



Date: 20 July 2010.
To: Raymond Coward, Executive Vice-President and Provost
Laurens Smith, Vice Provost
James MacMahon, Dean, College of Science
From: Richard Cutler, Head, Department of Mathematics and Statistics
Subject: Department of Mathematics and Statistics response to Regents' Review.

A Regents' Review of the Department of Mathematics and Statistics was conducted in spring semester 2010. The review team comprised Dr. Peter Olver, Professor of Mathematics and Head of the School of Mathematics at the University of Minnesota, who served as chair; Dr. George McCabe, Professor of Statistics and Associate Dean for Academic Affairs in the College of Science at Purdue University; and Dr. James Dorward, Professor of Education and Associate Dean for Research in the Emma Eccles Jones College of Education and Human Services at Utah State University. The Review Committee conducted a site visit on March 8 and 9, 2010, during which time they met with staff, undergraduate and graduate students, regional campus faculty (by IP video conference), and many faculty subgroups to discuss issues related to the Department. Prior to these meetings the Review Committee were provided with a self-study of the Department with appendices (A) priorities, goals and strategic planning, (B) general catalog pages including courses, (C) faculty CVs, (D) detailed staff duties and responsibilities, (E) course syllabi, and (F) the final report of the 2002 Regents Review of the Department. We would like to thank the Review Committee very much for the time and effort they put into the review process and for the many valuable suggestions and recommendations contained in their report. This document is a response to the Review Committee's comments and suggestions.

Overall Assessment. The Review Committee's overall assessment of the Department was very positive. From the general comments at the top of page 2: *"Our overall impression of the department was strongly positive, despite numerous challenges, budget constraints, and the recent loss of faculty. The department exhibits many strengths ..."* *"The department has a first rate faculty, with several achieving national and international prominence for their research contributions. Despite declining resources, the department remains in good shape ..."*

The Review Committee identified statistics and mathematics education for particular praise. From the appropriate sections on page 3 of their report: *"The Statistics Group has evolved into an under-appreciated gem of Utah State University, and one that deserves to be publicized as one of its notable strengths. USU is the only university in Utah, and indeed the Mountain Region, to offer a Ph.D. program in Statistics. Bachelors, Masters and Ph.D. statistics graduates are in high demand, and have no difficulty landing excellent jobs. The Statistics faculty is involved in many research projects and consulting with other university units, particularly in biological applications."*

and *“The Mathematics Education Program is a great success, and graduates of this program are in high demand by schools throughout Utah. Unlike many Mathematics Education departments, the students at USU are trained in rigorous, high level mathematics, and, as a result, are better prepared for teaching and research, as well as being able to pursue more advanced training in mathematics should they so desire. This accomplishment is the direct result of the Program being housed within the Department of Mathematics and Statistics, and the interactions that the faculty and students in education have with their colleagues in statistics and core mathematics. The department and the university need to further capitalize on the success of the Mathematics Education Program, using it as a means to publicize the strength of the university and its commitment to its Land Grant mission, as well as drawing national and international exposure.”*

Departmental Composition and Collegiality. As the Review Committee noted (second and third paragraphs on page 2), the Department of Mathematics and Statistics is an amalgam of three main groups—mathematics, statistics, and mathematics education—which, in other Universities, would be housed in separate departments and perhaps in different colleges. The Review Committee commented, *“Despite the potential for conflict and suspicion between these three groups, the Committee found an overwhelming degree of respect and collegiality among the faculty and throughout the department. Each recognizes the importance of all three to fulfilling the department's multiple, interconnected missions and ensuring its quality and health. Overall, the Committee found the morale and atmosphere in the department to be good to excellent.”*

On the subject of creating a separate Department of Statistics, the Review Committee stated, *“There was brief discussion as to whether forming a separate Statistics Department would be a good idea. Although strong arguments can be made for such an arrangement, the Committee believes that this is not in the best interests of the university, given the current uncertain budget climate, and therefore, did not consider this issue in detail.”*

We agree with the Review Committee’s assessment. Most long-term members of the Department of Mathematics and Statistics would say that collegiality in the Department is very high at this time compared to the situation in the past. Although there are indeed advantages to having separate departments housing the different groups in the Department of Mathematics and Statistics there are also advantages in being a single Department. Having many faculty in related areas in the same department facilitates—indeed, encourages—interesting collaborative research, and that is exactly what has occurred within the Department in recent years. There is no internal pressure at this time to split the Department of Mathematics and Statistics into smaller units.

