

SECTION 1: ACADEMIC PROGRAMS

The goal of the proposed academic programs is to create nationally recognized centers of excellence for the Baskin School of Engineering while providing a significant contribution to other academic areas and the UCSC campus as a whole. Senior leadership will be an essential element for starting and driving new and several existing programs. We will strive to attract renowned candidates to ensure successful achievement of our target areas of excellence.

Over the past 5 years, the School has built a framework for a comprehensive set of engineering degree programs at the cutting edge of technology, and has been recognized as a leading research center and engineering school. During the remaining period of the ten-year plan, the School will develop research programs in engineering that encompass innovative biomaterials, nanomaterials, biosensors and systems.

The proposed undergraduate programs reflect the growth of the School as well as the need to fulfill student curriculum expectations of a world-class engineering school located near Silicon Valley. In undergraduate education, our goal is to prepare engineering majors by providing an extensive array of lateral and integrated degree programs. New undergraduate programs in Applied Mathematics, Bioengineering, Computer Game Design, and Computational Biology are proposed or planned and reflect the School's desire to create programs which cross traditional disciplinary boundaries. This approach, which allows specialized areas of study for the undergraduate in a rapidly changing field of study coupled with education in other disciplines, benefits both the undergraduate student and the UCSC campus.

In graduate education, the School of Engineering's primary objective is to prepare students to assume leading roles in industry, national laboratories, and academia. Our graduate degree programs are designed for the pursuit of scholarly accomplishment by the active encouragement of both interdisciplinary and specialized areas of study, so that our students are equipped with fundamental skills and the ability to meet the demands of the ever-changing technical fields. The School will actively advance the pursuit of excellence in our graduate degree programs. Already at nearly 16% of the total UCSC graduate student enrollment, over the next five years the SOE plans to nearly double its graduate enrollments. This will be achieved through new and pioneering academic programs in areas of Autonomous Systems, Biomolecular Engineering, Software Engineering, Statistics and Stochastic Modeling and Technology and Information Systems Management, as well as increasing enrollments in existing graduation programs.

The Baskin School maintains a commitment to building bridges to other parts of the academic community at UCSC. Specifically, our plan includes the formation of degree programs at both the undergraduate and graduate levels jointly or in collaboration with departments in the Physical and Biological Sciences (PBS), Social Sciences, Humanities and Arts divisions.

Examples include:

- Applied Mathematics and Statistics is considering a proposal for a new undergraduate major in **Applied Mathematics**, a joint degree program with Mathematics;
- Biomolecular Engineering will propose new graduate program in **Biomolecular Engineering**, in collaboration with Molecular, Cell and Developmental (MCD) Biology, Chemistry, and Biochemistry;
- Applied Mathematics and Statistics, Computer Engineering and Electrical Engineering will propose a joint graduate program in **Autonomous Systems**;
- A new program track in **Computational Biology** will be developed in collaboration with MCD Biology and Biomolecular Engineering;
- Biomolecular Engineering, Computer Engineering, Electrical Engineering and MCD Biology departments are planning to create a new undergraduate program in **Bioengineering**;
- Computer Science will propose a new undergraduate program, **Computer Game Design**, in collaboration with Film and Digital Media and Mathematics Departments;
- Computer Science is considering proposing a graduate program in **Software Engineering**. Such a program could be related to faculty in Technology and Information Management and Computer Engineering, and could be a key initiative in the Silicon Valley Center;
- Electrical Engineering is planning a project-oriented **Masters of Engineering (MEng)** degree program, which fits in well with the new Technology and Information Management program and the possibility of a UCSC School of Management, centered at the Silicon Valley Center; and
- Technology and Information Management will launch a new graduate program, **Technology and Information Management**, in collaboration with Computer Science, Economics, and Psychology.

The Baskin School will also pursue the development of a certificate program related to the Technology and Information Management Program with UCSC Extension, and short courses based on faculty areas of expertise, depending on appropriate opportunities and mutual interest.

