offers only to outstanding candidates. We plan to have several "target of excellence" hires and also recruit eminent scholars who are of the caliber of National Academy members. Our approach should demonstrate the School's commitment to excellence. Senior leadership is a critical requirement for starting new programs, and we will strive to attract renowned candidates to ensure our success as we develop targeted areas of excellence.

The School of Engineering maintains a commitment to building bridges to other parts of the academic community at UCSC. In particular, we plan to form joint degree programs at both the undergraduate and graduate levels with departments in the Natural Sciences, Social Sciences, Humanities and Arts Divisions. Some examples of such joint

degree programs could be remote sensing (with environmental studies, and earth and marine sciences), engineering ethics (philosophy), computational linguistics (linguistics), history of technology (history), and engineering management (economics and psychology). We plan an environmental engineering program, which would interact strongly with several departments, such as environmental studies, earth and marine sciences, mathematics, biology and physics. In the research area, many bridges already exist between the School and physics, biology, earth and marine sciences and art, as well as many other departments. We envision many more such joint research efforts as the joint research collaborations grow.

AREAS OF EXCELLENCE



The Baskin School of Engineering will build and maintain excellence in three major areas: information technology (IT), biotechnology (BT), and nano-technology (NT). These three areas are closely linked and synergistic in nature, and activities in each area are supported and enhanced by contributions from the others. Applied mathematics and statistics makes critical contributions to each of these areas, in addition to their contributions to programs in the social and natural sciences.

Information Technology. Information technology includes the School's founding programs – computer science and computer engineering – along with information systems management and the developing program in software engineering. As our most evolved area, the School maintains several areas of excellence in its information technology programs.

Biotechnology. Recent worldwide events in biotechnology have accelerated our plans for a department of bioengineering. Research in biotechnology has rapidly advanced, introducing the need for more scientists and engineers. Due mostly to the work of Dr. David Haussler, the School maintains an excellent reputation for its work in bioinformatics. This recognition has resulted in Dr. Haussler's Howard Hughes Medical Institute Investigator award, the School's participation in one of the Governor's first

California Institutes for Science and Innovation ("QB3"), and extensive media coverage. As a result of these successes, the School has fast-tracked plans to establish a department of bioengineering. The Bioengineering Department will administer several interdisciplinary academic programs in bioinformatics, molecular level bioengineering, microarrays and microfluidics. Currently the bioinformatics area is our strongest area of emerging research excellence with international stature. Several senior faculty members have expressed interest in moving to UCSC and our success in recruitment will immensely accelerate our progress in this area of growing importance. Starting in Fall 2001, we will offer a BS degree program in bioinformatics and subsequently MS and PhD programs.

Nanotechnology. Nanotechnology is an enabling technology for both information technology and biotechnology. Size minimization for portability and energy savings cannot be realized without nanotechnology. Nanoscale device technology is best suited to molecular interfaces in bioengineering. The continuing trends in device feature size scaling (Moore's law) enables nanoelectromechanical systems (NEMS) which will have advantages over the current microelectromechanical systems (MEMS). The increasing needs for higher throughput network switching are most likely met by optical NEMS in the future with novel materials. This is the area that our School is lacking and yet cannot be overlooked in engineering disciplines. The Electrical Engineering Department already has a strong research program which uses molecular beam epitaxy (MBE) technology, and they have plans to build up this area. Strategic hiring of key senior faculty members will provide significant inroads.

Target Areas of Excellence by Department

X = Main department *Proposed

	AMS	CS	CE	EE	BE*	IE*
Bayesian statistics and dynamic mathematical modeling	**X**	X	X	X	X	X
Bioinformatics and biomolecular engineering	X	X	X		**X**	
Communications, signal and image processing	X	X	**X**	**X**		
Engineering management	X	X	X	X		**X**
Information technology infrastructure / database, storage, networks, and computer security		**X**	**X**	X	X	
Machine learning, human-computer interface, graphics and visualization		**X**	X	X		
Optoelectronics and optical systems			X	**X**		X
Remote sensing and environmental technology		X	X	**X**		**X**
Software engineering		**X**	X			
VLSI, nanosystems, MEMS / NEMS			**X**	**X**	X	**X**

Key:
AMS – Applied Mathematics and CS – Computer Science

Statistics
CE – Computer Engineering
BE – Bioengineering
EE – Electrical Engineering
IE – Interdisciplinary Engineering

ACADEMIC PROGRAMS

In this decade the School will develop research and instructional programs in Interdisciplinary Engineering which include materials, mechanical, environmental engineering and engineering management. Environmental engineering will provide significant synergistic alliance with environmental science programs in the Natural Sciences Division. Also, the Engineering Management graduate program will promote more interdisciplinary interactions with the Economics Department in the Division of Social Science.