Space Issues. The Review Committee noted that faculty were concerned with the proposed move of the Department to the new *Agricultural Sciences Building* (Executive Summary, page 1; General Comments, page 2; Space, page 8), that would result in a significant loss of space to the Department. Shortly after the Committee’s site visit, the *Animal Science* building, which is situated on the quad, was identified as an alternative future home for the Department. Although old and in need of renovation, this building has plenty of space for the Department as it is now

and to accommodate future expansion of the Department. The *Animal Science* building also has several areas that could be used as seminar rooms or as a common room for faculty, something that *Lund Hall* lacks. At a faculty meeting on April 8, 2010 those in attendance voted unanimously in favor of moving to *Animal Science* when it becomes necessary to vacate *Lund Hall*. The Department would like to thank Provost Coward and Dean MacMahon for presenting *Animal Science* as an alternative and for their ongoing efforts to secure funding to renovate *Animal Science*.

Faculty Hiring. Without a doubt the biggest problem facing the Department of Mathematics and Statistics is the loss of faculty positions, dating back to 2003—2006. It has affected the Department's ability to fulfill its mission in many ways, including the range and frequency of advanced and introductory courses that can be delivered, the graduate student advising capacity of the Department, and the ability of the Department to innovate and to reduce teaching loads of the most productive researchers. Further, there are five faculty in the Department aged 66 or older, so in the immediate future the situation may get worse rather than better and it is imperative that hiring new faculty begin as soon as possible.

The Review Committee had a lot to say on this issue, particularly as it pertained to the core mathematics group, and had several suggestions regarding hiring to rebuild the Department. Briefly, the Review Committee's points were:

- The Department has suffered the loss of many top faculty in since the last Regents' Review, and retaining those that are left is a priority but also a "*serious challenge*" (page 2 of the report).
- The Department needs an infusion of University resources to adequately fulfill its mission, which involves an enormous amount of service teaching for other units. From page 7 of the committee's report, "*Basic skills in mathematics at an elementary and advanced level are needed for a very large number of the USU undergraduates. The continuing increase in section sizes, and consequent degradation of individual attention and instruction, coupled with increase in faculty workloads, threaten the ability of the department to meet these needs. Given the recent losses to the department, additional resources are needed for the department to fulfill the role expected of it by the university,*" and from page 4, "*The Committee notes that several departments (engineering, computer science, etc.) have received new positions in recent years, but the mathematics department has not, despite the increase in teaching loads resulting from increased enrollments in these departments.*"
- The impact on core mathematics has been disproportionately high, so much so that the viability of the group in research and graduate education is in question. From page 4 of the Committee's report: "*... in most universities, the core group would constitute the entire mathematics department. If one compares the number of faculty in core mathematics at USU with the mathematics departments at peer institutions, the disparities and the danger of losing a viable mathematics program is starkly underscored.*"

The review committee recommends:

- The commitment of resources to rebuild core mathematics while maintaining and building on existing strengths in statistics and mathematics education (page 4, first paragraph).
- That the hiring in core mathematics should be focused and strategic rather than broad based. Again, from the Committee's report (page 4): "*Rather than hiring across all disciplines of mathematics, the department should focus on a few signature areas in which to build a critical mass in areas recognized for their excellence. The particular strength of the differential geometry group, with its high international research profile and consistent external funding, and its evident connections to differential equations, analysis, topology, and computer algebra, would be an ideal starting center for this rebuilding effort.*"
- Hiring a probabilist to be a bridge between statistics and core mathematics (page 3).
- That the Department *not* build in applied and industrial mathematics at this time, but to maintain a presence and support current faculty in this area, and to identify targeted opportunities to enhance the program (page 4).
- The Department add a fourth lecturer (page 5).
- A small increase in the number of regional campus faculty (page 5).