We should note that as the SOE continues to grow, some of the programs in CE and EE will begin to have a mechanical engineering flavor, particularly in the areas of MEMS, autonomous systems, renewable energy resources and in some instances in bioengineering. Since the number of faculty allocated to the SOE does not allow the development of a new department in Mechanical Engineering, we anticipate being able to develop mechanical engineering-like research and instructional programs within existing departments by planning concentrations and minors in those areas.

TABLE 3: Timeline for Engineering Degree Programs

		AY 06-07	AY 07-08	AY 08-09	AY 09-10	AY 10-11
		E S T A B L I S H E D		P L A N N E D		
<u>Applied Math & Statistics</u>						
Statistics	Minor					
Statistics & Stochastic Modeling		MS/PhD				
Applied Mathematics						BS
<u>Biomolecular Engineering</u>						
Bioinformatics	MS/PhD					
Bioinformatics	BS					
Bioinformatics	Minor					
Biomolecular Engineering						MS/PhD
<u>BME/CE/EE/MCD</u>						
Bioengineering		BS				
<u>Computer Engineering</u>						
Computer Engineering	BS					
Computer Engineering	BS/MS					
Computer Engineering	MS/PhD					
Network Engineering	MS					
Computer Engineering	Minor					
Computer Technology	Minor					
Autonomous Systems						MS/PhD
<u>Computer Science</u>						
Computer Science	BA/BS					
Computer Science	MS/PhD					
Computer Science	Minor					
Computer Game Design		BS				
Software Engineering		MS/PhD				
<u>Electrical Engineering</u>						
Electrical Engineering	MS/PhD					
Electrical Engineering	BS					
Electrical Engineering		MEng				
<u>Technology & Information Management</u>						
Information Systems Management	BS					
Technology & Information Management		MS/PhD				

APPLIED MATHEMATICS AND STATISTICS

Over the next five years, Applied Mathematics and Statistics (AMS) will help UCSC to:

- Strengthen the campus position as a major research university, by building on our already-recognized excellence in mathematical biology, mathematical astrophysics, control theory, and Bayesian statistics (nonparametrics, spatial-temporal modeling, and computationally-intensive methods of inference, prediction and decision-making, with applications in environmetrics, genetics, health policy, medical statistics, and computer modeling and simulation of complex phenomena);
- Promote innovation and enhance academic quality at both the undergraduate and graduate levels, and substantially increase doctoral production, (a) by converting the already-functioning informal AMS graduate program to a formal program with parallel tracks in Applied Mathematics and in Statistics, and (b) by co-developing with the Department of Mathematics a new undergraduate major and minor in applied mathematics;
- Substantially increase contract and grant support, by building upon existing strengths within AMS to reach out even more successfully to current research partners at Kaiser Permanente Division of Research, the Lawrence Livermore Labs, the Los Alamos National Laboratories, the National Aeronautic and Space Administration (NASA), the National Center For Atmospheric Research, the Sandia National Laboratories, and new partners, for new and continuing funding from institutions such as the CalFed Science Program, NASA, the National Institutes of Health, and the National Science Foundation;
- Manage the enrollment growth necessary to accommodate 2,800 new student FTE between now and 2010–11, and improve access for the diverse population that comprises California today, by continuing the process of joint curriculum planning with existing partner Departments (Ecology and Evolutionary Biology, Economics, Environmental Studies, Environmental Toxicology, Mathematics, and Molecular and Cell Developmental Biology), and extending this joint curriculum planning to new partner Departments (e.g., Psychology and Sociology), to expand existing AMS service teaching and develop new courses of greatest usefulness to the campus in both applied mathematics and statistics; and
- Encourage trans-departmental and trans-divisional academic and scholarly programs, by building upon existing strengths within AMS to deepen continuing collaborations with other UCSC scholars in programs such as the UCSC Center for Information Technology Research in the Interest of Society (CITRIS), the Center for Stock Assessment Research (CSTAR), the Institute for Quantitative Biomedical Research (QB3), and the STEPS Institute, and begin new collaborations.

