UC Santa Cruz
Strategic Academic Plan for Silicon Valley
Revised August 2013

1. Overview

The University of California and Silicon Valley have much to bring to each other. As the closest UC campus to the Valley, UC Santa Cruz in particular has the responsibility and the mandate to develop instructional and research programs for what is arguably the world's leading center of innovation. Here we present an academic plan for UCSC in Silicon Valley. The overarching philosophy of this plan is one of intersecting synergies. The first of these synergies results from the mutually beneficial relationship that often occurs between universities and industry. UCSC has much to gain from closer engagements with industry. Research problems that originate from industry can provide intellectually stimulating projects for students and faculty, and access to these problems would provide an advantage to UCSC researchers working in "high tech" fields. At the same time, industry benefits from access to well-trained students and research capabilities of faculty. Second, a new cohort of faculty aligned with emerging technology directions will create a channel of access to commerce for all of the UC campuses. The technology foci of this effort will drive a level of inter-disciplinarity that will supersede the departments and promote stronger engagements with companies. Third, educating both graduate and undergraduate students in programs informed by industry needs will improve employment prospects for UCSC students. Finally, close identification with Silicon Valley will strengthen the UCSC campus brand, and indeed that of the University of California system, both nationally and internationally. For students and researchers who want both ease of access to corporations and a campus experience, UCSC-Silicon Valley will be a favored destination.

Silicon Valley is defined by its companies and the innovative products they create. In UCSC's early years, the need for companies to develop close interactions with universities was less compelling than at present. Until the 1980s, many large corporations performed their own basic research and universities did not have the mechanisms or motives for partnering with industry on research projects. The ensuing years witnessed the Bayh-Dole act, increased competition in the high technology sector, especially from overseas, and a shift of emphasis towards short-term earnings, the latter of which lead to the decline of basic research in industry. Before that, many of the larger companies supported internal research and development laboratories that performed a significant amount of basic research. The companies viewed this research as a way to keep them connected to external developments in science, but it played another role, not quite understood at the time. The researchers in industry effectively translated problems arising from manufacturing and the broader world of commerce into scientific problems, which defined research directions in many areas of science. Thus, the loss of these labs has had an impact that extends beyond its effect on the individual companies. Corporations now have a greater need and desire to interact with academia for research and instruction. Conversely, engineering schools now bear the responsibility for bringing technology problems into academia, and new modes of academia/industry interactions are being developed. One particularly interesting model for such "tech transfer" is that of the university-originated start-up company. Start-ups are now seen as essential for the continued growth of the Silicon Valley economy and universities will play a major role in their creation.

Entrepreneurial activities are driven by interactions that are serendipitous, informal and immediate, all of which are enhanced by geographical proximity between researchers and investors. For large corporations, geographical proximity can enable a type of interaction that is difficult to achieve from a distance. Officers of such companies as Google, Oracle, eBay and Applied Materials have expressed an interest in hosting graduate students to conduct research projects at their companies. Thus we believe it is possible to turn the geographical proximity of UCSC to Silicon Valley into an educational advantage, while retaining the primacy of being a public educational institution.

An additional reason for UCSC to expand its presence in Silicon Valley is to strengthen our relationship with NASA. UCSC manages a University Affiliated Research Center (UARC) and benefits from management fee revenue. Perhaps more important than the financial benefit is the tremendous potential for increased interactions between NASA researchers and UCSC faculty. Continued operation of the UARC will require stronger research ties in the areas of earth and planetary sciences, autonomous vehicles, data science and air-traffic control. With an enhanced presence in Silicon Valley, UCSC can help NASA establish research collaborations with Silicon Valley companies and be a more effective bridge between NASA and the other UC campuses.

Growth of UCSC in Silicon Valley has been a long-term campus goal, and is consistent with the 2008 UCSC Strategic Academic Plan[1] and with important elements of the original 1963 Long Range Development Plan. In fact, one of the original planning premises on which the 1963 LRDP was built was an "ongoing cooperation with the surrounding communities with the goal of 'mutually advantageous growth.'" Establishment of a UCSC campus site in Silicon Valley furthers such growth and cooperation. A Silicon Valley presence will also lead to further growth of graduate enrollments at UCSC, a primary goal of both the 2008 plan and of the recent "rebenching" program. Two of the key vision elements of the 2008 plan are to "serve the people of the region" and to commit to "high quality production and transmission of knowledge." The present plan addresses UCSC's current lack of support for the people in the Silicon Valley region, and will enable high quality research and its dissemination. The *Technological Development and Societal Impacts* theme described in the 2008 plan is clearly applicable to all parts of the current plan for Silicon Valley. Also relevant are the three themes *Human Health Initiatives*, *Trans-nationalism and Globalism*, and *Evolving Environments, Science, and Policy*. The 2008 plan concludes with a call for the growth of professional programs and professional schools, which a presence in Silicon Valley will help achieve.

This Silicon Valley plan is consistent with the Baskin School of Engineering's updated academic plan and overall strategic vision, which includes growth of the departments to sizes that are competitive with other research universities and that are required to effectively engage with Silicon Valley companies on a variety of research topics. The BSOE's vision also includes growth of research and instruction in new areas of high technology, including social networking, gaming, human-centered design and sustainability. By investing in both the existing programs on

[1] 1965 UCSC Academic Plan page 16 - http://planning.ucsc.edu/sfc/PDFs/65-75_AcadPlan.pdf
"The Santa Cruz campus will also undertake to provide graduate training for the scientific and engineering personnel employed in the industrial complex of the Santa Clara Valley, possibly utilizing the proposed University Extension Center at Sunnyvale."

the main Santa Cruz campus and in new programs on the Silicon Valley campus, the BSOE can expand more readily without compromising the quality of the individual programs.

Launching or relocating specific programs in Silicon Valley will alleviate some of the growth constraints and limitations that we are experiencing on the Santa Cruz campus site. Although there are a number of capital projects in the ten-year plan for the campus, it is unlikely that any of those will move forward quickly enough to satisfy the needs of expanding academic programs. Thus, in many cases, expansion(s) that would be impossible in Santa Cruz due to space limitations would be made possible by expanding or relocating onto the Silicon Valley campus site.

Aspirational funds associated with rebenching will be leveraged to grow BSOE programs on the main campus, while a combination of funding sources will be used to grow the SV programs: aspirational funds, faculty research grants, industry-university partnerships, professional degree supplemental tuition, and revenue from UNEX courses incorporated into the academic programs.

The plan for Silicon Valley will leverage the existing infrastructure of University Extension (UNEX) for outreach and instruction. Some of the new programs, such as the Master's Degree in Electrical Engineering, the Master's in Technology and Information Management, and the Education M.A. with teaching credential will more readily leverage existing UNEX courses, and in so doing can be rolled out more quickly and at a lower cost.

UCSC has historically had a low proportion of graduate students relative to other UC campuses, due in part to the fact that we have very few professional master's programs. Establishing a presence in Silicon Valley will allow the launch of a wide variety of professional master's programs whose graduates would be readily employable by local companies. Professional master's degree programs are often supported by supplemental tuition paid by the student, which offsets all or part of the cost of running the program. More information is provided in Section 5, *Implementation Costs and Resources*.

Growth in Silicon Valley will also be of great benefit to our Ph.D. students, as it will allow greater and deeper connections to cutting-edge companies. These companies can be the source of intellectually challenging problems that stimulate our graduate students and form the core of academically rigorous dissertation research. These companies may also provide financial support to our students and be interested in hiring our students. Our presence in Silicon Valley allows us to build a bridge for our students that connects academic instruction with real-world applications.

In summary, several entities and individuals will benefit from the establishment of a new campus site in Silicon Valley. Among these beneficiaries are UC Santa Cruz faculty and students, the Silicon Valley community and workforce, the UC community and the UC Office of the President. Some of the advantages of expanding into Silicon Valley that we expect would appeal in particular to UCOP include the following:

- UC programs would grow to reflect the economic growth of Silicon Valley over the past several decades.
- Silicon Valley's position as the pre-eminent center of innovation in the nation makes investment in instruction and research there a visible contribution by UCOP to

California's economy. Growth in Silicon Valley is the most compelling route towards serving the local professional community in the Monterey Bay/San Jose region.

