

Self-Study and Preliminary Development Plan

Mathematics Department, University of San Francisco

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1 Introduction: Program Review 1993

Our department's last program review was ten years ago (Summer–Fall 1993). The self-study and preliminary development plan that we wrote (henceforth denoted by SS93) focused on our chief “asset” (a very friendly and dynamic faculty) and most pressing “problem” (a very low number of majors). Most of our suggestions and the outside reviewers' recommendations explored ways we could build on our strengths to develop a more attractive and flexible program.

We would like to structure our current Self-Study and Preliminary Development Plan on the unfinished business from 1993, since most of the issues that are important to us today were important ten years ago. The present document examines how the department and the administration responded to the 1993 recommendations, what was achieved, and what remains to be done. It also includes some new areas of concern that have surfaced since 1993.

1.1 The “Asset” and the “Problem”

Our previous document, SS93, and the outsider reviewers' report (henceforth called OR93) painted a picture of a very friendly and dynamic department working hard to innovate, especially with regard to technology in the classroom. But both SS93 and OR93 lamented the small number of majors. OR93 also criticized the relative inflexibility and unattractiveness of our program, and urged extensive innovation to make the major more attractive.

Today, these issues are still of paramount importance: our main asset, as always, remains our faculty with its intellectual and interpersonal strengths, and while we have made significant progress, we still struggle to raise the numbers of majors. We made many changes to the curriculum, some ongoing, in an attempt to improve our program, and also in response to college- and university-wide policy changes. In the next pages, we will study the evolution of our department, by looking at the SS93 and OR93 suggestions, and documenting what actually happened.

1.2 Summary of SS93/OR93

Our preliminary development plan contained the following items.

1. Improve the number of majors and minors, with a goal of tripling the number of majors.

2. Improve computing facilities and classroom environment.
3. Improve departmental space.
4. Study and improve the major program.
5. Explore creating a masters program.
6. Improve communication with majors.
7. Clarify some tenure and promotion policies.

The outsider's report responded by focusing on four areas: Faculty, Curriculum, Attracting Majors, and Other Issues. In more detail:

Faculty The reviewers made several suggestions about tenure and promotion. While interesting, these were not really issues that can be addressed without radically revamping the Collective Bargaining Agreement. (Example: "The Department [should] speak with a collective voice on promotion.") Three suggestions, however were relevant: earlier sabbatical support for probationary faculty, an appropriate reward system for all faculty, and a continuation of the trend of replacing part-time faculty with full-timers.

Curriculum The reviewers strongly suggested that the curriculum be made more flexible and attractive, by reducing and eliminating certain requirements, and that all required courses be offered at least once a year.

Attracting Majors The plan outlined in SS93 should be carried out, with administration support. In addition, the proposed curriculum changes will help. Also, efforts should be made to develop a more diverse student body.

Other Issues A number of issues were raised: improve departmental space; continue investing in educational technology, including developing a professional computing staff; keep separate from Computer Science; improve community outreach; keep vigilant with regards to educational ideas; defer planning a graduate program.

In the next section, we will examine how the department evolved over the past ten years, partially in response to the 1993 recommendations. Our exploration will repeatedly ask, "What was done?," "How well did it work?," and "What remains to be done?"

2 The Math Department, 1993–2003

2.1 The State of the Department

The past ten years have transformed our department, largely in positive directions. We have suffered some setbacks, described in detail later, but we hope that they are temporary roadbumps on a journey toward a very bright future. Let us begin with the highlights for now:

2.1.1 Departmental Role in University Administration

. Stanley Nel, originally hired as a math professor, continued his spectacular career during the last ten years. He concluded a very successful twelve-year stint as Dean of Arts and Sciences to move on to a newly-created Vice Presidency for International Relations. Nel will do many good things for the University in this position, but we are especially excited about the enhanced prospect of recruiting talented international students.

Tristan Needham, hired in the Math Department in 1989, became Associate Dean for Sciences in 1999. He will return to the faculty after a year's sabbatical in Fall 2005. We missed Tristan's services as a mathematician and teacher, but he has served our Department extremely well, not with favoritism versus other science departments, but by understanding us and trying extremely hard to enhance our strengths in collaboration with other departments (especially Physics and Computer Science).

Most recently, one of our top alumnae, Marta K. Nichols (graduated 1993), was appointed to the Board of Trustees.

It is especially important that Mathematics have a voice at such high levels of the University, because there is a tendency, at a Jesuit liberal arts institution such as USF, for Mathematics and other "hard sciences" to languish with low profiles compared to many programs in the Humanities that can more easily articulate a consistency with the University's Mission Statement.

And in fact, our program is quite consistent with the University's Mission. Mathematics attempts "to pursue truth and follow evidence to its conclusion" (Core Value #2), and our Department in particular believes in "learning as a humanizing, social activity rather than a competitive exercise" (Core Value #3). And like other departments at USF, we strive to become truly outstanding, to move our University toward its goal of being "internationally recognized as a premier Jesuit Catholic,

urban University” (Vision Statement).

2.1.2 National and International Recognition

. During the past ten years, several things have put our department “on the map.”

- In 1994, Paul Zeitz (hired in 1992) worked as one of the coaches of the U.S. team at the International Mathematical Olympiad (IMO). This team received a perfect score, the only team to do so in the history of the IMO.
- In 1995, Tristan Needham won an Allendorfer Award for his article, “The Geometry of Harmonic Functions.” This article was part of his immensely successful book, *Visual Complex Analysis* (VCA), published in 1997. VCA went on to win the National Jesuit Book Award, and has been translated into German and Japanese, and is well on to becoming a 21st-century math bestseller, with glowing endorsements, from among others, Roger Penrose.
- In 2002, we hired our most distinguished faculty member ever, John Stillwell. We owe this coup to Tristan Needham’s long mathematical friendship with Stillwell and to his extraordinary administrative exertions to coax him away from Monash University with a half-time (one semester per year) position at USF.
- In 2003, Paul Zeitz received a Haimo Award, in part for the activities stemming from his 1994 IMO work.

Thus, in the past ten years, the USF Mathematics Department has become at least somewhat noticed nationally, and even internationally. And these achievements are very strongly connected with one another. Stillwell’s recruitment, perhaps the best thing that has happened to our department, would have been impossible without Tristan Needham working in the Dean’s Office. Zeitz’s work, requiring many summers working with high school kids instead of pursuing traditional mathematical research, was only possible because of a sympathetic and understanding Dean (Nel) who understood the value of such nonstandard work. Likewise, Nel had an early and highly sympathetic understanding of Needham’s work, which greatly facilitated the writing of VCA.

In a nutshell, the comraderie of our Department has been one of the main ingredients for its success. We must, therefore, make every effort to maintain this

Departmental atmosphere. As you will see below, we have suffered some setbacks. But at the current time, we have a tremendous and crucial opportunity: for the first time since 1992, we are conducting a search for a full-time, tenure-track position. We received over 300 applications, and have an excellent chance to hire a dynamic new person who can really add vigor to our research and inspiration to our teaching. At the same time, we anticipate staffing problems that may not be resolved until the fall of 2006 (see Section 2.2.3 below).

2.2 The Faculty

We shall parallel the introductory remarks above with a more specific description of faculty achievements, followed by brief biographies. We conclude with an analysis of some staffing difficulties that we have had, and may continue to have.