AMS currently has 9 ladder faculty (4 in Applied Mathematics, 5 in Statistics), with a senior search in Applied Mathematics underway in 2005–06. By 2010–2011, AMS is projected to have 15 ladder faculty. AMS is projected to receive a total of approximately

\$1.7 million in contract and grant awards in 2010-11 (a 73% increase over the corresponding 2005-06 value); AMS expects to have a total of 39 graduate students in residence in 2010-11 (a doubling in size of the current informal graduate program); and AMS is projected to teach approximately 447 student FTE in 2010-11 (a 51% increase over the corresponding figure in AY2005-06). See the AMS 5-year plan in the appendix for recent honors and achievements.

We anticipate system-wide approval of a graduate program proposal in Statistics and Stochastic Modeling (SSM) by fall 2006 or winter 2007. However, according to the Graduate Council and the Committee on Planning and Budget, (a) the viability of the SSM graduate program is threatened without an immediate infusion of new faculty positions in statistics; (b) the establishment of a graduate program in applied mathematics is also a top campus priority; and (c) a similar infusion of new faculty positions in applied math is necessary to meet goal (b).

Once the SSM proposal is formerly approved, AMS will therefore seek system approval for permission to re-launch the AMS graduate program, with the title “Graduate Program in Applied Mathematics and Statistics” with parallel tracks in applied math and statistics.

The AMS graduate program will serve as a research and teaching springboard for a new undergraduate program in Applied Mathematics, which will be developed jointly with the Department of Mathematics. We anticipate launching this new undergraduate major and minor in 2009-10. In addition to serving as a double major possibility (e.g., with Biology, Mathematics and Physics), this major will potentially serve as an excellent source of high-quality AMS graduate students, in both applied math and statistics.

AMS recommends four future opportunities for UCSC investment in new endeavors related to AMS:

1. Proposal to establish a Research Institute in Applied Mathematics and Statistics (RIAMS), for collaborative research in areas including astronomy/astrophysics, computational genomics, environmetrics, mathematical biology and robotics;
2. Growth in SoE-Physics collaboration in the area of Biophysics (nanobiology of aging; protein motors);
3. Proposal of a new program in Control Theory, with collaboration from Astronomy/Astrophysics, Electrical Engineering, Computer Science and Computer Engineering; and
4. Creation of a Statistical Consulting Service, which will provide a UCSC central clearing house for statistical advice to faculty and graduate students on design and analysis issues in projects involving data collection, modeling and interpretation.

With additional faculty from the RIAMS proposal, AMS would propose an undergraduate major in statistics (an undergraduate minor in statistics has already been established). We will revisit this issue in 2008-09 by conducting a study of the undergraduate statistics degree program at other UC campuses.

BIOMOLECULAR ENGINEERING

The Department of Biomolecular Engineering (BME) was founded at UC Santa Cruz in January, 2003 making it the newest academic department in the School of Engineering. BME administers the undergraduate and graduate program in bioinformatics.

Biomolecular Engineering is a program of great promise within the long-term planning in the School of Engineering. The departmental faculty enjoy international acclaim for their pioneering research and graduate instruction in Bioinformatics and their ongoing contributions to the Human Genome Project. Faculty members use powerful new physical and computational engineering tools as they investigate fundamental problems of modern biology, biochemistry and biophysics. In this regard, BME is among the most innovative and interdisciplinary departments at UCSC, thereby bridging perceived boundaries between engineering and the sciences. The new department offers a highly interactive environment in which colleagues and their students can undertake cutting-edge interdisciplinary research and develop attractive academic programs for the next generation of biomolecular engineers. As a result, a substantial number of other UCSC faculty are now involved in collaborative efforts with their colleagues in BME, and are actively developing courses and programs of study in these areas. With an international head start in the area of bioinformatics, the department has been able to create unique teaching and research programs, and BME students upon graduation will find career opportunities in both academic and industrial settings.