We thank the Review Committee for their comments and suggestions, and we agree on all counts. With respect to hiring and research directions, the Department underwent an extensive strategic planning exercise in spring and summer of 2007, which was reprised in fall of 2008. Reports from the planning were included in Appendix A to the Department's self-study that was provided to the review team. At the time the Department identified four research focus areas: statistics, mathematics education, core mathematics, and interdisciplinary mathematics and statistics, particularly in the areas of quantitative biology and ecology. The Department also agreed that the rebuilding of core mathematics should be focused so as to create a small number of areas of excellence, and suggested that the existing group in differential geometry would be an ideal choice to build on initially because of the international reputations of group members, their consistent success in obtaining external funding, and because this area intersects many other areas in core mathematics. The strategic planning committee recommended hiring in applied probability in support of interdisciplinary mathematics and statistics; we thank the review committee for the idea of using probability to link statistics and core mathematics.

The rebuilding of core mathematics has already begun. The last two Departmental hires, Dr. Nghiem Nguyen and Dr. Nathan Geer, were in this broad area. At this time the Department has one vacant position from a (core mathematics) faculty member who passed away in March. Another, junior faculty member (in statistics) will be leaving in August 2010, and a junior faculty member in applied mathematics is serving a terminal year in 2010—2011. If the Department is able to fill all three positions with searches beginning this fall, it is the Department Head's recommendation that one position go to core mathematics, one to statistics to replace the

departing faculty member, and one hire be made in probability. If a fourth, new position is available, the Department Head's recommendation is that it be in mathematical biology/ecology, building on USU's strength in biology and ecology. This last recommendation is consistent with the Review Committee's comments concerning applied and industrial mathematics.

The Department has recently moved several lower division classes into large lecture format, a change necessitated by the recent budget cuts. With the departure of Dr. Eric Rowley to the regional campus system, the Department has a shortage of persons capable of consistently and effectively teaching large lecture courses. When tenure track faculty are drafted into this role, it inevitably impacts their time for research. Therefore, it is a high priority of the Department to hire *at least* one additional lecturer in the near future, as College resources permit. Four of the seven courses taught in large lecture format are statistics courses and we would like a new lecturer to be able to teach these courses.

The move of Dr. Eric Rowley to the Blanding regional campus of USU has provided some extremely valuable leadership to the mathematics and statistics faculty in the Regional Campus and Distance Education network and has permitted the delivery of mathematics education degree programs statewide. Dr. Rowley is actively involved in state and federally secondary teacher training programs (SMART and UMEP) and is part of a team that is putting together a large proposal to enhance the mathematical knowledge and training in pedagogy in mathematics of elementary school teachers. Already there are signs that Dr. Rowley is close to capacity with these important and varied activities and we agree with the Review Committee that a modest increase in the number of regional campus faculty would permit the development of new initiatives, including the delivery of more majors to regional campus sites. In order to share the effort of program development and participation, we recommend that the next hire of a regional campus faculty member in mathematics and statistics be someone with a doctoral degree in the clinical track (Dr. Rowley is a Clinical Associate Professor; all other regional campus faculty are Lecturers), and that consideration be given to hiring someone with extensive preparation in statistics who can deliver 5000 level statistics courses in support of the Mathematics and Statistics Composite Teaching major, the Actuarial Science options of the mathematics and statistics majors, and other Departmental majors involving statistics.

Differential Teaching Loads. The Review Committee endorsed the Department's policy of differential teaching loads that depend on seniority and research activity. The current policy is for junior tenure track faculty to have reduced teaching loads throughout their pre-tenure period to facilitate research in general, and grant writing in particular, and a small number of the most successful research faculty have reduced teaching loads, also to encourage and facilitate the writing of proposals for research grants. At the other end of the spectrum, some senior faculty who are no longer have active research programs have taken on significant additional teaching assignments.

The extent to which teaching reductions have been applied to senior faculty—there are only three this year, plus the eight untenured faculty—has been severely limited by the shortage of faculty in the Department to cover classes and the loss of resources in budget cuts that could

be used to pay adjunct instructors to teach lower divisions courses. It should be noted that the current teaching assignment policy marks a significant departure from previous Departmental practice in which virtually all faculty taught four classes per year and the new policy is very much aimed at improving the Department's research and external funding profiles.