2.2.1 Faculty Achievements

During the past ten years, the Department of Mathematics has been highly productive—especially given that two of our faculty held high-level administrative appointments during this time. These faculty achievements are summarized here. Details may be found in the Biographical Sketches that follow and also in the Curriculum Vitae addendum to this Review.

Two faculty were recognized with four awards from professional organizations: at the national level,

- Prof. Tristan Needham; Carl B. Allendoerfer Award, Mathematical Association of America, (Distinguished Writing)
- Prof. Tristan Needham; National Jesuit Book Award [First Prize], Alpha Sigma Nu, (Distinguished Writing)
- Prof. Paul Zeitz; Deborah and Franklin Tepper Haimo Award, Mathematical Association of America, (Distinguished Teaching)

and at the regional level

- Prof. Paul Zeitz; Award for Distinguished College or University Teaching of Mathematics, Mathematical Association of America, Northern California Section.

Two faculty served in the capacity of Editor for a professional journal. Three faculty served in an administrative capacity for a professional organization (for example, member of a review committee or an advisory council)—six instances between them. Five faculty collectively published twelve books (seven original works and five edited collections). Twenty-nine articles were published in professional journals or scholarly monographs. Two faculty had nine grant proposals awarded between them. Thirty invited lectures were delivered at professional meetings. Two faculty received awards from the University of San Francisco in recognition of their contribution to our institution (Distinguished Research and Distinguished Service).

2.2.2 Biographical Sketches of Faculty

Renée Brunelle Renée Brunelle received a BS in mathematics from the University of San Francisco in 1994 and an MA in pure mathematics with emphases in modern algebra and complex analysis from the University of California, San Diego in 1997. At USF she was instrumental in establishing the use of the Calculus Readiness Test for placing incoming students into the proper entry-level mathematics course, assists with the orientation of new part-time instructors in the Mathematics Department, and is a regular volunteer at both the annual Bay Area Math Meet and the College’s Major/Minor Fair. She is also involved with St. Ignatius Church as a lector, Eucharistic minister, and occasional choir member. When not trying to rid the world of math phobia one student at a time, Renée enjoys traveling, hiking, and reading.

Allan Cruse Allan Cruse attended college at Emory University where he majored in mathematics. He was awarded a fellowship for graduate study at UC-Berkeley by the Woodrow Wilson Foundation on condition that he agree to give “serious consideration” to pursuing a career in college teaching, and after finishing his Master’s Degree at Berkeley, he accepted USF’s offer in 1966 of a “temporary” position teaching classes in mathematics: that position morphed into a permanent one after he completed his mathematics doctorate, awarded by Emory University in 1974.

Professor Cruse began teaching computer science courses over two decades ago, soon after USF acquired its first UNIVAC 90/60 mainframe. His current research interests are in the areas of systems programming for microcomputers and combinatorial optimization.

Stephen M. Devlin Stephen Devlin grew up in New York and attended Manhattan College where he majored in Mathematics and minored in Religious Studies. He went on to study representation theory at the University of Maryland, earning his Ph.D. in 2001. He is currently finishing his third and final year as a C.L.E. Moore Instructor of Mathematics at M.I.T. before joining the faculty at USF in August 2004. Outside of mathematics his interests include writing screenplays, which he does for fun, and running, which he does to keep up with his wife Holly.

James K. Finch James K. Finch received his Ph.D. from the University of Illinois. His areas of interest include computational statistics and scientific visualization.

John Sterling Kao A native of Salt Lake City, John Kao attended the University of Utah graduating magna cum laude at the age of 17. Admitted to the Department of Mathematics at Princeton University, he earned his Ph.D. in 1991. He has taught at the USF since September of that year.

Dr. Kao’s research follows two lines of investigation: birth and death processes on stochastic flows (BDFPs) and stochastic vibrational control. These are described below—references in square brackets may be found in the Curriculum Vitae section of this Program Review.

Since they were first identified in Dr. Kao’s Ph.D. dissertation, BDFPs have proven fertile ground for scientific inquiry (see for example, M. Phelan, “Asymptotic Likelihood Estimation from Birth and Death on a Flow,” *The Annals of Statistics* (1996); also, Kao and Cinlar [1998]). Their study represents a first step in the application of modern results from the theory of stochastic flows of homeomorphisms to the classical problem of turbulent transport by fluids.

Vibrational control refers to the stabilization of unstable mechanical (physically realizable) systems by introduction of vibrations. This technique has been used, for instance, to stabilize beam trajectories in particle accelerators (alternating-gradient focusing). In “Principle of Vibrational Control: Theory and Applications,” *IEEE Transactions on Automatic Control* (1980), S.M. Meerkov wrote, “Is it possible to stabilize the system using not regular but random ‘vibrations’? . . . The answer to this question is not found, although it was discussed in many publications . . .” Kao and Wihstutz [1994]

were the first to answer this question in the affirmative. Their subsequent paper [2000] provided necessary and sufficient conditions for a broad class of stochastic processes (diffusion noise) to stabilize linear companion form systems (the simplest example being the inverted pendulum). Since, scientists at Universität Hannover, Germany, have experimentally verified the characterization derived by Kao and Wihstutz—stabilizing an inverted pendulum with random, vertical line, vibration of its base.

Pursuant to these endeavors, Dr. Kao served as Visiting Associate Professor, School of Engineering, Princeton University. He is an Associate Editor for the journal, *Advances and Applications in Statistics*. With respect to his other commissions on behalf of USF (service and teaching), Stanley Nel, Dean, College of Arts and Science, wrote on Dr. Kao's Academic Career Prospectus (dated 5/8/03), "For the next 2–3 years, focus on completion of monograph. Maintain current level of service. I judge your teaching to be truly outstanding."

Millianne Lehmann Millianne Lehmann received her M.A. in Mathematics from San Francisco State University in 1963 and joined the USF faculty 1965. Her areas of interest include mathematics education and technology-assisted instruction in mathematics. She was project director for the USF Middle School Math Institute (an NSF-funded program from 1984–1986. She has co-authored four books, the latest of which, *Quantitative Methods for Business, a Conceptual, Excel-Based Approach* (co-authored with Paul Zeitz) will be published by Wiley in 2004.

Professor Lehmann was Mathematics Department Chair for 14 years, most recently from 1991 to 1996. She was a founder of the USF Faculty Association (AFT Local 4269), and served it as an executive officer for 13 years.

She is currently on the Editorial Board of the Mathematical Association of America's Classroom Resources Materials Series and serves as a referee for the publications of the National Council of Teachers of Mathematics.

Professor Lehmann is married and has 6 adult children.

Tristan Needham Tristan Needham (son of the distinguished anthropologist Rodney Needham) grew up in Oxford, England, where he studied physics as an

undergraduate at Merton College before moving to the Mathematical Institute to study black holes under the supervision of Sir Roger Penrose. Tristan received his D.Phil. in 1987 and joined the USF mathematics faculty in 1989. The specific fields in which he is most interested are geometry, complex analysis, general relativity, and the history of science, but his overarching concern is with finding intuitive visual ways of understanding mathematics and physics. His book *Visual Complex Analysis* won first prize in the 1997 National Jesuit Book Award contest. An earlier paper arising from the book received the Mathematical Association of America's Carl B. Allendoerfer Award.