BME's near term goal is to recruit a sufficient number of faculty to achieve critical mass. We will recruit only the most talented faculty members who regard themselves as cross disciplinary, and can work at the molecular and nanoscale level with the tools of both computational and experimental science. The department plans to grow to a total of 14 ladder-rank faculty by 2010-11, including at least one Howard Hughes Medical Institute (HHMI) investigator, plus one faculty member who currently has a split appointment with the BME and Computer Engineering Departments. The department will also attract several affiliated faculty from UCSC's Molecular, Cell and Developmental (MCD) Biology and Chemistry and Biochemistry (CBC) Departments, as well as other School of Engineering Departments.

With a successful recruiting effort over the next several years, we believe it will be possible in the near term to undertake planning for a multi-department based bioengineering BS program, followed by BS, MS and PhD programs in biomolecular engineering over the longer term. UCSC presently has 20-30 faculty members working in bioengineering and affiliated areas. Members of this group are already working to create a unified vision of research, graduate training, and undergraduate education in the broad area of bioengineering.

As to be expected in such a thriving area at the forefront of modern biotechnology, it is both difficult and expensive to recruit faculty. Additionally, the rapid growth of our discipline has left the School, as well as the Division of Physical and Biological Sciences and the Campus unprepared for the laboratory needs of our faculty. BME's international

stature has assisted greatly in faculty recruitment, but can only partially mitigate the issues of insufficient resources. As an individual program, we have no way to address the short-term and long-term space issues related to wet laboratories and contiguity.

Thus, we find our nascent department at a crossroads, which is an appropriate place to be as we commence a five-year planning process. The faculty of the Department of Biomolecular Engineering expects a clear and committed priority within the School of Engineering, the Division of Physical and Biological Sciences, and the campus. We are heartened by the planned allocation of FTE that will allow the department to achieve its mature size by 2010-11. As a major priority, it then follows that research space and start up funding appropriate to such a venture must be allocated.

COMPUTER ENGINEERING

The Department of Computer Engineering will maintain and build excellence in research, undergraduate and graduate teaching, and service during the next five years. In research, we target five specific areas of research excellence:

- Computer system design;
- Design technologies;
- Digital media and sensor technology;
- Computer networks; and
- Embedded and autonomous systems.

In the coming 5 years, we plan to maintain excellence in these focused areas and build excellence in a cross-cutting interdisciplinary emphasis in assistive technology as we seek to train undergraduate and graduate engineers for the future.

Recent examples of research excellence include leading a \$5.2M multi-university consortium to develop the new science of ad hoc networks; creating and receiving national publicity on the development of a virtual white cane for the blind; receipt of NSF career awards; receiving a highly competitive NSF Major Research Instrumentation grant to launch our autonomous systems program; working with biology faculty and undergraduates to create a sensor network for coral reef monitoring, creating collars and a sensor network for monitoring of the activities and behavior of coyotes, and receiving continuing funding (with Environmental Toxicology) for research on real-time control of ground-water clean-up.

In teaching, we strive for innovation and excellence in the classroom and in academic programs. We have led efforts to integrate modern technology in teaching, and are constantly working to improve our undergraduate and graduate curricula. Recent examples of teaching excellence include innovation with tablet PCs and web archiving (supported by COT), offering a new first-year Hands-On Computer Engineering course every quarter to increase excitement and improve retention in engineering students, creating a minor in Computer Technology targeted for non-engineering students interested in K-12 teaching, and placement of our PhD and Postdoctoral graduates at leading industrial research laboratories and in faculty positions at UM Amherst (now tenured), UCI, Santa Clara, Georgetown (now tenured), Cal Poly San Luis Obispo, Bahcesehir University, U Naples, and U Twente.