- The UCSC Baskin School of Engineering has matured to a size that will allow it to spearhead a Silicon Valley initiative.
- Access to Silicon Valley companies will become easier with a UC campus site nearby. The plan described in this document can be viewed as a UCOP plan to establish a center for instruction and research that would enable faculty at other UC campuses to develop relationships with companies, gain access to the most immediate and relevant technology problems for research, and enhance the placement of students in Silicon Valley companies.
- Expansion of our Ph.D. programs in fields relevant to Silicon Valley.
- An opportunity would exist for students to do their undergraduate degree at any UC campus, and then come to UCSC Silicon Valley for an M.S. or M.Eng degree.
- The Santa Cruz campus will not build a standard complement of large-scale professional schools such as medicine and law. However, the campus is considering creating a School of Management, which could grow out of the Baskin School of Engineering's Technology and Information Management program, described below.
- Expansion into Silicon Valley will alleviate some of the space constraints, limitations and enrollment pressures on the Santa Cruz campus site.

2. Timeline

We provide an extended timeline for program expansion on the Silicon Valley campus site. We recognize the need to retain flexibility, which will allow continuing evolution of the campus over time in response to changing demographics, societal needs, technological developments and new external challenges (1963 LRDP). This plan does not commit the BSOE or the campus to any particular timeframe for the individual components, nor is it intended to be a detailed implementation plan. Each new academic program will be reviewed according to campus policy pertaining to new program development. All new Professional Degree Supplemental Tuition (PDST) programs to be concentrated at the Silicon Valley campus will be subject to UCSC and systemwide approval processes for new program development and for charging professional degree fees or self-supporting fees, which itself includes assessments of resource requirements, revenue, market demand surveys and analysis, enrollment projections, curriculum and courses of study, and implementation plans. Individual new courses will be subject to standard campus course approvals. Academic and support units will be brought to Silicon Valley as the academic and research programs there grow.

2.1 Initial Rollout: 2013-2016

We propose a four-year rollout program for the Silicon Valley campus site. In essence, this is already underway with the Technology and Information Management (TIM) program and the Master's Degree in Electrical Engineering (MSEE), both of which are administered by the Baskin School of Engineering and are presently offered at both the Silicon Valley and Santa Cruz campus sites. The one other academic program to be rolled out in 2013 in Silicon Valley will be the Master's Degree in Games and Playable Media (GPM). Plans are also underway to launch two additional programs in 2014-2015 (Network Science & Engineering and Education), another in 2015-2016 (Data Science) and two programs in 2016 (Figure 1).

Over the four-year rollout, we will track costs and revenues, learn from successes and failures, gauge demand for other programs, and ensure that the necessary infrastructure is in place before additional programs are launched.

Several of the BSOE academic programs to be concentrated at the Silicon Valley campus site will be supported by research institutes and centers. We envision that these centers will grow to become thriving research and teaching hubs, supporting a diverse community of students, faculty and industry collaborators. Centers planned for the 2013-2016 rollout include the Center for Games and Playable Media, the Data Science Institute, and the Network Sciences Institute. Discussions are also underway among BSOE Applied Mathematics and Statistics (AMS) faculty for establishing a Research Institute for the Development and Application of Statistical and Applied Mathematics (RIAMS) in Silicon Valley in the next five years.

2.2 Beyond the Initial Rollout: Years 2017-2020

It will be important to remain flexible with respect to which academic programs are actualized in Silicon Valley over the next decade and beyond. Programs will form in response to a number of variables, including the emerging and evolving needs of the community, the state of California and society, as well as academic areas of expertise identified by the campus. New areas of study may form in response to new technologies or societal challenges. From our current vantage point, we envision that about two academic programs per year would emerge in the latter part of the decade (Figure 1, bottom), where the actual programs will depend on the build-out and success of the earlier programs. Some of these are areas of research and teaching that already exist on the main Santa Cruz campus, while others would be entirely new. Section 6 includes descriptions of those programs that have been identified as solid candidates for presence in Silicon Valley, but other possibilities could arise.

3. Enrollment Projections

On average, UC engineering and computer science programs grow by approximately five graduate students for each FTE faculty. UC Santa Cruz has historically been somewhat below the average, but the BSOE student/faculty ratios are increasing, particularly in those areas in which we are projecting growth. Thus we expect that with the addition of 20 FTE, graduate student enrollment will grow by approximately 100. Going beyond this general statement, each academic program that expands onto the Silicon Valley campus will have its own enrollment projection(s). For example, the M.S. in Games and Playable Media program, which recently received systemwide approval, estimates a steady-state enrollment of 30 graduate students by 2016. The Technology and Information Management (TIM) professional degree program estimates steady-state enrollment of 13 students by 2015. These numbers are based on a combination of factors, including anticipated faculty and lecturer hires, space allocations and program demand.

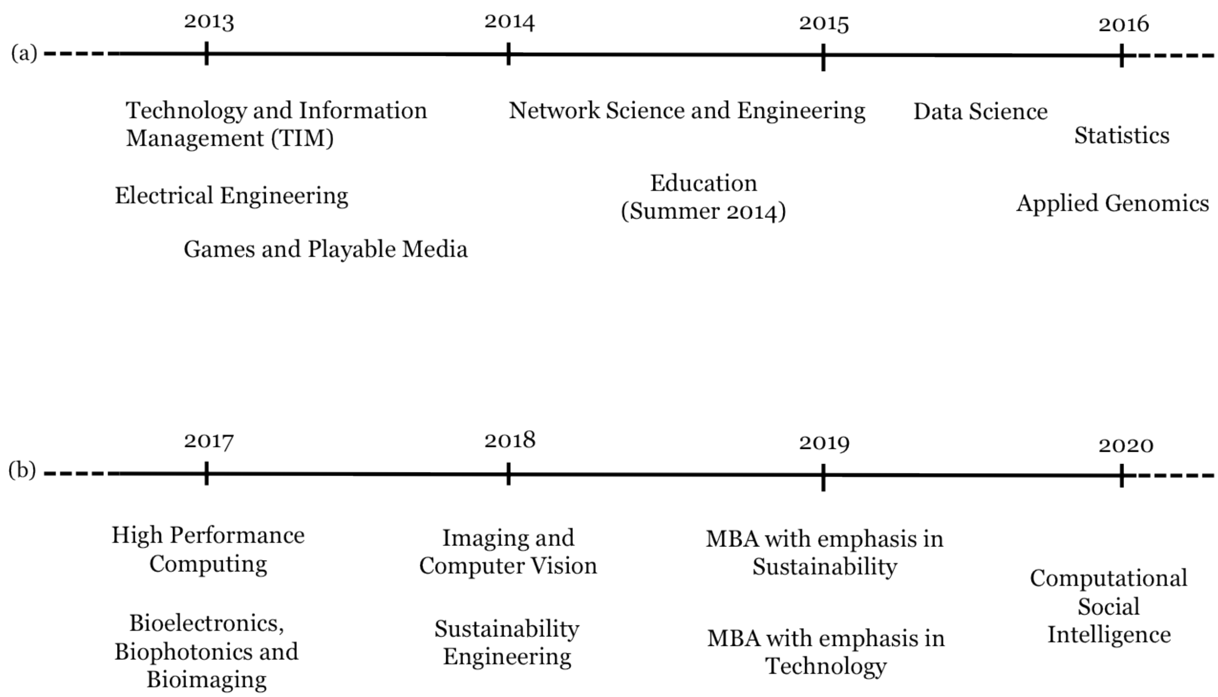

Figure 1: Silicon Valley program timeline. **(a)**: Initial program rollout 2013-2016; **(b)** 2017-2020.

4. Governance

The FTE envisioned for this plan will be situated in Silicon Valley and primarily appointed in the Baskin School of Engineering. These faculty will be governed in the same manner in which the faculty situated at the Santa Cruz campus site are governed, with the same rights and responsibilities regarding service, workload, personnel actions and contributions to education. FTE situated in Silicon Valley will be members of Academic Senate and be affiliated with a specific department and division. They will undergo the same merit review process. Appointment, review and promotion of these FTE will be subject to APM and CAPM procedures. These FTE will be subject to the campus' standard instructional workload principles and to their department's specific workload policy. Recently, each of the BSOE departments updated their policies to ensure equitable workload while allowing for flexibility based on program needs and faculty expertise. Many of the programs we propose to roll out initially at the Silicon Valley campus are graduate programs, and thus the instructional workload for the FTE associated with these programs will necessarily be weighted towards graduate courses.

BSOE FTE without a departmental affiliation are subject to the newly drafted schoolwide instructional workload policy. This policy set workload standards for those of the individual departments, and we expect it could be used by other divisions on campus as they launch new or move existing programs to the Silicon Valley campus site.