External Funding. The Review Committee indicated that external grant support in the Department is not quite where it should be (page 4). Indeed, while the Department of Mathematics and Statistics at USU compares favorably with the corresponding units in other western land grant institutions in terms of overall research (fourth out of nine institutions—page 25 of the self-study), it lags in terms of external grant support (seventh out of nine). Increasing external funding is a very high priority for the Department. All research faculty are strongly encouraged to apply for research and educational funding and, where appropriate, to participate in interdisciplinary research projects, preferably as PIs/Co-PIs/Co-investigators. The differential teaching load policy discussed above is one part of the package of incentives to faculty to pursue research grants, and merit raises are another. One important element in the effort to improve external funding is hiring very high quality new faculty researchers that are competitive for NSF and NIH grants, and another is retaining the promising young researchers already in the Department, some of whom have already experienced success in attracting external funding.

We would like to note that, historically, the research funding situation in the Department has been quite volatile. The current situation of only nine faculty being PIs or Co-PIs on externally funded grants is something of a low point, and is at least in part due to the loss of successful research faculty in the last eight years. Between 1996 and 2006, 18 faculty in the Department were PIs or Co-PIs/Co-Investigators on NSF or NIH grants. Nearly half of those faculty have left USU, including four associate professors that would have been research leaders in the Department had they stayed. The Department is very much in a “rebuilding” phase with regard to faculty research.

Graduate Student Issues. The Review Committee touched on a number of issues related to the graduate programs in the Department, including preparation of students for teaching, the preparation of students for the qualifying examinations, the availability of advanced courses, and distribution of advising responsibilities.

Most graduate students in the Department partially or fully supported financially throughout their degree programs by teaching assistantships that may involve grading and tutoring for advanced courses in mathematics and probability, teaching recitation sections of large lecture courses, and teaching entire sections of lower division courses that have many sections. The Department has always been active in preparing students for these assignments, and generally the graduate students have done very well: in 16 of the last 20 years the College of Science Graduate Student Instructor of the Year has been from the Department of Mathematics and Statistics, and several of those have also received the corresponding University award. For many years the Department has run a one-day workshop for all adjunct and graduate students immediately before fall semester and course supervisors visit each graduate student instructor's

class twice a semester. In response to student and faculty requests, the Department's teaching assistant workshop will extend over two days this year, the Wednesday and Friday of the week before classes begin. Ideally we would like to extend the workshop over a full week but that is not possible due to clashes with USU's international TA Workshop and College and Departmental retreats in the two weeks before classes begin. In the Departmental retreat this fall we will discuss some alternatives.

In the last paragraph on page 6 of their report, the Review Committee states, "*Concerns about inadequate preparation for the qualifying exams were expressed,*" and then later in the same paragraph, "*While graduate students in Statistics and Education are very strong, some concerns about the quality of students in the core mathematics Ph.D. program were expressed.*" We think these two issues are related, and the concern about the quality of graduate students in core mathematics extends to the M.S. program, although it should be noted that many of the students in both the core mathematics graduate programs are very good. The exam about which students have concerns about is the M.S. qualifying examination in analysis and advanced calculus. There is a sequence of courses that prepare students for this exam, Math 5210 and 5220 (*Introduction to Analysis I and II*), and the exam itself seems very similar to exams from 5, 10, 20 or more years ago. We have also noted some of the students that pass the exam on the second or third attempt subsequently struggle with the research requirements of the M.S. degree. There does not seem to be a simple or short solution to this problem. The Department would like to maintain viable graduate programs in core mathematics but until the core group is rebuilt and the Department becomes an attractive destination for graduate students in core mathematics, we will have trouble consistently recruiting the highest quality students in that area.

Graduate programs in mathematics and statistics contain a lot of coursework compared to graduate programs in other disciplines. Students in the M.S. programs in the Department generally do 27 credits of courses and 3 research credits. Students in the Ph.D. programs do 30 credits of courses and 30 credits of research. Due to shortages of faculty resources, the Department has been limited in what graduate courses can be offered. As the review committee notes, the Department has not been able to offer dedicated 7000 courses for several years and Ph.D. students that first complete an M.S. in the Department often run out of 6000 level courses that they can take. We agree with the review committee that advanced courses are an important part of a Ph.D. student's education and offering such courses is a high priority for the Department as faculty resources increase.