Stanley D. Nel Stanley Nel grew up in South Africa, and studied Cosmology under George Ellis at the University of Cape Town, where he earned a Ph.D. in Applied Mathematics. As a Rhodes Scholar at Balliol College, Oxford, he did research as a member of Roger Penrose's Relativity Group at the Mathematical Institute. His papers have focused on the observational foundations of cosmology, and on techniques for obtaining solutions of Einstein's field equations in General Relativity. He joined the Mathematics Department at USF in 1983, and served as Dean of the College of Arts and Sciences from 1990–2003. He is currently the Vice President for International Relations at the University of San Francisco.

Peter S. Pacheco Prof. Pacheco's research interest is in parallel scientific computing. He has been involved in the development of the MPI Standard for message-passing, and has written a short User's Guide to MPI. His book *Parallel Programming with MPI* is an elementary introduction to programming parallel systems that use the MPI 1 library of extensions to C and Fortran. It is intended for use by students and professionals with some knowledge of programming conventional, single-processor systems, but who have little or no experience programming multiprocessor systems.

His current research is in developing software for computational neuroscience and optimizing parallel I/O systems. With his students and Patrick Miller of LLNL, he has been developing a collection of programs, *Object-oriented Neurosys*, for the simulation of large networks of biologically accurate neurons on parallel computers. With his student and Prof. Gregory Benson (USF Computer Science Department), he has been working on benchmarking the performance of various I/O schemes on multiprocessor nodes

of Linux Clusters.

In January 2001, with Prof. Benson, he received a grant to build a cluster from the W.M. Keck Foundation. The Keck Cluster currently consists of 64 dual-processor Pentium III nodes interconnected by Myrinet.

John C. Stillwell John C. Stillwell was born in 1942 in Melbourne, Australia and educated at Melbourne High School and the University of Melbourne. He received an M. Sc. from the University of Melbourne in 1965 and a Ph.D. from the Massachusetts Institute of Technology in 1970. After working for 31 years at Monash University in Melbourne, John joined the Mathematics Department at USF in 2002. He is interested in many aspects of mathematics, but particularly its history in the 19th and 20th centuries. These interests are reflected in the books he has written, on topics from number theory to geometry, and his translations of classic works by Dirichlet, Dedekind, Poincare and Dehn. His best known work to date is *Mathematics and Its History* (Springer-Verlag 1989 and 2nd edition 2002). He has been an invited speaker at several international conferences, including the International Congress of Mathematicians in Zurich in 1994, and meetings of the American Mathematical Society in Baltimore in 1998 and Melbourne in 1999.

Benjamin Wells Benjamin Wells teaches both mathematics and computer science courses as a member of both departments. He regularly teaches freshman seminars that combine science and art. He holds degrees from MIT and UC Berkeley and has studied in four countries. He won a John Templeton Foundation science and religion course prize in 1998 and held the USF Davies Professorship in 1989. The last student of noted logician Alfred Tarski, Wells works on the boundary of logic, algebra, and computing; he also contributes to computer graphics, visual communication, and classic computers. He is Graduate Program Director for Computer Science. He enjoys mysticism, cooking, computer-supported art, hiking, languages, dancing, tales, and married life with two children.

Robert Wolf Robert Wolf graduated from the Massachusetts Institute of Technology in 1962 with a bachelor's degree in mathematics. From the University of California at Berkeley, he received a master's degree in 1964 and a doctorate in 1968, both in mathematics. He received a master's degree in physics in

1990 from San Francisco State University in 1990. He is interested in the mathematical and physical sciences.

Paul Zeitz Paul Zeitz majored in History at Harvard and received a Ph.D. in Mathematics from the University of California, Berkeley, in 1992, specializing in Ergodic Theory. Between college and graduate school, he taught high school mathematics in San Francisco and Colorado Springs.

One of his greatest interests is mathematical problem solving. He won the USA Mathematical Olympiad (USAMO) and was a member of the first American team to participate in the International Mathematical Olympiad (IMO) in 1974. Since 1985, he has composed and edited problems for several national math contests, including the USAMO. He has helped train several American IMO teams, most notably the 1994 “Dream Team” which, for the first—and only—time in in history, achieved a perfect score. This work, and his experiences teaching at USF led him to write *The Art and Craft of Problem Solving* (Wiley, 1999). He has also been very active in local events for high school students. He founded the Bay Area Math Meet in 1994 and co-founded the Bay Area Mathematical Olympiad in 1999.

He was recently honored, in March 2002, with the Award for Distinguished College or University Teaching of Mathematics, by the Northern California Section of the Mathematical Association of America (MAA), and in January 2003, he received the MAA’s national teaching award, the Deborah and Franklin Tepper Haimo Award.

When not doing mathematics, he enjoys outdoor adventures with his wife (a former park ranger) and his two small children.

2.2.3 Problems Faced by Faculty

Our department has been blessed with a friendly and talented faculty. As mentioned earlier, a healthy faculty culture is crucial. However, its health is rather delicate, and it has seen some erosion during the past ten years. Our two biggest problems have been a gradual “aging” of the faculty, along with a loss of tenure-track staffing.

Since Fall 1992, when Zeitz was hired, until Spring 2002, when Stillwell was hired, we had no new tenured or tenure-track appointments. And while Stillwell is a superb addition to the faculty, he will work only half-time (on campus every other semester). Since 1998, all permanent members of the department had tenure.

Needham became Associate Dean of Science at the beginning of 1999, and will not return to the Mathematics department until Fall 2005 (after a year-long sabbatical). Pacheco did not completely leave the department, but he has mostly taught CS courses since 1998, when he became chair of the CS department. His office was moved from the 2nd floor of the Harney Science building, where most of the Math offices are, to a much nicer office on the 5th floor.

We hired Renée Brunelle as a temporary term position in Fall 1997. This has helped to fill the void left by Pacheco and Needham. However, Brunelle plays a different role, concentrating, with great success, on Calculus and Statistics.

Since Wells and Cruse teach more in CS than in Mathematics, the department has had, from 1998 until 2002, a rather small core, consisting of Brunelle, Finch, Kao, Lehmann, Wolf, and Zeitz. We certainly managed, but morale was not great. One cannot quantify the effect of colleagues moving up to the 5th floor or to the Dean's office. Suffice to say that those "left behind" experienced a department that was somewhat diminished in terms of collegiality and intellectual energy.

The arrival of Stillwell has helped enormously, as will Devlin's arrival in Fall 2004 and Needham's return a year after that. However, Lehmann is retiring at the end of Spring 2004, and it will be impossible to fill her shoes. Brunelle's position was approved for one more year (i.e., Fall 2004–Spring 2005), but it seems highly likely (for budgetary reasons) that her term position will not be renewed after Spring 2005. Unless our department can grow in absolute terms, we will have only one untenured full-time faculty member (Devlin).

2.3 The Curriculum

We overhauled the department's curriculum twice during the past ten years. In 1994, in response to the 1993 Program Review, we created a more inviting and flexible major, which we will refer to below as the *1994 major*. In 2001, the college of Arts and Sciences began converting from a 3- to a 4-unit norm for course credit. We again shifted our curriculum to accommodate these changes, creating, yet again, a new major, in early 2003. We shall refer to this 4-unit-norm major as the *2003 major*. To complicate matters further, at roughly the same time, a new Core Curriculum replaced the GEC, which profoundly affected our course offerings at the service and lower-division level. Here are the details.