Recent examples of service excellence include serving as Provost of Crown College; chairing the Committee on Educational Policy; leading UCSC's CITRIS branch; directing the Korea Telecom executive program; being Associate Dean for Undergraduate Affairs; leading SOE Outreach; and chairing CONCUR 2005, the lead international conference and concurrency theory. Computer Engineering has also taken significant part in UARC development.

The Department of Computer Engineering seeks to sustain and build excellence with diversity. This is a particularly difficult goal within the discipline of engineering which has traditionally has not had significant representation among women and underrepresented minorities. Because of this problem, the Department has placed a strong emphasis on diversity within engineering.

Computer Engineering has had no net growth since 2001-02. In spite of the lack of growth, we have been able to meet or exceed most 10-year plan measures, when adjusted for the number of faculty. The numbers show a high level of effectiveness for allocated resources, lending strong support to the idea of moderate growth within the Department of Computer Engineering and its broad interdisciplinary research programs.

Future Opportunities for Investment

The Department has identified five exciting opportunities for the near future, the first three of which will be supported with new FTE and the latter two of may be supported with any additional positions or turnover. Investment in these areas will enable (in part) the development of a program in bioengineering, the development of a world-class program in autonomous systems and control, and solidification of our international prominence in networks.

- **Assistive Technologies and Bioengineering.** This area is of extreme importance to our aging population. We envision the creation of a research center, with strong collaborations with faculty in digital media and sensor technology, embedded and autonomous systems, biomolecular engineering, electrical engineering, and molecular, cellular, and developmental biology. We are in the planning stages in developing a BS program in Bioengineering jointly with the departments of BME, EE and MCD Biology.
- **Program in Autonomous Systems.** Computer Engineering proposes the development of interdisciplinary graduate group in Autonomous Systems and Control, with CE, EE, AMS, and TIM. Hiring in Computer Engineering for this program will focus on the design and construction of autonomous systems. . This program is expected to be part of a mechanical engineering emphasis in the SOE within the next decade.
- **Networks Pinnacle of Excellence.** Network and internet security has become a key area of applied research within the computer networks field. Computer Engineering is poised to expand to internetworking and applied network security.

COMPUTER SCIENCE

The quality of UC Santa Cruz's Computer Science Department is reflected by the accomplishments of its faculty. The Computer Science Department has been in existence for over thirty years and offers four degrees: B.A., B.S., M.S. and Ph.D. in Computer Science, with a combined BS/MS degree currently under development. The program includes nineteen full-time ladder rank faculty with 126 students enrolled in the graduate program. To date, the Department has awarded more than 220 Masters and 80 Doctoral degrees. University-industry interaction is enhanced through the employment of computer professionals as visiting faculty and through arrangements for students to gain practical research experience by working as interns in nearby industrial research laboratories.

The Department is highly regarded on campus and at the national level for its excellent faculty, extramural funding, and high quality of teaching. Of the current nineteen faculty members, ten are full professors, three are associate professors and six (one of whom was hired this year) are assistant professors. The technical strength and the impact of faculty research is demonstrated by their appointments to the editorial boards of several ACM and IEEE journals, a Sloan Foundation Fellowship, and participation in numerous technical program committees and NSF panels. The department faculty includes two ACM Fellows (Pohl and Kolaitis) and an IEEE Fellow (Long). Four department Assistant Professors have received NSF CAREER awards. All Computer Science faculty members have funded research projects and publish regularly in leading technical journals. During the past five years, the Computer Science faculty received \$11,589,000 in extramural funding, including \$2,624,000 in 2004-05.

The Computer Science faculty conducts research in the following primary areas: Computer Graphics and Scientific Visualization, Computer Systems, Machine Learning, Databases and Software Engineering. The Department of Computer Science is highly regarded for its strength in Computer Graphics and Scientific Visualization. The Department also enjoys great strength in the area of Systems Research with seven faculty members and 20 graduate students working in storage systems, distributed computation, programming languages, and database systems.