We expect there will be no difficulty in applying the same rights and responsibilities to the faculty at the Silicon Valley campus. A pilot program will either help confirm this, or it will substantiate a need for a separate campus-wide policy that defines the governance of SV faculty.

5. Implementation Costs and Resources

Each new program will have a unique set of resource requirements. Some may require several new FTE faculty, while others may need to add only one or two lecturers. Facilities, laboratory requirements, staffing and other operating expenses will also vary by program. Although these variations make it difficult to project total implementation costs for a full suite of 10-15 new programs in Silicon Valley, we can estimate costs based on previous programs.

Two newly approved academic programs to be located on the Silicon Valley campus offer valuable insight. Table 1 shows projected costs for the M.S. degree in Games and Playable Media (GPM) and the M.S. degree in Technology and Information Management (TIM), both of which are Professional Degree Supplemental Tuition (PDST) programs. Projected revenue from supplemental tuition is also shown. It is anticipated that by the 2015-16 academic year, the GPM master's degree program will be revenue neutral. During the first three years, when the program is ramping up, we anticipate a shortfall totaling $742,000 for this program. Financial resources committed to covering the shortfall include $500,000 allocated by CPEVC Galloway and the remaining $242,000 from BSOE funds. TIM is projected to be fully revenue neutral by the 2016-17 academic year, with fairly small shortfalls in the first two years of the program. Even between these two programs, the variation in both projected costs and anticipated revenue are evident. The GPM program will require one new FTE Faculty and an FTE staff person, and will have higher software and computational costs than most other programs, whereas the TIM degree program is being offered by existing ladder rank faculty.

	2012-13	**2013-14**	**2014-15**	**2015-16**	**2016-17**
GPM					
Costs	$421,908	$680,123	$832,036	$946,740	$984,630
PDST Rev	-	$433,500	$758,625	$946,740	$984,630
Variance	($421,908)	($246,623)	($73,411)	$0	$0
TIM					
Costs	N/A	$115,277	$206,210	$318,710	$387,727
PDST Rev	N/A	$92,000	$188,475	$319,860	$389,120
Variance	N/A	($23,277)	($17,735)	$1,150	$1,393

Table 1. Projected costs for two recently proposed professional master's degree programs to be located on the Silicon Valley campus site.

PDST programs offset costs either in part or in full, and we envision a number of these professional degree programs will be successful in Silicon Valley. Appendix A describes a financial model for analyzing the economic viability of individual PDST degree programs. The model, which is based on campus financial planning guidelines for professional degree fees and the UCOP template for professional degree fee programs, makes it possible to evaluate forecasted revenue and expenses for a "standard" professional degree program over a ten-year period. Formulas are based on fixed and variable costs, which were accumulated and analyzed and then used to write the appropriate formulas.

Other degree programs may be offered in Silicon Valley at minimal cost to campus by extending existing programs. For example, a Master of Science in Electrical Engineering (MSEE) is now offered both at the Santa Cruz and Silicon Valley campus sites. The MSEE Silicon Valley will incorporate UNEX courses and may use the UNEX concurrent enrolment mechanism to draw graduate students into the program.

5.1 Facilities Expenses

The campus' recent experience at 2505 Augustine Drive in Santa Clara provides valuable information regarding lease, utilities and contractual operating costs of suitable space in Silicon Valley. As programs expand or relocate onto the Silicon Valley campus, it will be necessary to lease additional nearby space. Space requirements will vary by program, but will typically be in the 3,000- to 6,000-square foot range, including offices, labs and shared classroom and meeting spaces. At current rental costs of suitable spaces near Augustine, this represents $5,000-$15,000/month, including rent, utilities and other operational costs.

5.2 Faculty FTE

All new FTE faculty hires will be subject to the normal campus allocation process.

6. Themes for Instruction and Research

The UCSC Academic Plan for Silicon Valley would take advantage of the synergies available both on campus as well as in Silicon Valley. The synergies are organized around four broad themes representing future technology directions, consistent with the campus vision and the Baskin School of Engineering Academic Plan:

1) Information Management
2) Human-Centered Design and Computing
3) Personalized Health Technology
4) Sustainability

A number of new graduate programs will be built out of these four themes, and several existing programs will grow along theme lines. The growth of associated research agendas will be critical for deeper connections to the resources in Silicon Valley. This plan is centered on programs that match the research opportunities provided by strategic partnering with companies on emerging technologies, and those companies are identified within the research descriptions below. The programs listed herein generally build on existing strengths of the main campus, and some existing courses can be shared with these new proposed programs. While the current curricular focus is at the graduate level, we envision future possibilities for upper-division undergraduate courses and course-based research offered at the Silicon Valley campus. Two other benefits that arise from offering undergraduate courses at the Silicon Valley campus are the ability to offer summer sessions with corporate internships, and the ability to liaise with UNEX to attract international students to UCSC. The integration of undergraduate study lies beyond the main scope of this plan, but will be discussed in broad terms.

6.1 Information Management

Companies such as Google, Amazon and Facebook are using data and the internet to create products and services that were unimaginable only a few years ago. The rapid pace of change in this industry sector leads to quickly changing needs for technology management. The technologies being managed as well as the technology of management itself requires constant renewal of skill sets for managers and engineers in Silicon Valley.

Below we describe seven academic programs related to Information Management that UCSC could launch in Silicon Valley through a combination of new and existing resources.

6.1.1 DATA SCIENCE

Computing has undergone three distinct revolutions: computation, networking, and now data. Data has become the "crown jewel" of many companies and the foundation of new internet businesses such as eBay, Amazon and Google. Companies are now routinely generating terabytes to exabytes of data — far more than has ever been effectively captured, stored and utilized. Data Science has emerged as an academic discipline in response to this massive generation of data and the need to manage it. As a discipline, data science integrates methods from statistics, computer science, computer engineering and other fields to capture, process, analyze, store and utilize data. Data science supports a host of important data-driven research and has numerous industry and business applications.

UCSC is in a unique position with respect to the emerging primacy of data. We are leading innovators in the hardware of data acquisition and storage (networking and supercomputers), and in the software of data analysis (data mining and behavioral analysis). The Baskin School of Engineering possesses research acumen in the key areas that form the foundation of data science: data storage systems, network sciences, database research, machine learning, statistics and image processing and visualization.

The nascent Data Science Leadership Initiative (DSLI), will help coordinate efforts that could propel UCSC into a position of national leadership. Over the next five years, the BSOE plans to submit both undergraduate (B.S.) and graduate (professional M.S.) degree proposals, and to create a donor-funded Data Science Institute in Silicon Valley, envisioned to house approximately 40 faculty members and hundreds of research scientists and students.

Within the Data Science Institute would fall multiple specialized research groups. We currently envision two such groups: First, Scalable Data Management and Analysis (SDMA), comprising faculty in storage systems, distributed systems, databases, machine learning, statistics, and security. This group would be capable of delivering a professional master's degree (SDMA M.S), addressing the needs of business and the scientific computing communities through an integrated approach in storage systems, databases, distributed computing (including networking), statistics, and machine learning. Second, depending on the type and number of hires made in this area, it will be possible to build a professional master's degree program focused entirely in Machine Learning to meet the strong demand for this knowledge by Silicon Valley workers.

6.1.2 TECHNOLOGY AND INFORMATION MANAGEMENT

The Technology and Information Management (TIM) Program performs research and instruction in data analytics, the technology of information management, and the management of information technology. This program has been offering B.S. degrees in Information Systems Management for more than ten years. M.S. and Ph.D. degree programs in Technology and Information Management were approved in 2012, and the Professional Degree Supplemental Tuition program for the TIM M.S. was approved in 2013. The M.S. program, located at UCSC's Silicon Valley campus, is differentiated from other management degrees offered in Silicon Valley by its strong technology focus. TIM faculty already have interactions with AMG, AOL, Cisco, Google, HP Labs, IBM, Microsoft, NEC America, Robert Bosch LLC, SAP, Toyota and Yahoo!

6.1.3 MASTER'S IN BUSINESS ADMINISTRATION

With the TIM program firmly established, the foundation is in place to create an M.B.A. (Master's in Business Administration) program. By leveraging courses in TIM and existing courses at UNEX, relatively few additional resources will be needed to launch an M.B.A. focusing on strengths at UCSC, such as technology and sustainability.