2.3.1 Response to OR93: The 1994 Major

We quickly approved a new major that was designed to be more flexible and attractive. The old (pre-1994) major required 4 semesters of calculus, two semesters of linear algebra, two semesters of abstract algebra (a “bridge” course plus a semester of a standard modern algebra), and two semesters of analysis (real and complex), plus 3 semesters of upper-division electives, plus two semesters of physics. The 1994 major reduced or eliminated many of these requirements:

Calculus: 3 semesters required, instead of 4.

Linear algebra: 1 semester required, instead of 2.

Abstract algebra: Only the bridge course (renamed Math 300, Formal Methods) required, instead of 2 courses.

Physics: Requirement eliminated.

In addition to the 5 lower division requirements in the 1994 major (3 semesters of calculus, 1 semester of linear algebra, plus formal methods), students were required to take 7 upper-division (300- or 400-level) courses. Of these 7 courses, one had to be “classical” (e.g., Complex Analysis), one had to be “applied” (e.g., Ordinary Differential Equations), and one had to be “axiomatic” (e.g., Modern Algebra).

In sum, the 1994 major was 36 units (not including Statistical Reasoning, required as a GEC course), in contrast to the old 39-unit major (45 units, if you count the required year of physics). The new major was, on paper, a weaker major, since it required less, but it was undeniably more flexible, and seemed to work reasonably well to attract math majors (especially double majors from physics and computer science, and dual-degree students), while providing the top students the same opportunities as the old major for deeper and more rigorous study.

On the other hand, the 1994 major had numerous problems. For example, we frequently debated the wisdom of not requiring the fourth semester of calculus, but the majority of the department agreed that it was more important to offer as many upper-division courses with as few prerequisites as possible, as otherwise it would be very difficult for all the students who wanted to take a course to do so. The main constraint was (and is) the low number of majors; consequently, most upper-division courses are offered just once every four semesters.

But of course this need to reduce prerequisites also made it harder to offer truly rigorous upper-division courses. The solution was to renumber several of the most advanced courses (for example, Real Analysis) to 400-level, requiring Formal Methods (math 300) as a prerequisite.

2.3.2 Conversion from 3- to 4-unit Curriculum

In 2001, Dean Stanley Nel (originally hired as a math professor) initiated a movement from 3- to 4-unit norms for courses. The rationale was a simpler workload for students (4 courses per semester rather than 5 or 6), an improved distribution of workload for faculty (fewer preps; the standard teaching load went from 3 courses every semester to a 2-2-2-3-course, typical 4-semester rotation), and an opportunity for a more intensive curriculum.

The departments in the College of Arts and Sciences converted to this new plan with varying speed and enthusiasm. Mathematics was notably one of the last departments to do so, with a number of faculty members quite opposed to the changes. The debate over this and the transition difficulties engendered irritation and bitterness among some math faculty that has not fully healed.

The department voted in October 2002 to convert to the 4-unit norm; the changes did not fully go into effect until this current (Fall 2003) semester. In creating the 2003 major, we faced the challenge of reducing the total number of courses offered (since our staffing did not change), while improving the intensity of the major. We took a very conservative route, one that hardly perturbed our curriculum. We agonized over removing several courses from the 2-year rotation. The remaining ones grew in size and depth by approximately 33%. Here are the main features.

Course Delivery: We decided to deploy our new 4-unit courses by teaching 4 hours (i.e., 200 minutes) per week (in contrast to some humanities departments which retained the old 150 minutes in class, but added other activities outside the classroom), usually in a 3×65 minute format.

Calculus: We consolidated the four 3-unit courses into three 4-unit courses, with no change in total content.

Courses Eliminated: We eliminated the Advanced Linear Algebra course, hoping instead to teach more linear algebra in Elementary Linear Algebra (which now had 33% more contact time), plus a few other courses. Likewise, we

eliminated Partial Differential Equations. The only single-semester course that we eliminated was Foundations of Mathematics. These last two courses had histories of cancellation due to low enrollment.

Expanded Courses: The remaining upper-division courses remained unchanged in name, but with greater expectation of depth and breadth of coverage. As one example, the Fall 2003 Complex Analysis course looks at topics like the Maximum Modulus Principle, Rouché’s Theorem, and the Fundamental Theorem of Algebra, first as topological consequences of conformality (by deriving the Argument Principle without integration), and then later revisited as corollaries of Cauchy’s Integral Formula. This approach, advocated in Tristan Needham’s *Visual Complex Analysis* textbook, was impossible in 2000, as there just was not enough time to do things the deep, geometric, conformal way. The extra 33% of contact time gives the professor many more options.

Required Courses for Major: The 2003 major consists of ten 4-unit courses. All majors must take Calculus I, Calculus II, Calculus III, Linear Algebra, and Formal Methods; plus 5 upper-division courses, which must include one classical and one applied course. We also created an *Honors Major* which requires 3 more upper-division courses, one of which must be 400-level; plus a year of calculus-based physics.

The 2003 major, in some ways, is a move back towards the old (pre-1994) major, in that now all mathematics majors are required, once again, to take 12 units of calculus. There is some worry, however, that the reduced number of courses (10 versus 12) may harm students, depriving them of mathematical breadth, even while giving them somewhat more depth (40 units versus 36 units). The 2003 major is still too new to evaluate; it will take another few years before we graduate students who took all of their math courses with the 4-unit norm.

The college-wide conversion from 3- to 4-unit courses has also had an unintended negative consequence for our department: a decline in Mathematics Student-Credit Hours (SCHs). The cause is the replacement, by some departments, of their requirement of two 3-unit math courses under the old scheme with a single 4-unit math course, rather than two 4-unit courses. For example, business majors used to take Statistical Reasoning and Quantitative Methods in Business, a total of 6 units, but the new requirement is a single 4-unit broader Quantitative

Methods in Business course that now includes some statistics. Chemistry replaced two semesters of calculus (6 units) with one 4-unit semester.

These changes, while regrettable, are easy to understand. A typical student now takes just 32 courses while at USF (128 units required for graduation, divided by 4 units per course), in contrast to the 43 or so courses taken previously. With a dozen fewer courses taken, something has to give, especially in the larger and more complex majors. When faced with the choice of replacing 6 units with either 8 or 4, it is tempting to choose the latter, especially since this frees up a course, and under the new scheme, individual courses are far more precious than they once were.

The net result: hundreds fewer students take statistics, and significantly fewer take Calculus.¹

2.3.3 The New Core Curriculum

At roughly the same time as the 3-to-4-unit conversion, the university overhauled its General Education Curriculum (GEC), replacing it with a distributional, learning-outcomes-based Core Curriculum. As one would expect, this was a complex and controversial change, and like the 2003 major, it is too early to tell just how these changes will play out. But there are a number of significant aspects of the new Core that have great potential to impact our department.

- The Core is much smaller than the GEC. A typical math major only needs to take 40 units of core courses, compared with a minimum of 50 under the GEC. This frees up the schedule, making it easier for ambitious students to do the new Honors Major, or to double-major in Physics or Computer Science (everyone needs to take a semester of science under the Core). This may significantly offset the danger of reduced breadth alluded to above, since it is now relatively easy for most math majors to take more than the 10 courses required.
- Under the GEC, almost all undergraduates had to take Statistical Reasoning (math 103 for science and business majors, math 101 for others). Under the new Core, non-math majors must take a course with specified mathematical learning outcomes which has been officially approved for the Core.