The Computer Science Department emphasizes the placement of its degree recipients and actively assists them in obtaining rewarding positions. Graduates have gone on to a variety of positions in academia and industry. A number of Computer Science graduates have pursued teaching careers, securing positions at institutions such as Rice University, Johns Hopkins University, the University of Pittsburgh, UC Berkeley, and a recent position at UC San Diego. Placements in industry have included positions at bellwethers such as Apple Computer, Bell Labs, IBM Almaden Research Center, Micron Technology, National Semiconductor, Oracle, Raytheon Corporation, Sun Microsystems, Sarnoff Corporation, SGI, Veritas, Xerox, Yahoo, and several startup companies. Additionally, some students have accepted employment at government research facilities, including Los Alamos National Laboratory, the Naval Research Laboratory and nearby NASA Ames Research Center. The strong placement record the Computer Science

Department has compiled is not only a reflection of the strength of its programs, but also the quality of its students.

In the next five years, highest priority will be faculty recruitments for supporting the Computer Gaming/Entertainment initiative, Database Systems, Software Engineering and Programming Languages, Machine Learning and Data Mining, and Operating Systems. Additional faculty recruitments are anticipated for supporting areas of Computer Security, Computer Graphics, Algorithms, Machine Learning, Artificial Intelligence, Systems, and Software Engineering.

We are currently recruiting faculty in Computer Gaming in order to create a new sub-major. This is important in two regards: computer gaming is a fast growing research area that integrates existing strengths in the department; computer gaming is very attractive as a recruitment tool for very high quality undergraduates. Computer Gaming already exists as a pathway in the ordinary CS major. By creating a new named degree program tentatively titled **Computer Game Design** we expect to reverse the recent decline in the number of CS majors and increase the quality of entering freshmen. UCSC will have the first such degree in the UC system that emphasizes rigorous technical computer science.

Resource issues for this new degree are adequate for accepting 25 majors. The courses within CS for this degree already exist or can be managed when the new CS gaming position is filled in 2006. Programs that have been contacted by us, especially digital media, economics, music and mathematics all welcome this initiative and plan to accommodate the first cohort.

The Computer Science department currently has 262 undergraduates (declared and proposed majors) and 126 graduate students (as of Fall 2006). We expect to bring on board approximately 25 new CS gaming students a year over the next 4 years.

We expect to increase our service offerings in several ways over the next two years. We have a new lower division computer gaming course that is expected to attract 200 students. Our general education programming courses are gaining in popularity and are required by the business economics major and some science majors. We expect to have 300 students in our yearly offerings for these courses. CMPS 10, a feeder and general education course, remains very popular and has two offerings with nearly 300 students per year. We expect the graduate program to grow in proportion to faculty growth—namely approximately 7 grad students per faculty.

ELECTRICAL ENGINEERING

A key strength of the department and a major distinguishing feature is the research focus on the underlying science necessary to solve important engineering problems. Our faculty have key collaborations across divisional boundaries with colleagues in Applied Mathematics, Astronomy, Chemistry, Physics, Molecular, Cell and Developmental Biology, Earth Sciences, Ocean Sciences, Education, both on and off campus, and with various medical schools.

EE faculty have been recipients of numerous national and international awards, such as the IEEE Third Millennium Medal, the Rank Prize in Optoelectronics, the Burton Medal of the Microscopy Society of America, The Mac Van Valkenburg Award of the IEEE Circuits and Systems Society. In addition, our faculty have been elected as IEEE Fellows, AAAS Fellows, Packard Fellows and four of our faculty have won NSF CAREER awards. EE faculty have played major roles (PI or co-PI) in large scale multi-investigator, multi-institution research centers. The NSF Engineering Research Center in Biomimetic, Microelectronic Systems (USC, lead; UCSC, CalTech) and the ONR Center for Thermionic Energy Conversion (UCSC, lead; UCB, UCSB, Purdue, Harvard, North Carolina State) are just two examples.