6.1.4 NETWORK SCIENCE AND ENGINEERING

The Computer Engineering (CE) department currently offers a master's degree with an emphasis in network engineering. The growing importance of cloud computing and services, plus the need to support intelligent grids, calls for new solutions to mobility support, network security, and ability to scale the Internet by orders of magnitude. Android phones, emerging wireless standards (e.g., WiFi direct and white-space networking), and multi-player interactive applications are major drivers of wireless-network innovation.

The area of architecture and embedded systems is a closely related area in which CE needs additional faculty to complement its growth in networks, while addressing the growing need in SV industry for research and graduates who can design embedded systems and systems based on networks on a chip.

CE has already made plans to augment significantly its interaction with Silicon Valley companies with the launching of the Network Sciences Institute (NSI) as well as increasing collaborations with NASA Ames. The NSI will focus initially on network theory and technology, from social networks and security in the cloud to prototypes using Field Programmable Gate Arrays and Android phones, computer systems and architecture, and human-centered design. CE faculty have started preliminary discussions with Cisco, Juniper and F5, and they will approach companies with a formal proposal for participation in the NSI consortium towards the end of the year, with the ultimate goal of having 15 to 20 company affiliates. The CE collaboration with NASA Ames focuses on robotics, human-centered design, and networks for cyber-physical systems. CE faculty and students began carrying out research at the SVC site in Fall 2011. CE will seek NSF funding using NASA and NSI affiliates as partners. CE is also planning to expand its successful partnership with Cisco by establishing a similar program with Juniper.

6.1.5 STATISTICS

The department of Applied Math and Statistics (AMS) proposes to create a research institute for the development and application of statistical and applied mathematical sciences (RIAMS). This institute has long been in the planning documents for AMS and will have goals similar to those of the NSF-funded Statistical and Applied Mathematical Sciences Institute (SAMSI) in North Carolina. The Institute would invite faculty from Stanford and Berkeley to become members and would be unique in California. Associated with this center would be a new Professional MS in Statistics (PMSS). Communications with AMS MS graduates in Silicon Valley companies such as CISCO, Yahoo!, Kaiser Permanente, eBay and PayPal, suggest that a PMSS would be a popular degree. A distinctive feature of the program will be the focus on hierarchical models as a tool to quantify the uncertainty in complex systems, accounting for all sources of variability.

6.1.6 HIGH PERFORMANCE COMPUTING

High performance computing focuses on the expertise needed for the formulation, coding and implementation of models for high complexity systems that require high performance parallel computing. Such expertise is ever more in demand by companies in Silicon Valley. AMS proposes both the creation of a Center for High Performance Computing (CHPC) and an associated Professional MS degree (PMHPC). The program will bridge the expertise of modelers, computer scientists and end users to provide practical vocational training in HPC.

6.1.7 STEM EDUCATION

Beginning in the summer of 2014, UCSC's state-accredited teacher education program will also be offered in Silicon Valley. The Department of Education has approval to extend its M.A. with credential program in secondary science education to Silicon Valley through a partnership with UNEX. Further expansion of the M.A. program would fit naturally into UCSC growth in Silicon Valley. Access to Silicon Valley provides opportunities for faculty research, as well as placement opportunities for graduates. The region is part of the service area for the UCSC Education program, so the campus will be better able to serve the large and diverse community with a physical presence in the valley. Current shortages of teachers in math and science demonstrate a clear need for this program. Growth of Education programs in Silicon Valley could assist efforts to create a School of Education.

6.2 Human-Centered Design

Many of the most exciting new technologies and products benefit from the integration of human activity into product design. While the human-machine interface has always constituted an engineering challenge, new factors are emerging and redefining the importance of research in this area. These ideas include the prevalence of distributed computing, new haptic device hardware, and the enabling use of wireless networking. The role of the human as a component of the system is clear for gaming products, but "human centered design" also impacts products such as the iTunes system, new paradigms for retail commerce, and a multitude of apps for smart phones.

Research in human-centered design will be approached from different perspectives. Advances in software engineering, networking, and access to data enables new modes of human interaction. For instance, the growth of broadband enabled social networking sites that allowed sharing of digital information. Current research in the BSOE will continue to provide new enabling advances in the areas mentioned above. Beyond this lay opportunities to involve other academic disciplines, most notably the arts and the social sciences, in explorations to most fully use and understand digital information technologies. Artistic design using digital media, for example, encounters different possibilities *and* constraints than design using traditional media. Some realizations of digital technology might involve government policy change to enact. We envision many opportunities to involve the non-engineering divisions in research projects with Silicon Valley companies *and* we expect these companies to value the access to the interdisciplinary research capabilities that exist at UCSC. Some examples of these opportunities are in the next sections.

6.2.1 GAMES AND PLAYABLE MEDIA

Computer games are changing how humans interact with technology. Behind this important new media form, which is both a rapidly growing international industry as well as driver of technological and cultural innovation, is a research area where cutting edge approaches are applied to challenging engineering, social and design problems. Some fields in which games are having significant impact are: game-based education, game-like rule structures and reward systems applied to work environments, and game-based crowd-sourcing of scientific research. Game research at UCSC, with its unique research focus on the intersection between game technology and design, is well-positioned to expand into Silicon Valley. In addition to the active game-industry presence in the Bay Area with firms such as EA and Zynga, large IT companies, such as IBM, Google, Microsoft and Intel, are developing a strategic interest in games.

We envision a Silicon Valley extension of the existing Center for Games and Playable Media (CGPM) to be a research group comprising new faculty in artificial intelligence, computer graphics, game design, games for training and education, natural language processing and generation, and procedural content generation. It is anticipated that certain individuals would having overlapping interests, such as artificial intelligence and procedural content generation, or graphics and game education. This group will deliver the professional Master's degree in Games and Playable Media, recently approved by the Regents. The degree will provide a grounding in artificial intelligence, computer graphics and game design.

6.2.2 COMPUTATIONAL SOCIAL INTELLIGENCE

The Web dramatically reduces the cost of collaboration among large groups of people, and makes cost-effective the contributions of small amounts of knowledge from large numbers of people towards a common goal. Companies like Amazon, EBay, Facebook and Google, and nonprofit sites like Wikipedia, all build on this core idea. Social intelligence, also known as social computing or crowd-sourcing, is concerned with how to engineer, understand and optimize internet information systems, which include very large scale collaboration. Yahoo, Google, Microsoft and IBM all have groups working in this area, and thus there is substantial potential for industrial interaction. A Silicon Valley center or research group affiliated with the Network Sciences Institute or the Center for Games and Playable Media would organize such interactions. The Center for Statistical Analysis in the Social Sciences would also be a natural collaborator. In addition, a Professional Master's degree program in Social Intelligence (PMSI) would appeal to a broad spectrum of engineers who wish to learn how to create and augment web sites with deep social collaboration features.

6.2.3 IMAGING AND COMPUTER VISION

Imaging systems including non-conventional cameras (e.g., light field cameras, www.lytro.com) and 3D cameras (e.g., Microsoft's Kinect, www.xbox.com/kinect) is a growing commercial field, and 3D screens are being incorporated on television sets and video game consoles. Cell phones and tablets are able to support camera pairs for stereoscopic teleconferencing. Mobile image capture devices are being developed and used for urban mapping (Google's StreetView) and robotics (e.g., Willow Garage). New chip level hardware is being developed for 3D imaging (e.g., Nvidia's new boards). This important emerging area encompasses sensors, systems, processors and algorithms and represents an exciting new opportunity for UCSC in Silicon Valley. The BSOE is exploring the possibility of providing a Master's Degree in Imaging and Computer Vision in the next five years.

6.3 Technology of Personalized Health

The internet has already had an impact on healthcare by providing access to resources for self education and diagnosis. The full impact of advanced information technology on healthcare has yet to be realized but several exciting new developments provide a glimpse of the future. These include patient ownership of their complete medical history to new portable devices that sense and report vital bodily function status to ubiquitous genomics and genome-based therapies. The common element of all of these new technologies is the partial displacement of professional healthcare provider by the patients themselves, aided by expertise in the cloud.

The central place of information technologies for future healthcare represents large opportunities for the BSOE in relation to Silicon Valley. While the absence of a medical school has kept UCSC out of traditional medical research, the campus is well-positioned through existing programs to define and create a new effort in personalized health care and personalized medicine. This effort would recognize that much of the value-added in medical technology is in the handling of data, which is in the process of being pushed down to the patient level. Promoting this as a area of emphasis for Silicon Valley will allow UCSC researchers to gain access through collaborations to various healthcare and medical companies in the Valley. Through such collaborations will come a continuous stream of challenging intellectual problems that will help make UCSC a center modern personalized health.