¹It is not easy to compare 4-unit courses with 3-unit courses, but no matter how one does the computation, Calculus I and II enrollment has dropped at least 20 percent since we converted to the 4-unit plan. Some of this may be caused by a recent sharp decline in Computer Science majors.

Examples of these are Statistics and Calculus. The provost makes the final decision for each proposed Core course, following the learning outcome guidelines and the advice of the various area committees (the one for math and science has 9 people: the chairs of math and each science department, plus representatives from nursing and business). Under this new system, it is possible to propose many possible alternatives to Statistical Reasoning for Core math credit, *not all of them taught by the Mathematics Department*. For example, both Sports Science and Physics have courses which any student can take for Core math credit.

This will most likely exacerbate the decline in math SCHs described earlier. Indeed, math SCHs declined 14% from 2001–02 to 2002–03, mostly attributable to the sharp decline in statistics enrollment. It is still too early to tell if this trend will continue, or reverse.²

- The Mathematics Department can no longer count on Statistical Reasoning as a guaranteed source of SCHs, but it now has an opportunity to revitalize its lower-division offerings to compete for Core credits. John Stillwell, who often teaches an upper-division History of Mathematics course, is interested in developing a Core version of this course which will be suitable for non-majors. Benjamin Wells has taught a freshman seminar on Mathematics and Esthetics which has received Core credit in the past, and most likely will continue to do so in the future. Also, now Humanities majors with mathematical leanings can get core credit for Calculus, for example. We have also developed a new Biostatistics course, required of all Biology majors, which debuts in Spring 2004.

2.3.4 Service Courses

At most 10% of our SCHs come from upper-division courses, and about 20% come from Calculus and Linear Algebra. Since only about 1 in 5 Calculus and Linear Algebra students are math majors, this means that roughly 85% of our SCHs come from serving non-majors. Here is a brief overview of the most important service courses offered during the past ten years.

²The Spring 2003 and Spring 2002 SCHs are virtually identical, as is the case with Fall 2003 and Fall 2002. This probably indicates that the downward trend is not continuing.

Statistics Ten years ago, Statistical Reasoning was required of virtually all students. For example, we taught 25 sections in 1998-99. We now teach about half as many sections of Elementary Statistics and Biostatistics. This has greatly reduced our reliance on part-time faculty.

Quantitative Methods in Business This course is our most important single service course, required of all Business majors. It features an innovative Excel-intensive approach, and uses the textbook by Lehmann and Zeitz, *Quantitative Methods in Business: A Conceptual, Excel-Based Approach*, to be published by Wiley.

Calculus and Linear Algebra The nature of the enrollment in the calculus sequence has changed considerably over the years. At one time Calculus I, Math 109, was the entry level mathematics course for all majors in the College of Science and, further, every science major except those in biology was required to take 12 units of calculus. Now, only Math and Physics retain the 12-unit calculus requirement. In addition, many science majors and especially the strongest ones now arrive at USF with credit for at least Calculus I awarded as a result of high school advanced placement or work done at other universities or colleges. The most obvious effect of these changes has been an erosion of the enrollment in the calculus sequence and the loss of what was once a prime recruiting ground for majors and minors.

Computer Science Service Courses The Math Department is quite dependent on CS enrollments, since all CS majors take some calculus and discrete math. During the past ten years, the CS department gradually reduced math requirements, dropping Probability (Math 370), for example. The situation appears to have stabilized in the past year, with a new 12-unit math requirement of Calculus I, Discrete Math, and a new course which combines Linear Algebra and Probability (Math 202). Recently, CS enrollments have declined sharply, which of course adversely affects Mathematics.

2.4 The Math Majors

We failed to achieve our ambitious goal of tripling the number of math majors, but we did make significant progress.

2.4.1 Profile of Math Majors, 1994–2003

Between 1994 and 2003, seventy-five math majors graduated from USF. The “average” major was a female with a math SAT score of 660³ and a math GPA of 3.15. The average “quality” of the majors, at least measured by SAT, hasn’t changed in any significant way: each graduating class has had a median SAT very close to 660, usually with a handful of students scoring above 700. The most recent graduating class (Spring 2003) was the largest in quite a while, with 14 students granted a degree in mathematics.⁴ This class was also one of strongest in years, with half of the students scoring 700 or above on the math SAT.

The quality of the majors at the top end has consistently been good. In four of the last six years, the winner of the Dean’s Medal for Excellence in Sciences has been a Mathematics major (often double-majoring in Physics). A number of our top students have gone to good graduate schools in math and physics, such as U.C. Davis, U.C. San Diego, Cornell, Northwestern, and Harvard. We now regularly have several students placing in the top third or even top fourth nationwide, on the Putnam Exam. In 2000, our team ranked 63rd in the nation, out of 400 universities, our best performance in recent memory, and in 2002, one student scored 40 points, perhaps the best showing of any USF student since Leo Harrington went here.

2.4.2 Attracting Majors

There are several ways to measure how well or poorly we attract majors. One is to actually count the number of declared math majors. This measures something, but it may overestimate the size of the major due to students who later drop out of the major. On the other hand, counting the number of students who graduate with a math degree (counting double majors as well) may underestimate, since some students may study a lot of math intensively, but then later fail to graduate with a math degree, for a variety of reasons. Consequently, we have chosen three different measures of our effectiveness in reaching the “non-service” student: majors and minors, graduates, and upper-division SCHs.

Figure 1 shows a very positive, relatively recent trend: steady growth in the number of majors, minors, and math degrees granted since a low in 1997. An analysis of SCHs also validates this: In Figure 2, we again see a rising trend since

³About one-third of the students did not take the SAT.

⁴It is quite hard to get accurate data, since many of our majors also double-major with another subject, and sometimes double-major students are not crosslisted.

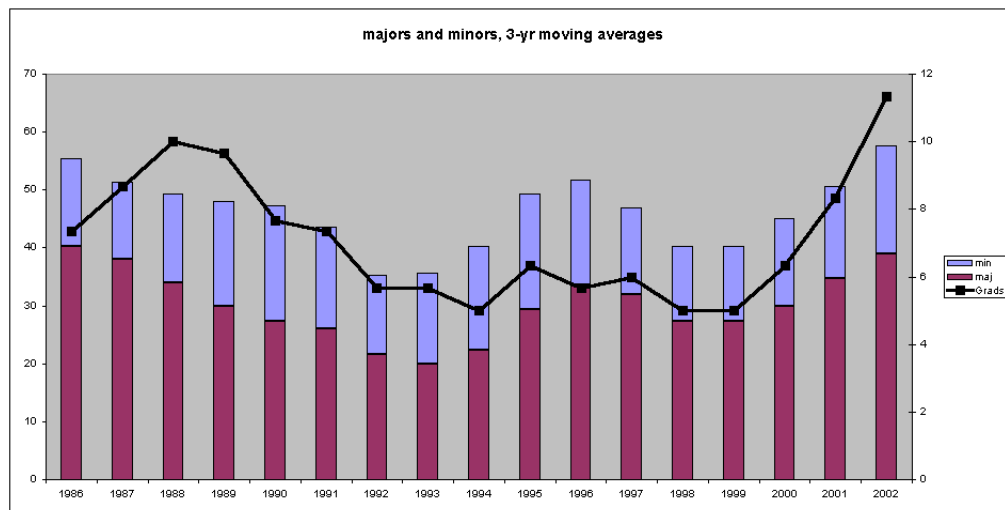


Figure 1: Math majors and minors [left scale] and graduates [right scale], 1984–2002 (3-year moving average).