We see the intersection of the life sciences with engineering (and particularly electrical engineering) as one of the intellectually exciting areas of the future. This is true not only for the instrumentation arena, but also in the biomedical, environmental and materials areas as well. We also see the intersection of the environmental sciences and electrical engineering as another emerging area in which our faculty are getting involved. Faculty are not only working on both developing novel forms of remote sensors for earth and ocean environments, but they are also investigating many aspects of the “physical layer” of wireless communications needed to tie networks of sensors (radar, sonar and optical) together in order to sense multidimensionally on a large scale.

With a significant program in opto-thermo-electric conversion devices, some faculty members in the EE department are also looking at alternative methods of energy conversion. Energy generation and its environmental impact is another of the key issues in society and it will certainly become more important in the future as fossil sources are depleted. The other exciting area in which we plan to expand (and which overlaps with the other areas) is that of low power/analog/mixed signal circuit design.

Because of the multidisciplinary research of the EE faculty, the faculty is involved with several campus research centers: the Santa Cruz Institute for Particle Physics (SCIPP), the Center for Adaptive Optics (CfAO), the Center for Biomolecular Science and Engineering (CBSE), the Center for Integrated Marine Technology (CIMT), the Institute for Geophysics and Planetary Physics (IGPP) and the Center for Remote Sensing (CRS), two of the California Institutes for Science and Innovation -- the Center for Information Technology in the Service of Society (CITRIS), a consortium of UCB, UCD, UCSC and UCM and the Center for Quantitative Biology (QB3), a consortium of UCB, UCSF and UCSC) – and, the new California Institute for Regenerative Medicine (CIRM).

The number of Electrical Engineering ladder rank faculty has been increasing at a rate of about 8.25% per year since the department approval in 2000. By 2010-11 we will have grown to 18 FTE. Furthermore, we would like to increase the number of adjunct/research faculty whose primary concentration is on research. However, the UCSC policy of having adjunct appointments go through the identical hiring process as for ladder rank faculty results in excessively long delays in hiring and prevents the department from taking advantage of unique targets of opportunity.

As the EE department has started to grow in the device and nanotechnology area, more materials processing needs and specialty spaces have become essential. Thus, there is a critical need in EE for wet chemistry, materials processing and characterization space (much of this needs to be in vibration and EM interference free environments). In the long term, we are looking at expansion space for both applied optics, microfabrication and processing in the 2300 Deleware building. There is also the long-term possibility of utilizing research space in the Bio-Info-Nano Research and Development Institute being planned at NASA-Ames Research Park.

As we look at the mix of MS and PhD students in our graduate program, we are exploring the possibility of offering another type of graduate degree, a project oriented masters of engineering (MEng). The basis for this is that there are a significant number of students enrolled in graduate courses in EE at UCSC who work in Silicon Valley. UCSC has established the Silicon Valley Center headquartered at the NASA-Ames Research Park in Mountain View, just 35 miles away and the School of Engineering is committed to developing academic programs in that center.

Other plans for the next five years include:

- Expanding the department by five faculty in our focus areas of excellence;
- Offering a wider selection of courses that will benefit the entire campus;
- Revise student advising and mentoring system to improve student retention;
- Continue investigating ways to improve math fundamentals of EE undergrads;
- Increase external funding to more than \$500-600K per faculty, a number consistent with the top ten EE departments in the country; and
- Develop administration infrastructure to allow EE faculty to more easily put together large-scale research proposals.

It needs to be mentioned again, that a crucial aid in allowing EE to pursue these various pathways is the ability to be able to attract esteemed research/adjunct faculty. UCSC needs to streamline the process for adjunct appointments. This is not only a problem for electrical engineering, and engineering as a whole, but will also be a problem for the proposed School of Management.

TECHNOLOGY AND INFORMATION MANAGEMENT

The objective of the Technology and Information Management Program (TIM) is to conduct cutting edge research and produce graduate students in the area of managing information, knowledge, innovation, and technology. The operations of the Bachelor's degree program in ISM (Information Sciences Management), launched jointly by the Economics and Computer Science departments, have resided for last seven years within the Computer Science department. The establishment of an independent department offering Masters and Doctorial degrees is proposed for Fall 2007.