In 2010, the School will have a comprehensive set of engineering degree programs that cover IT/BT/NT areas. We plan to offer the following degree programs:

Applied Mathematics	BS*, MS, PhD
Biomolecular Engineering	BS*, MS, PhD
Bioinformatics	BS, MS, PhD
Computer Engineering	BS, MS, PhD
Computer Science	BA, BS, MS, PhD
Electrical Engineering	BS, MS, PhD
Engineering Management	MAS, MS, PhD
Environmental Engineering	BS, MS, PhD
Information Systems Management	BS
Materials and Mechanical Engineering	BS, MS, PhD
Software Engineering	BS*, MAS, MS, PhD
Statistics	BS*, MS, PhD
Web and Internet Engineering	MAS

*We will explore the possibility of offering undergraduate degrees in biomolecular engineering, software engineering, and applied mathematics and statistics.

This document will focus on new programmatic initiatives, since they require a significant resource commitment. However, resources to meet enrollment growth in our existing programs are equally important and the School looks forward to a budget process that fairly addresses workload growth and recognizes differential workload measures.

Bioinformatics and Bioengineering

Eight faculty positions are planned to support the growth and development of these programs. Originally cast as biomolecular engineering, the School now envisions a department of bioengineering that houses both the bioinformatics and biomolecular engineering programs and their faculty. These programs plan to have a strong presence in the Silicon Valley Center.

Software Engineering

The School is in the third year of a five-year implementation plan for software engineering. Four of the eight positions planned for the program have been authorized in the last two years. We anticipate completing faculty hiring for the program in 2004-05, which coincides with the first cohort of graduate students. Software engineering is an important component of our Silicon Valley Center plans.

Engineering Management

Engineering management is the School's next priority after software engineering, and we are prepared to recruit a senior leader to begin implementing the program. Like software engineering, we envision this program as a critical aspect of our involvement with the Silicon Valley Center. A total of four faculty are planned for the program, with potential for growth from enrollments at the Silicon Valley Center.

Interdisciplinary Engineering

Our vision so far has had foci on information technology and biotechnology. For significant research in nanotechnology areas with close interdisciplinary education, we plan to start an Interdisciplinary Engineering Department that will host programs in environmental engineering, materials science and engineering, mechanical engineering and engineering management.

MAJOR INITIATIVES

In addition to our plans for new academic programs, the School plans to engage in several new initiatives to promote our reputation for excellence and innovation, and contribute to the campus's goals.

Silicon Valley Center

The engineering management and software engineering graduate programs remain high priorities for the School's on-campus programs, and we also consider them key components of the Silicon Valley Center's academic plan. There is great demand for engineers and engineering managers among Bay Area industries. The software engineering and engineering management programs cater to working professionals who want to update and augment their skills. As such, the programs will attract more working students if they can be easily accessed. If we offer these programs at the Silicon Valley Center, we can achieve two goals: 1) we make pertinent graduate study more convenient to professionals who live and work in Santa Clara County, and 2) we increase the campus' visibility in the process. As students explore the educational opportunities at the Silicon Valley Center they will learn more about the programs offered on campus and possibly choose to pursue doctoral study. The School anticipates the Center will uncover more opportunities to further our goals – biotechnology and statistical consulting center are additional strong possibilities. Many of NASA's goals match our research vision in IT/BT/NT as well. We see many opportunities in the Silicon Valley Center and we look forward to leading the campus's efforts to bring UCSC to Silicon Valley.

Pacific Rim Roundtable for Technology and Society

The regional advantage of the Pacific Rim will continue to be dominant in the new millennium in which technology must be developed in the interest of society and the environment. A Roundtable consortium to discuss and lead technology and energy resource development in harmony with society and environment would well serve the Pacific Rim. This program will be hosted through our Engineering Management program and will strongly resonate with and piggyback on UC's CISI initiatives for the Center for IT Research in the Interest of Society (CITRIS) and QB3. This activity will also serve as an important gateway for UCSC to the Silicon Valley region and Pacific Rim countries including Japan, China, Korea, Singapore, and Taiwan among others. Both the Social Science and Natural Science Divisions can be significant partners in this initiative.