6.3.1 BIOELECTRONICS, BIOPHOTONICS AND BIOIMAGING

Personalized health monitoring and delivery will require advanced devices that bridge the gap between biological and electronic systems. Among the many opportunities for the BSOE to expand in this area are *bioelectronics* (designing electronic devices for embedding into biological systems), *biophotonics and bioimaging* (using light-matter interactions in a biological framework in order to study and visualize biological materials), and *biomaterials* (taking clues from how biological systems grow materials, or using synthetic methods to create biologically compatible materials). A professional Master's degree in Bioelectronics, Biophotonics and Bioimaging would prepare students for careers in this segment of the biomedical industry, either as engineers of the next-generation of medical devices, or as researchers who use optical devices to study materials.

This is an extremely active area of research and development in Silicon Valley, and a professional Master's degree program would benefit from interactions with Valley companies such as Agilent, Abbott laboratories, Accuray, Affymetrics, Alara, Alpha Innotech, Angiotech Biomaterials, Arcxis, ArthroCare, Biotechnologies, Bayspec Inc., Boston Scientific, Calmar, Caliper Life Sciences, Carl Zeiss Meditec, Cepheid, Coherent Inc., Cutera, Curexo, Fluidigm, IFOS, Illumina, Insite Vision, IRIDEX, Hansen Medical, Hologic, Johnson and Johnson, MedImmune, Mobius Photonics Inc., NanoSirius, BeGen Biologics, Perkin Elmer, Spectros Corp., SRI, Varian Medical Systems, and Vector Labs among others.

New devices and techniques for imaging biological materials will lead to further growth in the already rapidly expanding area of signal and image processing, which reduces the myriad of data in digital images to usable information. While we do not currently expect to offer a degree in signal and image processing, the BSOE has some strengths in this area which we can expand and project into Silicon Valley through collaborations with such companies as SRI International, Ricoh, Microsoft, Google, Pelican Imaging, Aptina, Adobe, Apple, HP Labs, Lockheed Martin, Skybox Imaging, Yahoo Research, Dolby Labs, Pixim and Epson R&D.

6.3.2 BIOENGINEERING AND GENOMICS; APPLIED GENOMICS

Although bioengineering and genomics research and education at UCSC will be centered on the Santa Cruz campus in the Department of Biomolecular Engineering, Silicon Valley is part of a larger Bay Area ecosystem of corporations and universities that would become natural partner for UCSC in these areas. A Professional Master's Degree in Applied Genomics would serve an unmet need in Silicon Valley. The four keys areas most relevant for the Valley are:

Biotechnology. The application of newly developed technologies to healthcare and biomedical research is an area of vibrant growth: locally in "Biotech Bay" as well as nationally and globally. As new questions, needs and ideas emerge in these research areas, new technologies will be required, presenting a unique opportunity for UCSC. Faculty in the BSOE have developed innovative technologies for sequencing, analysis, single-cell manipulation, high-resolution sensing, biorecognition and adaptive optics for biological imaging. We anticipate that these innovations will undergo further enhancements and that new technologies will continue to emerge. Leading companies such as Illumina, Cepheid and Roche are potential partners in this area.

Nucleic acid/protein purification and identification. Progress in this field is essential for Bay Area corporations to maintain their leadership in biotechnology and drug design. For example, single molecule analysis of DNA composition will likely dominate the multi-billion dollar DNA sequencing industry over the next few decades. Single cell analysis of nucleic acid and protein content of individual cells in cancerous tissue will be essential to understand disease progression and tumor response to drugs. Bay Area companies in this field include Agilent, Illumina, Pacific Biosciences, Life Technologies, Roche, Genentech, Gilead, Nugen, and Nektar.

Viral enzyme discovery. Viruses of archaea and extreme bacteria provide both a key to our understanding of the evolution of life on earth as well as a resource of genetic discovery. Primary investigations in California's hyperthermophilic and hypersaline resources (Lassen, SF Bay, Searles for example) can provide novel DNA/RNA modification enzymes, polymerases, industrial proteases or cellulases/lipases/amylases. These discoveries feed industrial applications as diverse as bioenergy, laundry detergents, beer manufacturing and human medicine. Companies invested in this area currently, include Genencor (Palo Alto) (part of Danisco), Novazymes (Davis) and Codexis (http://farmprogress.com/story.aspx/first-cellulase-enzyme-developed-9-51222). Companies not currently in Silicon Valley with interests in this area include New England Biolabs, Virenium and Dupont.

Translation of genomics into the clinical point of care, in particular working towards bringing machine learning and genomic sequencing into the clinic. This research would coordinate between health care providers, medical device makers, and bioinformaticians to design algorithms and solve problems that can help patients and care providers. This work could have immediate impact in the clinic and is especially relevant to cancer prognosis and treatment. Bay Area companies with likely interest in this field include Intel, Genentech/Roche. Also, Cisco could provide an important convergence of hardware and biotech where the research done by BME would provide the software platform.

6.4 Sustainability

The relationship between people and the physical world is changing rapidly. Along with continued population growth comes the continued use of fossil fuels in developed nations, the accelerated use of such fuels in previously underdeveloped regions, increased stress on water supplies for food growth, and the global effects of air, water, and thermal pollution. The concept of sustainable practices for consumers and manufacturers emerges at the intersection of science, engineering, and social policy. UCSC has a tradition of forging new interdisciplinary research and instructional directions and an important component of the Silicon Valley plan is to create an academic center for study and research into sustainable practices. We see great opportunity to perform science and engineering research that is informed by policy needs as well as constrained by physical law. To this end, we discuss below an effort in advanced research in power systems. We see the opportunity to create policy ideas that are informed by the latest developments in science and technology. To this end we envision a center for sustainability policy research. One of the key areas of concentration in the TIM program is sustainability management. Concurrent with the goal of creating a school of management, we would create an emphasis in Sustainability Management for the M.B.A. We expect that, with the help of UCSC, Silicon Valley can become a world-leading venue for advanced intellectual property in sustainable practices.

6.4.1 POWER SYSTEMS AND SUSTAINABILITY

The lack of sustainable energy supplies raises a diverse set of issues across the academic spectrum, from physics to social science. These issues are addressed in the BSOE's Center for Sustainable Energy and Power Systems (CenSEPS). Adding capability in this area would result in the only Power Engineering program in any of the UCs and profit from the emergence of "green technology" in Silicon Valley among large companies such as PG&E, Microsoft, Applied Materials and Google as well as a large number of smaller but well established power electronics companies such as Bloom Energy, Delta Products, Fairchild Semiconductor, Freescale Semiconductor, International Rectifier, IXYS, Linear Technology, Oki, Microchip Technology, Micrel, National Semiconductor, NXP Semiconductors, STMicroelectronics, Supertex, Tesla Motors, Texas Instruments, Vicor and Vishay. Additionally the valley is a center for start-up companies in green tech, some with significant overlap with EE are Amyris, BetterPlace, Brightsource Energy, Columb Technologies, eMeter, Hara, Innovalight, Nanosolar, Purfresh, Redwood Systems, Serious Energy, Solazyme, SunPower and Trilliant**.** Currently there are no academic programs in this area in the UC system and only two in the Cal State system. The absence of both Berkeley and Stanford from this subject area at the moment provides a window of opportunity to fill a niche and establish a unique center of expertise in this area in the Valley. Over the next five to seven years, we envisage the development of Master's and certificate programs in the area of sustainability and sustainable power engineering in Silicon Valley.

7. Educational Programs

7.1 Graduate Programs

7.1.1 PH.D. PROGRAMS

Research conducted in areas listed above will require Ph.D.-level graduate students. There is a long history of graduate thesis research being performed away from campus, in the field, and specifically within corporations. Conducting research in close collaboration with companies is especially attractive for engineering Ph.D. students. Companies can possess unique resources such as access to certain types of data (e.g., in marketing, sales and demographics), access to unique instrumentation (e.g., computer clusters, device fabrication chambers and biotech labs), and access to the ever-changing strategic goals of industry sectors. Access to such resources can mean the difference between a mediocre thesis and one which has tremendous impact. From the company's perspective, providing access to these resources and participating in the creation of intellectual property is a useful way to pursue a project with low fixed costs, as well as assess the capabilities of a future employee. Such research projects are often funded by U.S. agencies, in particular the Defense Advanced Research Projects Agency, further reducing costs to the company. The technologies above are all conducive to the establishment of large groups of Ph.D. researchers, which would enable growth in the number of Ph.D. students at UCSC.