The new department will combine knowledge of engineering analytics with the broader knowledge of how to use these analytics to solve problems and create value in today's fast changing technology and business climate. Topics of interest include information management, knowledge engineering, commercialization of technology, new product development, stochastic optimization with risk assessment, business intelligence, and data mining, enterprise integration, and application of knowledge and emerging technologies to business enterprises. Our prior research work and on going collaboration with Silicon Valley companies, such as Cisco, IBM, Yahoo and HP have given TIM a major advantage in business knowledge engineering. We will sustain our excellence in this area, especially in the context of service economy.

The Technology and Information Management program is expected to have strong ties to several departments within the UCSC campus, including computer science, computer engineering, electrical engineering, applied mathematics and statistics, biomolecular engineering, economics, psychology, sociology, anthropology, biology and environmental studies. There are several future opportunities for investment in new endeavors that provide for synergistic interdivisional collaborations. These include:

- Robotics for business;
- Knowledge engineering in health systems or biology;
- Information management in social networks; and
- Managing innovation.

We expect that some of these collaborations are likely to result in new degree programs after the TIM graduate degrees are approved.

Over the next five years, our priorities are as follows:

- It is critical that we are successful in recruiting 4 new ladder faculty with expertise in: financial engineering; new product and services design development and management; innovation engineering and management; and knowledge services and management. Since these are emerging areas with very high salary premiums, we will pursue a strategy of hiring those who possess the necessary skills and industry exposure or have demonstrated an ability to span area boundaries and are fast learners;

- We will build upon this foundation with 4 additional ladder faculty with expertise in TIM and other campus programs; and
- TIM has a high priority to build divisional and inter-divisional collaborations. We propose development of campus-incentive programs where 2/3 faculty FTE is housed in one department while 1/3 FTE is housed in TIM or vice-versa. TIM is extremely keen in having a total of 3 to 5 FTE offering 1/3 FTE to 9 departments.

The five TIM faculty (including the associate adjunct professor) are actively engaged in seeking extramural research support. Successful funding in the past couple of years includes two NASA projects funded through the UARC ARP competition, and research projects funded by HP and Cisco. TIM faculty is engaged in writing NSF CAREER grants and collaborative NSF grants with CE and Economics faculty. We have also submitted a proposal to Samsung in collaboration with the SOE Dean. TIM is interested in participating in an IGERT grant and is looking to campus leadership to articulate principles so that every group can get a fair chance of participating in these grants which are limited to 2 per institution. TIM faculty is actively pursuing several industry contacts with many companies including IBM for research funding. Campus funding for seed projects involving interdivisional collaboration will also prove very useful to TIM faculty.

Technology and Information Management is an area that develops principles and concepts that impact managers and executives, rather than engineers alone. Consequently, TIM is an area where the following measures of excellence are appropriate:

- Placement of undergraduate and graduate students;
- Alumni support (an area that school of Engineering must build and emphasize; we like to nurture our undergraduate and graduate students through active mentoring; many of them are likely to hold executive and managerial positions down the road);
- Impact of executive courses on industry to be evaluated through evaluation questionnaires; and
- Impact of our research on industry practice and executive impact to be evaluated through industry survey on a long-term (for example, five-year) time scale.

Other goals for the next five years include:

- Increase service course offerings which will benefit the entire UCSC community;
- Build upon our successful internship program with Seagate Technology;
- Engage in an intensive undergraduate outreach program, with a target of increasing enrollments by a compounded rate of 10-15% over the next 3-5 years
- By 2010-11, reach a graduate student level of 58, with 8 FTE faculty and 4 adjunct faculty (externally funded); and
- Recruit Silicon Valley executives for presenting campus seminars and becoming TIM adjunct faculty.