1997.⁵

These recent improvements are heartening, but many questions remain. It is not clear whether the rise in majors, which is modest, yet significant, is caused by the *department's* actions. We

- Changed our curriculum (twice!).
- Actively tried to recruit students by telephoning admitted students.
- Held yearly math contests on campus (Bay Area Math Meet) since 1994.
- Used our best faculty to teach courses with potential for new majors such as Calculus.
- Continued to enhance the social aspects of the major with weekly Math Teas.

All of this has helped, but it is hard to judge what has helped the most, and what else we can do. At the very least, we are happy that the size of the major has increased, bucking national trends.

⁵The dramatic decline in SCHs in the late 1980s was caused by changes in CS requirements.

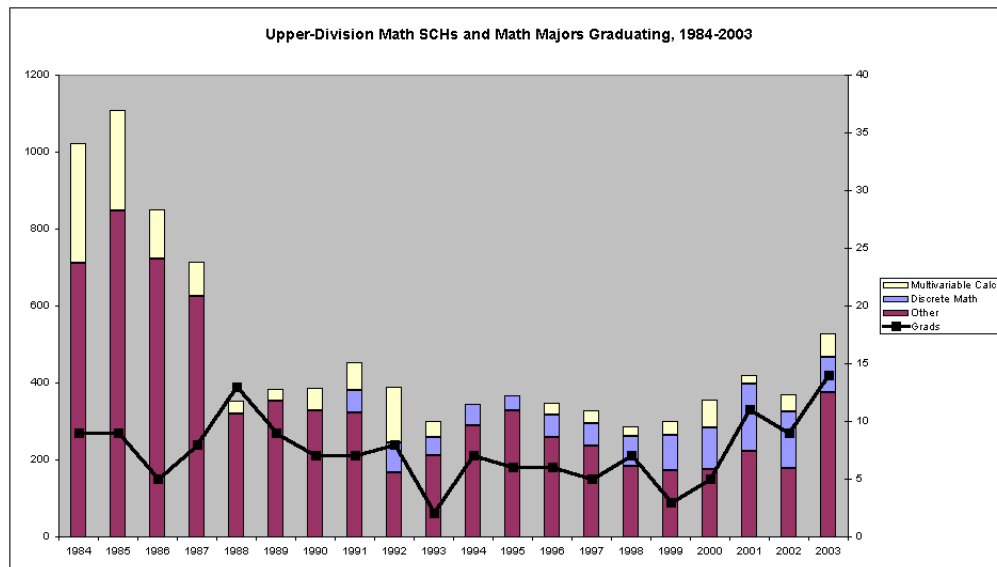


Figure 2: Upper-Division Math SCHs [left scale] and graduates [right scale], 1984–2003.

2.5 The Role of Technology

2.5.1 Introduction

In this section, we discuss the role of information technology in the mathematics department. Our main focus is the use of technology in teaching. However, we also briefly discuss how some of the faculty use it in research and service.

In the teaching subsection, we refer to two different types of access to technology in the classroom: “cart PCs” and “smart” classrooms. Some of the University’s classrooms are specifically equipped to make it relatively straightforward for the faculty to use technology in the classroom. (See http://www.usfca.edu/its/faculty_services.html.) These classrooms have been dubbed “smart.” They provide built-in projectors, projection screens, and speakers. They also have VCRs, DVD players, and PCs. The video output of each of these devices can be routed to the projector. Additionally, the classrooms provide cabling so that instructor laptops can be connected to the projector.

If an instructor wants to use technology in the classroom, and his class has not been assigned to a smart classroom, he can ask the University's Instructional Media department to deliver a cart PC. This consists of a PC and projector mounted on a wood and metal cart. In principle, the University's Instructional Media Department wheels the carts in and sets up the computer, projector and a screen prior to the start of class.

Before proceeding to a detailed discussion of the use of technology in individual classes and in individual professors' research and service, we summarize the main problems the department has with information technology.

2.5.2 Technology Issues

- Perhaps the most significant problem is the department's lack of access to smart classrooms. Instructors who need to use technology in classrooms but aren't scheduled in smart classrooms must either ask for delivery of a substandard cart PC, or else prepare overheads. The former option entails numerous disturbances to the smooth running of the class (see above), and the latter prevents the instructor from showing students how to make interactive use of software in solving problems addressed in the classroom.

Even when the cart PC is delivered on-time and correctly set up, the carts must be set up in the middle of the front of the classroom. Since the carts and accompanying hardware are bulky, this obstructs the vision of a number of the students. The power and ethernet cables are plugged into an outlet in the center of the front wall of the classroom, creating a hazard for anyone walking across the front of the room. Finally, the projectors aren't very bright, and, as a consequence, all the curtains must be drawn before using them, and lights need to be switched off and on every time the instructor switches from using the computer to using the blackboard.

There are currently 73 general-purpose classrooms on campus. Of these 13 are smart. The mathematics department normally teaches its classes in Cowell and Harney, which have 16 general-purpose classrooms of which 6 are smart. The mathematics department typically has access to only one of these rooms (Harney 512), and access to this one room has been severely restricted this year. A brief examination of the schedules of classes for 2003–2004 shows that only three of its classes were scheduled in this room in the fall, and only five in the spring. Some 16 sections in the fall and 14

sections in the spring make extensive and routine use of technology in the classroom. Clearly, the department needs improved access to smart rooms.

This situation appears to be changing; there are plans to upgrade 10 new classrooms in the Lone Mountain building. The crucial question will be one of access (other departments will compete for them) and convenience (Lone Mountain is far from Harney). There are also several smart classrooms in Cowell, which is nearer to Harney. In order to make these rooms more accessible to Mathematics, we will need to install software. The dean's office has agreed in principle to help with this. Further negotiation is needed.

- An additional problem is the lack of access to computer laboratories for lower division service courses, such as elementary statistics and quantitative methods for business. Both of these classes are scheduled to meet in computer laboratories several times each semester. However, the available labs are often too small to provide a computer for each student. The University should either build labs large enough to accommodate these classes or provide laptops for distribution to students in regular class meetings.
- Published lab manuals for calculus courses are generally useless. So the faculty must devote huge amounts of time to the preparation of labs (see the appendices).
- There is no guaranteed free access to the University network from off-campus. So most faculty spend large sums of money paying for ISPs or waste large amounts of time trying to access the University's public dialup facilities. An alternative used to be provided by the mathematics and computer science departmental servers, which provided dialup access to faculty. However, there has been only erratic support for these dialups for several years now, and it seems likely that funding for staff to maintain them will not be forthcoming.
- While the smart classrooms are much superior to the cart PCs, they are not problem free. Perhaps the most obvious problem is the lack of easily adjustable lighting.
- Another issue reported by one of the faculty is the lack of easy access to CD and DVD burners.

- Access to software can be a problem. The courses for math majors that make use of technology in the classroom typically use Mathematica. However, Mathematica is not installed on the cart PCs, and Harney 512 is the only smart classroom in which it has been installed.