7.1.2 M.S. AND M.ENG. PROGRAMS

Nearly all the academic areas in UCSC's school of engineering offer M.S. degrees, and many of these would be made easily accessible to students in Silicon Valley. An attractive outcome of the present proposal is the ability to offer M.S. courses and degrees to Silicon Valley professionals for whom the geographical proximity of the UCSC-Silicon Valley campus would be a deciding factor for pursuing an M.S. In addition, many engineering schools in the UC system are offering or planning to offer M.Eng. degrees. The M.Eng. degree combines course work of the M.S. degree but with additional courses in business management training. Unlike the M.S., which is often a stepping stone to the Ph.D. program, the M.Eng. degree is terminal and geared towards engineers who seek advancement in the management ranks. The possibility of Professional Degree Supplemental Tuition allows for additional resource streams. Location in Silicon Valley is also attractive to international students, which would help the campus meet its goals to grow its fee-paying international enrollment.

7.1.3 M.B.A. PROGRAM

As described above, the opportunity exists to create an M.B.A. program which would focus on areas of excellence at UCSC and of relevance to Silicon Valley. Silicon Valley is known for its strong entrepreneurial atmosphere, so such an M.B.A. program would be a natural fit.

7.1.4 M.A. AND ED.D PROGRAMS

Offerings in education will include the M.A./credential in Education, initially with an emphasis in science education. Future possibilities include additional subject areas for the M.A., and a Doctorate in Education (Ed.D.), which has been approved at UCSC and is currently in suspension but could be re-focused for launch in Silicon Valley.

7.2 Undergraduate Programs

UCSC-Silicon Valley will be focused on serving both the needs of corporations for academic partners in research as well as the training of future employees. Training undergraduates to be work-ready for technology firms requires understanding the ever-changing needs of these firms through persistent academia/industry interactions. Toward this end, the Baskin School of Engineering created in 2011 the opportunity for senior engineering majors to fulfill their capstone design requirements by working on a design project proposed by a company. The next step in the evolution of the academia/industry link is to incorporate industry-sponsored design courses in every year of the undergraduate experience. A natural outgrowth of this goal is that in the junior and senior years, many students will want to conduct the project research on the company's premises. With this and the overlap of upper-divisional courses and graduate courses, combined with the need for students to live close to the instructional venues, we anticipate the eventual creation of a strong upper-level undergraduate presence in Silicon Valley. There is also the potential for collaboration with Foothill and De Anza Community Colleges. An undergraduate-serving campus would require a level of planning and investment that is not within the scope of the present document.

8. Conclusion

The next decade promises to be an exciting period of growth and expansion for UC Santa Cruz. New academic programs will arise from a combination of societal needs, emerging technologies and faculty expertise; graduate student numbers will surge as we reach to meet the campus goal; and new partnerships with industry and among campus divisions will be forged. The Silicon Valley initiative will play an important role in this evolution, offering an opportunity and a venue to grow in ways that complement growth on the Santa Cruz campus and that benefit the whole of the University of California system.

While the Baskin School of Engineering may be in the best position to lead the initial efforts in Silicon Valley, we believe that other divisions and departments will find numerous opportunities there to launch new academic programs or expand existing ones. These other departments and divisions will contribute to a vibrant academic community that both serves and is served by the people of Silicon Valley.

APPENDIX A

USER’S GUIDE:
FINANCIAL MODEL FOR EVALUATING PDST PROGRAM COSTS & REVENUES

UCSC SILICON VALLEY INITIATIVES (SVI)

PDST Program Planning Template User Guide

Tedd Siegel

3/25/2013

A Guide to entering new program information in the PDST financial model, with an emphasis on customizable, program- level assumptions.

Contents

Introduction & Overview

This **User Guide** is designed for use by individual program planners who will be using the **Program Template** to input information to the overall PDST financial planning model. Along with providing this data for the overall consolidated financials analysis (multiple PDST programs over 10 years) the Template also provides a 10 year view of the financial performance of any <u>one program</u> (given its various revenue and cost assumptions). Just as we can do "sensitivity analysis" based on 6 program starts in ten years, so also can we do the same thing for one program over ten years. Given input assumptions, one can use the Template to look at PDST tuition "cash flow" in a given year (with an eye toward where to draw the line on cost); likewise, one can use it to project how different numbers of students, or ramping up of student numbers, in relation to a given PDST price point, impacts the amount of PDST revenue available for one time or ongoing program costs.

This guide, once again, however, is practical. It is mostly a simple how to guide for inputting program information. There are also suggestions about how to go about doing the basic analysis of the information in the summary tables (summary income, and detailed income statements).

PDST Program Expansion Financial Model

As mentioned above, the PDST Financials spreadsheet package represents a "financial model." What is meant by financial model in this case? By financial model, we mean that it shows financial performance in relation to a complex set of assumptions, over a time function.

Specifically, the overall financials begin with the assumption of 6 new PDST program starts over a 10 year period, with a three year ramp to steady state for each program beginning with its respective "year one." It also assumes certain things (modifiable) about PDST price point and escalation, offset revenues going to the campus, start up revenue from the division, possible other revenues, and costs and their escalation (one time, and continuing, both direct cost labor, and opex and capex). A particularly important assumption is that in cases where we want to rely on PDST revenue to support regular faculty FTE, there must be a minimum steady state ratio of 30 to 1.

The PDST financials model was initially developed with the specific purpose of creating a customizable tool that would allow the division to quickly prepare a set of financials to backup new revisions of the Academic Plan for Silicon Valley, as assumptions about specific programs and their characteristics became available. One need only plug in the updated info, because the model, as a whole, was in place irrespective of the particular aspects of program data.

Because the system was designed to allow for a variety of kinds of analysis, at the divisional level, and between the division and the central campus, the present version is not very user friendly for the individual program planner (lots of distracting information).

This guide shows step-by-step how to input program information, and as a consequence, what information to ignore at the individual program level. SVI plans to update the documents overall from a usability point of view, once a reasonable number of people have worked with the toolset. This guide is meant to bridge until that happens.

Specific Program Assumptions

Specific program assumptions are such things as: whether the program is 4 quarters per year or 3 quarters; the cost of PDST tuition, expected ratios of resident to non-resident, program start-up revenue, possible other revenues, FTE costs (regular faculty, lecturer, staff), fringe rates, escalations, OPEX costs (non-labor operations) and CAPEX (infrastructure).

Non program assumptions are: state tuition and supplemental tuition rates, return to aid percentages, campus and student services fees, a variety of things that are, from the point of view of the individual program ledger, offset revenues (that go back to the campus).

New Program Planning Template

The New Program Template is simply a single program sheet from the consolidated system of financials, presented as a standalone. The next revision will include ONLY the items that are necessary for basic program planning and for inputs to the overall system (nothing extraneous or redundant to cause distraction). The larger financials package allows for customization of global system assumptions on the consolidated worksheet (e.g., regular tuition, return to aid formulas, fees, OP tax on revenue, etc.).

Customizing Revenue Side Assumptions

Modifiable parameters are identified in the Program Template with a blue highlight. The first thing that must always be input is the decision about whether the program is a three quarter or a four quarter program, as this decision drives a number of calculations (on both the revenue and cost side).

To set the number of quarters:

1. Find the quarters row at the top of the spreadsheet:

Silicon Valley Initiatives (SVI)												
New Program Template		Prog 1 Start										
	QUARTERLY	2013 / 2014	2014 / 2015	2015 / 2016	2016 / 2017	2017 / 2018	2018 / 2019	2019 / 2020	2020 / 2021	2021 / 2022	2022 / 2023	
		Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Total
QUARTERS FOR THIS PROGRAM:	4	3	4	4	4	4	4	4	4	4	4	
Potential Academic Quarters in a Year	4	4	4	4	4	4	4	4	4	4	4	

2. Enter 3 or 4 in the blue input area.
3. Note that year 2 reads as 3 when 4 is input, because the first summer is technically year 2 Q1 from a revenue point of view.

Number of Students (ramping, and steady state)

At lines 36, 37 of the "Academic Plan Assumptions" section immediately below the "Summary Income Statement" there are blue input fields for entering information about the target number of students, both resident and non-resident, per year. In selecting these numbers, you should show a "ramp" to a desired steady state--for example, a progression over the first three years, from 15, 25, 30 students per year, with 30 per year thereafter. Note that the spreadsheet will auto calculate the percent resident and non-resident based on the numbers provided.