Summer Session

The School is committed to participating in year-round operations, and we have discussed several possibilities to meet this charge. The Silicon Valley Center presents opportunities to attract students returning home to the Silicon Valley region for summer break. We might also offer courses for transfer students so they are farther along in their studies when they matriculate. Through our discussions, we realize the need for an academic coordinator to assist with the planning and implementation of a summer session, and we request support for this position, as well as additional resources to address faculty compensation issues.

College Sponsorship

The School proposes an information technology / engineering theme for College 11 or Crown College that will form a partnership between the School and the Colleges. The focus of the core course might promote computer literacy, or explore links between engineering / computer science and other campus disciplines (arts, economics, linguistics, biology, etc.). In addition to forming a strong academic foundation for the college's theme, our "sponsorship" of College 11 or Crown College would promote residential colleges for engineering students, allowing them to form closer ties. It would also facilitate a graduation ceremony for the School's students, a request we find increasingly difficult to honor on our own.

RESEARCH EXCELLENCE

Our reputation will be based on our research excellence. In addition to particular areas of research excellence, we also have a unique spirit of collaboration, which is reflected in our interdisciplinary partnerships. We want to maintain this collaborative spirit as we expand our research activities. As the School grows, we will build upon our areas of excellence and expand into new areas that further collaboration across departmental boundaries, forming new interdisciplinary connections between engineering, arts, humanities, social and natural sciences.

The School plans to have three organized research units: the Center for Biomolecular Science and Engineering (CBSE), the Institute for Networks and Information Systems

Technology (iNIST), and a third ORU centered around interdisciplinary science and engineering, including materials, mechanical and environmental engineering. Each Center encompasses a set of research activities founded on our current and planned areas of excellence.

Center for Biomolecular Science and Engineering

Directed by Dr. David Haussler, the Center for Biomolecular Science and Engineering is one of 21 centers around the world that make up the International Human Genome Sequencing Consortium, a crucial component of the Human Genome Project. The Center's affiliates represent a multitude of disciplines: biology, chemistry and biochemistry, computer engineering, computer science, applied mathematics and statistics, environmental toxicology, environmental studies, and physics. The CBSE has been very successful in achieving an international reputation for their work on the human genome. The Center will host Santa Cruz's component of the California Institute of Science and Innovation (CISI), "QB3," a venture shared with UC San Francisco and UC Berkeley. The School of Engineering is committed to developing the CBSE and plans to appoint 10-18 faculty over the next 10 years who will further the work and reputation of the Center.

iNIST

The Institute for Networks and Information Systems Technology will serve as an umbrella organization for several planned centers of research excellence. The Centers will each focus on an area of systems or networking, supporting technologies, or on applications related to the Internet and data-intensive systems. The School has prestigious faculty and world-renowned research in many of these areas, especially in the core areas of networking and computer systems. The new electrical engineering program has brought expertise in areas of communications, opto-electronics, packaging and instrumentation. Faculty in mechanical engineering, materials science, and environmental engineering will further efforts in remote sensing, opto-electronics, packaging, and instrumentation. The Institute is part of a proposal for another CISI, "CITRIS" with Berkeley and Davis, and we anticipate the Governor will fund the Center in his 2001-02 budget. The CISI project will fund new facilities and additional research staff at Santa Cruz to support the Institute's contributions to the $400 million CITRIS project.

Interdisciplinary Engineering Research Center (Tentative Title)

A third ORU in the School of Engineering will promote innovative research in novel and smart materials, environmental sensing and engineering, ocean engineering, nanoelectromechanical and microrobotics, and engineering management. These areas contain enormous opportunities for synergy with the two other ORUs in the School and also in collaboration with the Naval Postgraduate School in Monterey.

ADMINISTRATION

Developing a new School of Engineering, especially the campus's first professional school, represents a significant investment in resources and planning efforts. Our major

challenges in meeting our operational requirements include a serious space shortage, and several funding issues.