2.5.3 Teaching

Several instructors use email to discuss problems with students outside of class and office hours, and some instructors also set up class websites for posting announcements of exams, homework, etc., some using software such as Blackboard. In addition to these general applications, many of our courses use computers in specific ways, as outlined below.

- 0206 101. Elementary Statistics (4). Near the beginning of the semester, the instructor takes the class to a Cowell lab once a week for 4-5 weeks to teach them how to use Excel in the context of statistics. For the rest of the semester the the students are occasionally assigned homework problems that require the use of Excel.

The Cowell labs only have 20 computers and the enrollments often exceed 30 students in individual sections. For example, there are 37 students in Brunelle's section in Fall 2003. Thus it would be extremely beneficial to have bigger labs. It would also be very useful to have statistics classes meeting in a smart classroom so that that the instructors can use Excel during regular class meetings. This would obviate the need for overheads, but, more importantly, it would allow instructors to demonstrate the use of Excel as an effective interactive tool for studying problems in statistics.

- 0206 102. Biostatistics (4). This newly-created course will require a small amount of computer use (less than that in Math 101), with Excel.
- 0206 104. Algebra for Business and Science (2). This course requires students to use Excel.
- 0206 106. Quantitative Methods in Business (4). This class is also Excel-based. The instructors use it to demonstrate concepts in most class meetings, and students are frequently assigned homework requiring its use. Roughly six class meetings are scheduled in computer labs. During these sessions, students get directly supervised instruction in the use of Excel.

These classes would also benefit greatly from guaranteed access to smart classrooms and larger computer labs.

- 0206 109–110. Calculus and Analytic Geometry I–II (both 4). Students enrolled in 109 or 110 must also enroll in a lab section that meets once a week for two hours. The lab sections meet in Harney 530 and enrollments are capped at 15 students per lab section, which is the number of PCs in the Harney 530 lab. The lab section instructors are advanced undergraduate math majors.

These labs are usually used to provide students with hands-on instruction in the use of Mathematica for solving problems similar to those being currently studied in class.

There is no guarantee that the lecture sections will be scheduled in a smart classroom. So there is often a lack of consistency between the class and the lab, since in the lecture section, the instructor must solve problems using hand calculation.

- 0206 130. Elementary Linear Algebra (4). There is no official technology component to this class. However, one instructor has his students use a program that carries out Gauss-Jordan elimination, finds matrix inverses, and finds elementary factors of square matrices. This software is mainly used to help students check their calculations.
- 0206 195. Freshman Seminar (4). In fall 2003, Professor Wells ran a freshman seminar in mathematics and esthetics. In this class, he showed prerecorded programming, and he used Powerpoint slides, Macintosh applications, and internet content.

Although the class was offered in a smart classroom, there were technical difficulties. The room and console lighting was somewhat problematic, although it does seem to have been better than other smart classrooms. Another issue was lack of access to facilities for burning CDs and DVDs.

- 0206 201–202. Discrete Mathematics (4), and Linear Algebra and Probability (4). These are service courses for the computer science department, and although there is no official technology component, instructors often make use of computers for illustrating concepts. For example, some instructors

illustrate the tremendous difference in performance of algorithms by running small programs in class — e.g., comparing bubble sort and heap sort. Computer programs are also used to illustrate the importance of probability to computer science. For example, some instructors demonstrate the difference between average and worst-case performance of insertion into various types of hash tables. Other important examples illustrate the importance of statistics by studying the variability in network and disk I/O bandwidth.

Although the use of technology in this class isn't as great as it is in some other classes (e.g., calculus I and II), it would still benefit greatly from guaranteed assignment to a smart classroom.

- 0206 211. Calculus and Analytic Geometry III (4). There are no separate lab sections for this class. However, students are expected to be familiar with Mathematica, and instructors assign some homework problems and group projects that require the use of Mathematica.

This class would benefit greatly from guaranteed assignment to a smart classroom, since hand-sketches of many of the concepts requires a great deal of time and skill.

- 0206 300. Introduction to Formal Methods (4). One instructor used Powerpoint running on a cart PC.
- 0206 340. Differential Equations (4). In the past, this course has used Mathematica quite extensively, far more so than Complex Analysis (see below).
- 0206 355. Complex Analysis (4). Students used Mathematica, on their own, in the 5th floor labs. Mathematica is not installed on the wheel-in machines, and it has proved difficult to connect laptops to the wheel-in monitors. A Mathematica-equipped wheel-in computer or a smart classroom would have greatly helped with this class.
- 0206 367. Number Theory (4). This course has occasionally used Mathematica.
- 0206 394. Applied Mathematics Research Laboratory (4). This course typically requires that students work in teams developing a large piece of mathematical software. Past projects have included development of parallel

software for the solution of differential equations, speech recognition, circuit simulation, and simulated annealing.

- 0206 485. Topology (4). The principle use of technology in this course has been for online publication of the instructor’s lecture notes on point-set topology. Some use has also been made of Mathematica for the illustration of immersions of non-orientable surfaces in space.

The instructor used computer software in class. The software was run on a cart PC and because of the small size of the classroom, there were no difficulties.

2.5.4 Research

- Professor Cruse has a network of dual- and quad-processor computers set up at home which he used during his sabbatical leave in calendar year 2002 to explore a cutting-plane approach in integer linear programming to several questions concerning the existence of combinatorial designs. After 512 hours of continuous computation (i.e., 21.3 days) during July 2000, he succeeded in finding a “new” Ramsay-Number: $R(4, 5) = 25$. However, in mid-August while re-checking this finding he learned that this number, which had been an unsolved question for thirty years, had already just been found by another researcher. (The good news is that this validated his approach.) He also used the computers to assist him in understanding some mathematical issues involving RSA public-key cryptography and Fermat’s Little Theorem which arose during a course he took at UC-Santa Cruz Extension on wireless network security.
- Professor Pacheco’s research is in parallel scientific computing. He has made extensive use of parallel computers at remote sites as well as local use of a 32-processor nCube, and, more recently, the University’s 128-processor Keck Cluster. In most of his research he has involved mathematics and computer science majors as developers of parallel software.
- Professor Wells has several current research projects involving Computer Science graduate students. Two of these are related to mathematics. The first is a classroom demonstrator written in Java for a complete portion of the lambda calculus involving only beta-reduction. The second is an implementation of his observation that a universal Turing machine could

have been run on a clustering of the ten Colossus machines functioning in Bletchley Park at the end of World War II. This implementation will use the Colossus simulator being written in Java by another team of his students.

He also uses computers in generating mathematical art that he has shown in local and international art exhibitions.

2.5.5 Service

- All of the faculty make extensive use of technology in routine service matters, e.g., email discussion and preparation of documents.
- Professor Cruse was contacted by Professor Kim Summerhays of the Chemistry and Computer Science Departments for advice on a scheme for implementing software copy-protection, based on using the unique serial number built into Intel Pentium-III processors. Besides writing some programs to demonstrate accessing these serial-numbers on dual-processor and quad-processor workstations, he used the technology of internet search engines to locate about a dozen articles documenting the technological and geo-political hazards of adopting the proposed scheme, which Intel no longer supports (after emphatic protests from China, the publication of some security-flaws by a journal author in Germany, and disclosure of some allegations, denied by Intel, that its serial-number technology was created at the instigation of federal police agencies).