To enter the target number of students per year:

1. Find the "Student in Program" area of the "Academic Plan Assumptions" section.

34							
35	Students in Program (assume 85% Resident and 15% NonResident)						
36	# of students - resident	83.6%	13	21	25	25	25
37	# of students - non resident	16.4%	2	4	5	5	5
38	# of students - total		15	25	30	30	30

2. Enter the desired number of resident and non-resident students per year.

PDST Tuition (annual)

The program price point (PDST tuition) can be set at this level of the financial model system, or it can be set along with other global parameters like regular tuition and fees. It is assumed here that each program will have a specific level for PDST tuition (within allowable per policy, but tailored to what the individual market will bear).

To set level for quarterly PDST tuition:

1. Find the blue input area for PDST Tuition, line 66.

66	- PDST set @ initial rate per year	$	28,900

2. Input the desired price point.
3. Move up to line 53, and enter the desired escalation rate per year, beginning in column G.

52	Escalation factors (increase per year):			
53	- PDST	5.0%	-	5%

Start-up Revenue

In the same area where you found the PDST tuition input, you will also find the row for program start-up revenue, on line 77.

To enter agreed upon program start-up revenue (for year 1):

1. Find the blue input field for "start-up divisional revenue contribution for first year".
2. Enter the agreed upon amount.

Other Revenue

At line 178, there is an input field for "Other Revenue." This is the place where one would enter any campus programmatic subsidy, matching start-up funds, etc. (up and beyond the divisional start-up). Also, if there were real external revenue sources for a program beyond the PDST tuition, one would add that here.

Customizing Cost Side Assumptions

The cost side of the program planning spreadsheet also allows for a great deal of individual program customization. There are input fields and associated automatic calculations related to direct cost labor (regular faculty FTE, lecturer FTE, and staff FTE); there are standard and custom input fields for start-up and ongoing operational costs (OPEX); there are standard and custom input fields for initial capital expenses (CAPEX).

Faculty FTE allocated to PDST

As stated in the introduction to this document, one of the things that makes the overall financials package a financial "model" is the fact that it prescribes a minimum ratio of students (at steady state enrollment) to any one new regular faculty hire, if the intent is to fund that FTE with PDST tuition revenue. That ratio, once again, is 30 to 1. The implication of this policy-level directive from the central campus is as follows: to the extent that a given program intends to recruit a regular faculty member, the program must show a ramp to a steady state of at least 30 students per year (unless there has been identified some aspect of "other revenue" that was sufficiently reliable in the out years that would cause campus stakeholders to regard this as an acceptable subsidy for this purpose). If a program intended to recruit 2 regular faculty members that would be paid from PDST revenue, the minimum expectation is 60 students per year at steady state.

The above requirement does not extend to include lecturer appointments. A program can hire any number of lecturers, year to year, that the PDST revenue forecast can support (along with the total set of overhead costs).

The PDST Program Planning template (functionally) allows individual program planners to customize the specific set of labor costs associated with staffing the program. It is understood that for some programs, regular departmental faculty (already paid for, so to speak) will do some portion of the teaching; some programs will start by hiring a director, or a new key faculty member; some may rely on mostly lecturers.

However, per guidance from central campus (Planning & Budget) individual program planners may not assume that they can cost shift by seeking to use PDST revenues to pay some portion of regular faculty who otherwise have their costs covered (unless the course they are teaching are PDST only offerings). Guidance on this issue is likely to evolve. Please consult with your divisional office on a regular basis.

To add regular faculty cost to the program planning template:

1. Under the "Other Program Assumptions" area, in the FTE calculations section at line 80, locate the blue input fields for Faculty Salary and Overhead.

80	**FTE Calculations per person & allocation % to Program:**	ANNUAL	ANNUAL
81	**FTE Faculty**		
82	#1 - FTE Faculty base salary	$ 100.000	(100.000)
83	#1 - FTE Faculty overhead %	50%	(50.000)
84	#1 - FTE Faculty - % of time to the program	100%	100%
85	**#1 - FTE Faculty total cost**	**$ 150.000**	**$ (150.000)**

2. Input the desired salary and fringe costs.
3. If approved to do so, pro rate the salary by inputting a percent FTE per year.
4. Note also that if 4 quarter program was selected, the model will automatically calculate summer salary, as 9/12.

FTE Lecturer

Also in the area called "Other Program Assumptions," at line 109, the PDST program planning template allows the program planner to input salary, overhead, and percent effort for up to 6 full or part-time lecturers (where the costs will be allocated to annual PDST revenue). It is generally expected that PDST programs will rely on some number of faculty lecturers to teach courses. When adding these labor costs, one should do so in the context of the total available annual PDST revenue (relative to other costs, or perhaps supplemental revenue such as campus or divisional subsidies, etc.).

To add faculty lecturer FTE:

1. In the blue input cells, enter salary and overhead.
2. Enter the desired percent FTE per year (columns F-L).

FTE Lecturers (50% time allocation is the normal expectation)		
#1 - FTE Lecturer base salary	$ 80,000	(80,000)
#1 - FTE Lecturer overhead %	50%	(40,000)
#1 - FTE Lecturer - % of time to the program	50%	50%
#1 - FTE Lecturer total cost	**$ 60,000**	**$ (60,000)**

FTE Staff

The template is presently set up to include staff FTE at the divisional level, i.e., shared resources across programs for divisional accounting needs, and for student career placement (a key component for professional master's programs that rely on placement success to be able to attract future students). At the consolidated level, the model presently allocates costs for a new research accountant after every 3 program starts, and likewise, a new placement officer every three years (assuming new programs are added every year. As allocated costs, these don't fit very well into the individual program planning template. Please leave these areas blank for the moment. The next revision of the model will find a better way to manage allocated (shared) cost line items.

OPEX Categories

Beginning at line 266, individual program planners can insert custom one time and annual program costs. There are three pre-set annual categories (supplies, marketing, library, and software licenses). Additionally, there are ~10 undefined OPEX categories that can be defined as needed, with costs per input in blue cells per year. Use these fields to account for all the programs (non labor) operating expenses that are meant to be allocated to PDST revenue on an annual basis.

To add Operational Expense items:

1. Find the Operating Expense section, beginning at line 233.
2. Input annual cost category items in the blue input cells.
3. Name new OPEX categories as needed, and enter annual costs as needed.

Library-per year per program ($3.5k per yr)	$ 3,500	(3,500)	(3,675)	(3,859)	(4,052)	(4,254)	(4,467)	(4,690)	(4,925)	(5,171)	(5,430)	(44,023)
Software licenses ($22.5k yr 1)	$ 22,500	(22,500)										(22,500)
Marketing costs ($55k per yr)	$ 55,000	(55,000)	(57,750)	(60,638)	(63,669)	(66,853)	(70,195)	(73,705)	(77,391)	(81,260)	(85,323)	(691,784)
Supplies ($23k per yr)	$ 23,000	(23,000)	(24,150)	(25,358)	(26,625)	(27,957)	(29,354)	(30,822)	(32,363)	(33,981)	(35,681)	(289,292)
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
ADDITIONAL OPEX (excluding direct labor)												-
Assessment-UCOP revenue assessment (2% of total PDST revenues)	2.0%	(8,670)	(15,173)	(19,117)	(20,073)	(21,077)	(22,131)	(23,237)	(24,399)	(25,619)	(26,900)	(206,396)
Assessment-IT info users (per student per yr)	$ 666.50	(9,998)	(16,663)	(19,995)	(19,995)	(19,995)	(19,995)	(19,995)	(19,995)	(19,995)	(19,995)	(186,620)
Total: Operating Expenses		(385,168)	(448,160)	(583,747)	(611,935)	(641,532)	(672,609)	(705,240)	(739,502)	(775,477)	(813,251)	(6,376,620)
NET INCOME / (LOSS)		$ 147,278	$ 60,119	$ 56,684	$ 60,518	$ 64,543	$ 68,770	$ 73,209	$ 77,869	$ 82,762	$ 87,900	$ 779,651

CAPEX

Beginning at line 289, the template allows for the customization of CAPEX costs. There are the following pre-set capital expense categories: Instructional hardware, equipment, furniture, library allocation for new regular faculty FTE, and a catch all category, “additional start up costs.” To reiterate, this is a financial model, and not a budget tool per se; our aim here is to model costs down to a reasonable level of granularity only in order to analyze program financial performance (and the aggregate of multiple programs) over a time function.