Capital Program and Space

The School currently has a space shortage that will become severe in fall 2001. We have outgrown our space in Baskin Engineering and are seriously in need of offices and research labs for new faculty. The first relief will come with the physical sciences building, scheduled to open in winter 2003. Until that time, our space situation will progressively worsen. We are considering interim strategies, such as renting off-campus space for research groups and locating faculty in other areas on campus. However, it is possible these dislocations could affect our momentum and collaborative spirit.

Planning for the Engineering II building is well underway. Scheduled to open in 2005, the building will initially house several engineering units and the economics programs. The two CISI projects we are involved with will fund add-on space to house associated research staff. At this point, the QB3 proposal is funded, and we anticipate the Governor's support for the CITRIS proposal led by Berkeley. The School should reach a size in 2010 that warrants exclusive occupancy of the Baskin Engineering and Engineering II buildings.

Major Resource Issues

The School currently has three primary operational resource issues: funding for faculty, funding for staff positions, and funding facilities costs. We also anticipate another emerging concern: furnishing new space.

- Funding for Faculty

  As mentioned previously, competition for qualified faculty is remains high. We face three challenges related to faculty recruitment: salaries, start-up packages and housing.

  The current engineering salary scales impair our ability to make competitive offers, even to junior faculty. Upgrade funding is also an issue for the School. Until the School's faculty reaches a size that yields normal turnover, and resulting turnover savings, we are unable to fund all of our upgrades and will make requests to Campus Provost Simpson as necessary. However, this is not an expressly local issue – Dean Kang plans to initiate a UC-wide proposal for a separate IT salary scale. A separate scale will improve our efforts to compete with industry and attract the caliber of candidates required to maintain the University's prestigious reputation.

  The School recognizes there are opportunities to raise extramural funding to enhance start-up packages, and we are committed to searching out these opportunities. Start-up funding has fallen very far behind competitive levels, and we hope Office of the President will make a case to the Governor to increase the State's support for this item. The quality of faculty recruited to the University has a direct impact on our ability to maintain and promote California's competitive advantage in technology-related industries.

The local housing market is perhaps the most daunting aspect of coming to Santa Cruz, and faculty at all levels are feeling its effects. The School could use an MOP allocation that provides $500,000 per recruitment, yet we anticipate receiving about half that amount. We urge the campus to find an interim solution until new campus-based housing is constructed.

- Funding for Staff

  This year, the School's staffing budget went into deficit. In the same way faculty salaries have fallen behind, so have staff salaries. Turnover savings no longer exist, as we usually have to offer new employees a higher salary than their predecessor. Recruiting and maintaining technical staff is especially challenging, and this group places the largest strain on our staffing budget. We are investigating mechanisms for extramurally funding portions of the research infrastructure; however, all of the options we are considering will take several years to fully implement.

  New initiatives also necessitate additional staff resources. Year-round operations, the decentralization of graduate admissions, and our involvement in the Silicon Valley Center will increase our workload, and the School is requesting assistance in meeting these staffing needs.

- Furnishing New Space

  We have been alerted to the lack of funding for furnishing the physical sciences building, and we request assistance from the campus in meeting these costs.

THE BASKIN SCHOOL OF ENGINEERING IN 2010
DEPARTMENTS, PROGRAMS AND FACULTY RANGES

In 2010, the School of Engineering plans to have 140 faculty. Actual faculty distribution will be informed by enrollments, but within the ranges shown below.

	Faculty Ranges		
	Lo	Mid	High
Applied Mathematics & Statistics	18	22	25
Applied Mathematics – BS*, MS, PhD			
Statistics – BS*, MS, PhD			
Bioengineering	12	15	18
Bioinformatics – BS, MS, PhD			
Biomolecular Engineering – BS*, MS, PhD			
Computer Engineering	22	28	32
Computer Engineering – BS, MS, PhD			
Off-campus Network Engineering program – MS			
Computer Science	28	35	40
Computer Science – BA, BS, MS, PhD			
Information Systems Management – BS			
Software Engineering – BS*, MAS, MS, PhD			
Web and Internet Engineering – MAS			
Electrical Engineering	18	25	30
Electrical Engineering – BS, MS, PhD			
Interdisciplinary Engineering	12	15	20
Engineering Management – MAS, MS, PhD			
Environmental Engineering – BS, MS, PhD			
Materials and Mechanical Engineering – BS, MS, PhD			
Total		**140**	

*We will explore the possibility of offering undergraduate degrees in biomolecular engineering, software engineering, and applied mathematics and statistics.