3 Self-Assessment Summary

In 2003, we used the same self-assessment questions from 1993. Both surveys had serious flaws. In 1993, only 6 faculty and 7 current students responded, although 112 alumni responded. In 2003, we had 7 faculty responses (out of 10), 12 students (out of 35), and only 10 alumni (out of 35). The small numbers of students in both surveys and the small number of alumni in the 2003 survey make the results hard to interpret. It is quite possible that the samples are biased, for example.

Consequently, we will compare the two surveys in a very brief way. Table 1 summarizes the main points, using the scale poor (1), fair (2), good (3), excellent (4). Most of the categories used are self-explanatory, and the more obscure are explained with notes. For fuller explanations of the questions asked, see section 6

(pp. 13–17) of SS93. We will also include a copy of the 2004 survey results with this document.

The main point is that very little seems to have changed in ten years. In 1993, faculty and current students had mostly positive opinions about the department, but alumni were significantly less positive. The only important exceptions to this generally positive attitude were low opinions of departmental career assistance for students and graduates, and very low opinion of physical resources (e.g., offices) for faculty. A decade later, faculty responses showed little change, student responses were slightly less positive and alumni responses were noticeably more positive. Of course, the samples are tiny.

When compared with the many other institutions that have conducted similar surveys, our department scores better in most categories. It may be most useful to dwell on those categories for which USF seems to lag behind other schools. Faculty research and professional activity appears to have declined during the decade, dropping to below-average percentages from average-to-above-average percentages in 1993. And there has been no change since 1993 in the faculty's extremely negative opinion of the quality of space and other facilities for classes and administration: this number stayed at the very low 1.5 level. It is instructive to note that the "global" pool of 2,482 faculty averaged a 2.8 response for this category. Indeed, 48% of these faculty ranked their space as "good", with 18% ranking their space as "excellent." In contrast, only 14% of our faculty (i.e., one person) gave a "good" ranking, with 57% giving a poor ranking, 29% a fair ranking, and no one ranking the space as excellent.

The relatively low research and professional activity is probably not a good thing, but this survey uses a rather crude yardstick for measuring such performance: it does not, for example, weight award-winning books or articles. It is also hard to tell if the faculty as a whole is underperforming, or some faculty members are overperforming and others are inactive. And also, the survey results seem to contradict the anecdotal impression that the faculty has improved in performance and recognition during the last ten years.

On the other hand, the extremely low scores for quality of space mean only one thing: our department has long suffered from unusually substandard office space, and this situation has not changed at all since 1993.

Table 1: Self-Assessment Surveys, 1993 and 2003

	1993			2003		
	Fac	Stu	Alum	Fac	Stu	Alum
Environment for Learning	3.5	3.5	3.0	3.5	3.3	3.2
Scholarly Excellence	3.2	3.6	3.0	3.3	3.4	3.4
Quality of Teaching	3.3	3.6	2.8	3.2	3.2	3.5
Faculty Concern for Students	3.2	3.6	2.8	3.6	3.3	3.6
Curriculum	2.6	3.0	2.5	2.6	2.9	2.9
Departmental Procedures ^a	2.8	3.2	2.3	2.9	3.2	2.9
Available Resources ^b	2.7	3.4	2.5	2.6	2.9	3.2
Student Satisfaction with Program		3.9	3.0		3.4	3.4
Resource Accessibility ^c		3.0			3.0	
Employment Assistance			1.9			2.4
Faculty Work Environment	3.4			3.3		
Faculty Research Activities ^d	43%			26%		
Faculty Professional Activities ^e	23%			17%		
Student Accomplishments ^f	30%			31%		

a How well the dept handles advising, etc.

b Library holdings, financial resources, etc.

c Availability of counseling, financial aid, etc., as well as social/intellectual opportunities within the dept

d Fraction of faculty getting grants, publishing, refereeing, editing, etc.

e Fraction of faculty serving on regional or national committees, etc.

f Fraction of students attending meetings, getting scholarships, etc.

4 Preliminary Development Plan

Ten years ago, our department felt a great need for change, and the years thereafter have seen lots of change, much of it positive. The consensus opinion of the department at this time is that we are in less need of change—indeed, we are rather tired, at this point, of curricular changes—and that the department is doing well overall, with good prospects for the future. But there are several obvious issues that need addressing, all interconnected.

4.1 Continue to Increase the Number of Majors and Minors

We have had moderate success in increasing the size of the major, but we have no confidence that we can maintain or extend the recent positive trends. We still need more vigorous efforts to recruit students and enhance the attractiveness of the major. The curricular changes of the past years have helped, but only modestly.

4.2 Increase Faculty “Youthfulness”

In February 2004, we appointed Stephen Devlin (see p. 7), to replace the retiring Millianne Lehmann. Devlin, our choice among 328 candidates, will begin work at USF in August 2004. His youth and energy will greatly increase our mathematical vitality, but we will remain a rather “old” department, in both the biological as well as career sense. It seems more likely than not that we will not have funding to keep René Brunelle beyond the next academic year. Certainly we will benefit, with a net gain of one recent Ph.D., but we will still have a somewhat unbalanced department, with all but one untenured member. Moreover, all faculty members will be male besides Brunelle.

The department would greatly benefit from an increase in non-tenured (but not adjunct) faculty. This can be accomplished in three ways: replacing retiring faculty with tenure-track faculty who are recent Ph.D.s, retaining or extending term faculty appointments, or increasing the size of our major to justify new hires.

4.3 Improve Departmental Space

Faculty office space is abysmal. These conditions are not new; indeed, no changes have occurred since our last program review, although two faculty members have

improved their personal office space (Pacheco, by moving to the better offices for Computer Science faculty on the 5th floor of Harney Science Center, and Needham, who became Associate Dean of Sciences, and who will most likely occupy Lehmann's relatively nice office when he returns to the Department next year). The poor offices do not help morale, and the fact that office quality is quite unevenly distributed among the faculty (due to seniority, mostly, but with wide variations among departments) doesn't help.

Classroom space is adequate, but we are badly in need of more smart classrooms. There seems to be good momentum for this, but the situation still needs improvement.

Besides low office quality, there is no good social space for students to gather. Our Math Teas are pleasant gatherings, but very crowded. Even a slightly better space would vastly enhance the quality of life for our majors, and arguably would help with recruiting new majors.

The only long-term solution to these problems requires extensive renovation or new construction. Needham, in particular, has worked tirelessly to get various plans approved (and funded) for expanding and improving the Harney Science Center building. The future looks guardedly bright at this time, but realistically, it will be several years, at the very least, before the situation improves.

4.4 Summary

The three issues outlined above are deeply interconnected. Improving the physical resources of our department will help to increase the number of majors, and to increase our vitality as a faculty. This in turn may lead to enough growth to justify new faculty. When recruiting new faculty (as we are now), we have lots to offer: a very friendly and smart faculty that is fully and successfully engaged in its teaching mission, and improving in its research productivity and outside reputation. The 2-2-2-3 teaching load helps to attract good new faculty prospects. Our intelligent and accomplished students, with strong social ties to the faculty and each other, are another plus. And our warm relationship with the College administration is a crucial ingredient for our success and attractiveness.

Indeed, we have a lot to offer, but, as outlined above, there is much room for improvement as well.