To input CAPEX costs:

1. Locate the blue input fields in column F, beginning at line 291.
2. Input costs per year as desired.

289	Cash In-Flow / (Out-Flows): CapEx / Start-up / Other:												
290	Net Income / (Loss):			147,278	60,119	56,684	60,518	64,543	68,770	73,209	77,869	82,762	87,900	779,651
291	Additional start-up costs for program	$	-	-	-	-	-	-	-	-	-	-	-	-
292	Additional CapEx to be funded by Other Revenue (ie lab buildout)	$	-	-	-	-	-	-	-	-	-	-	-	-
293	CapEx-instructional computer hardware ($35k yr 1)	$	35,000	(35,000)	-	-	-	-	-	-	-	-	-	(35,000)
294	CapEx-equipment ($45k start up in yr 1)	$	45,000	(45,000)	-	-	-	-	-	-	-	-	-	(45,000)
295	CapEx-library for each new FTE	$	5,000	(5,000)	-	-	-	-	-	-	-	-	-	(5,000)
296	CapEx-furniture ($75k start up in yr 1)	$	75,000	(75,000)	-	-	-	-	-	-	-	-	-	(75,000)
297	Other													-
298	Total Cash In-Flow / Out-Flows			$ (12,723)	$ 60,119	$ 56,684	$ 60,518	$ 64,543	$ 68,770	$ 73,209	$ 77,869	$ 82,762	$ 87,900	$ 619,651

Once all desired inputs and customizations have been entered, the document is ready, in principle, for sensitivity analysis. Again, the individual template provides financial performance information (for one program) over a ten year period, given a set of assumptions about price point, revenue, and cost information (labor, OPEX, and CAPEX). It also provides information about non-PDST revenue that the program generates that go back to campus or is returned to aid. The larger model (multiple programs rolled up into consolidation) provides this view for an entire set of PDST program starts over a 10 year period.

Summary Income Statement

The overall Program Template has the following sections: Summary Income Statement, Academic Plan Assumptions, and Detailed Income Statement.

- **Summary Income Statement** (gross and net revenue, net income, cumulative cash flow)
    - This table is essentially “the bottom line” for the program’s financial performance over 10 years—it shows you what to drill into at the level of the Detailed Income Statement and thus when and where to be potentially concerned about cash flow after you have entered your various program assumptions. Hopefully, it is obvious that these line items are the summary lines, for any given year of the program, from the Detailed Income Statement, which provides detailed breakdowns of these sums.

		2013 / 2014 Yr 1	2014 / 2015 Yr 2	2015 / 2016 Yr 3	2016 / 2017 Yr 4	2017 / 2018 Yr 5	2018 / 2019 Yr 6	2019 / 2020 Yr 7	2020 / 2021 Yr 8	2021 / 2022 Yr 9	2022 / 2023 Yr 10	Total
10	SUMMARY INCOME STATEMENT / CASH FLOW											
12	Revenue:											
13	Gross Tuition Revenue	626,290	1,200,305	1,511,895	1,584,428	1,660,588	1,740,556	1,824,523	1,912,688	2,005,261	2,102,463	16,168,996
14	Offsets / Payouts for Campus Costs & Student Aid	(335,845)	(692,026)	(871,463)	(911,975)	(954,513)	(999,177)	(1,046,075)	(1,095,317)	(1,147,022)	(1,201,312)	(9,254,725)
15	Other-net revenue & costs	242,000	-	-	-	(0)	-	-	-	-	(0)	242,000
16	Net Revenue	532,445	508,279	640,431	672,453	706,075	741,379	778,448	817,371	858,239	901,151	7,156,271
18	OpEx - Direct Labor / Operating Costs / Assessments	(385,168)	(448,160)	(583,747)	(611,935)	(641,532)	(672,609)	(705,240)	(739,502)	(775,477)	(813,251)	(6,376,620)
20	Net Income / <Loss>	$ 147,278	$ 60,119	$ 56,684	$ 60,518	$ 64,543	$ 68,770	$ 73,209	$ 77,869	$ 82,762	$ 87,900	$ 779,651
22	Other Cash Flows - Inflow / <Outflows>	(160,000)	-	-	-	-	-	-	-	-	-	(160,000)
24	Net Cash Inflow / <Outflow>	$ (12,723)	$ 60,119	$ 56,684	$ 60,518	$ 64,543	$ 68,770	$ 73,209	$ 77,869	$ 82,762	$ 87,900	$ 619,651
26	Cumulative Cash Flow	$ (12,723)	$ 47,396	$ 104,080	$ 164,598	$ 229,141	$ 297,912	$ 371,120	$ 448,989	$ 531,751	$ 619,651	$ 619,651

Gross & Net Revenue

The Gross Revenue figure in the Summary Income Statement is the sum of all the different flavors of revenue, at their respective price points, and at the volume indicated by the number of students. This figure, as gross, does not yet reflect any offsets/payouts, or program cost (a net revenue figure). Again, the Detailed Income Statement breaks this same figure down into PDST tuition, regular tuition, and supplemental tuition, and further disambiguates them with respect to proportion of resident or non-resident in each case, as applicable. As gross, it also includes any start-up revenue allocated to the program by either the division or the central campus. It also reflects the escalation rates that have been input into the template.

Net Income

Net income, as one would assume, is total revenue per year after offsets/payouts, and annual operating expenses. Here again, this claims on the revenue are spelled out in fine detail in the Detailed Income Statement (lines 158-286). Note that one-time CAPEX costs appear as a separate line in the Income Summary (Other Cash Flows) such that the Net Cash Flow (bottom line of summary is the difference, in any given year, between Net Income and Net Income minus CAPEX.

Cash Flow

A few words about Cash Flow are in order. In general, the activity of managing a P&L statement, which the overall set of program Financials is based upon, is first and foremost a cash flow management task. A business unit manager is watching quarterly and annual revenues across multiple products or product lines, forecasting possible perturbations, and taking steps to ensure that the unit remains “in the black.” Since we are an educational, not-for-profit organization, this is not what we are about, in the strict sense. However, there are some analogous aspects nonetheless.

Single Program Sensitivity Analysis

First, at the individual program level, program planners need to be able to insert their revenue and cost information into a format that will show how much discretionary revenue there is, year to year, in order to reinvest in new or “nice to have” items. In addition, the ability to project actual financial performance over some number of out years, and then be able to tweak these numbers by modifying price point, volume of students, and one time and recurring costs is also part of basic planning. With respect to cash flow per se, it may be that campus policy on PDST programs, or other aspects of policy require that revenues be spent in any given year by the program. Even if this is the case, knowing what is available year to year so that one can zero out without running red would seem to be important. Finally still at the individual program planning level, this is not exclusively a planning exercise. If it turns out that a program has 19 students where the plan was for 30, then it is important that divisional and campus analysts see these actual numbers so that adjustments can be made.

At the divisional or campus level, the same sensitivity analyses are available at the level of consolidated programs (how multiple programs are performing, over a time function, as a whole (given the unique assumptions of each).

Academic Plan Assumptions

The second major part of the template is the assumptions area:

- **Academic Plan Assumptions**—(Students in program, tuition revenue per year, revenue escalations, PDST tuition price point, other globally applied values like regular tuition cost and fees, program labor costs, and return to aid formulas).
    - This section is presently a blend of global assumption inputs and individual program revenue and cost parameters. For individual program planning, the global or campus level assumptions are for information only purposes (and thus should not be modified without direction to do so).

Detailed Income Statement

- **Detailed Income Statement**—(detailed gross revenue, offsets/payouts, other revenue, total net revenue, total OPEX detail, net income, total CAPEX detail, total annual and cumulative cash flow)
    - This section mirrors the major line items of the Summary Income Statement, but breaks down each summary item figure into its various components. **Gross revenue**, for example, shows annual tuition revenue totals broken down by tuition type per year (along with startup divisional revenue, fees, and any other revenue types). T**otal Tuition offsets and payouts** reflects the same figure as the summary income statement (all revenues leaving the books), but breaks it down by return to aid formulas and percentages destined for the campus general fund. **Total net revenue** mirrors the summary income statement, but breaks out all revenues to the program per year. Operating expense and Capital expense sections are likewise accounted for in detail, resulting in a Net Income line that mirrors in the summary income statement. This is

the available cash for annual program reinvestment (if any) prior to the allocation of Capital expense. The total cash flow is the cash position per year after this additional subtraction.