Nearly all faculty in the Department who are active in research are receptive to advising graduate students, but not all are equally attractive to the graduate students, and as a result there is a great imbalance in the graduate student advising loads among the faculty. This issue has been raised several times in the past. The Department's strategic planning committee from 2007 recommended that graduate student advising as well as research productivity and service assignments all be considered in determining teaching loads and we note that two of the three senior faculty that have teaching reductions are advising substantial numbers of graduate students.

Undergraduate Education. The Department's undergraduate programs have been consistently increasing in size and this summer the number of declared majors in the Department exceeded 250 for the first time. In terms of graduates, the Department compares favorably with comparable departments at other institutions in the state. For example, in 2007—2008 the Department had 47 graduating majors and the Department of Mathematics at the University of Utah had the same number of graduates. However, we recognize that there is considerable potential for further, *substantial* growth in the number of Departmental majors. The actuarial profession is always rated among the “best” jobs in the United States and some institutions nationwide produce many times the handful of Actuarial Science majors we produce each year. There remains a statewide and nationwide shortage of mathematics teachers, and virtually all graduates from the Department's education majors obtain jobs immediately upon graduation. Statistics (distinct from Actuarial Science) is generally a small major at most institutions that offer it, yet the demand for analysis in banking, business and industry is so large that graduating from this major guarantees a good job. We recognize that we have not been as effective as we might in communicating the value of majors in the Department and we are working on doing better at this task.

With regard to retention, in recent years, out of about 200 declared majors in the Department, 40 or more have been graduating each year, which compares well with other departments in the College. What we have observed—and this may be a source of confusion from the self-study—is that many students that initially declare mathematics as their major ultimately graduate from another major in the Department, such as Mathematics Education, Actuarial Science, Statistics, or the joint Mathematics and Statistics major.

From page 7 of the Review Committee's report: *“The committee recommends forming a Mathematics Club as a means of bringing math majors together and giving them opportunities to meet with faculty, visitors, and graduate students and to learn more about research opportunities, graduate education, and career choices in mathematics and statistics, both within and outside academia.”* We very much agree with all these comments. A few years ago the Mathematics and Statistics Club in the Department was very active under the guidance of Dr. David Brown. In the faculty retreat this year we will discuss how to resurrect the club in a sustainable way, perhaps with duties shared among several faculty members.

Staff Issues. On page 6 of its report, the Review Committee writes, *“The four staff members in the department are outstanding; their contributions are valued by all who depend on them,”* and *“In recognition of the superior role they are playing, guaranteeing the smooth operation of the department and fulfillment of its many missions, and to ensure their retention, the Committee recommends that merit pay, bonuses, and appropriate promotions be seriously considered.”* We agree very strongly with these comments and recognize how fortunate we are to have such outstanding support. This fall, the three senior positions occupied by Cindy Moulton, Linda Skabelund and Nancy Smart will be re-evaluated by USU's Human Resources department, hopefully leading to some promotions. (The fourth staff member at the time of the review, Erika Perkins, has relocated to Idaho and we are in the process of hiring a new receptionist for the Department.)

Alumni Tracking and Creation of an External Advisory Board. The Review Committee urged the Department to institute a system of alumni tracking and engagement, and to establish an external advisory board (page 8). We agree with the Review Committee about the importance of maintaining contact with alumni and acknowledge that we have been remiss in our efforts to foster such contact. Information about many of our alumni is available in the College and this fall we will create a newsletter for alumni that will inform them of changes and achievements in the Department and to facilitate contacts among alumni and between alumni and the Department.

The Department's Regents' Review Committee from 2002 recommended the creation of an external advisory board but this recommendation was never acted upon or even discussed by the faculty. The Department has many graduates that have achieved success in business, industry, government, and both K—12 and higher education. The Department could definitely benefit from the collective wisdom of such individuals. The creation and composition of an external advisory board for the Department will be discussed at the faculty retreat in August.

A Vote of Thanks. The 2010 Regents' Review was a very positive experience for the Department of Mathematics and Statistics. We would like to thank those who facilitated it, including Dean MacMahon, Provost Coward and Vice Provost Smith. We would especially like to thank the Review Committee, Professors Dorward, McCabe, and Olver, for their time and hard work in conducting the review, and for giving us the benefit of their collective wisdom through the many recommendations and suggestions in their report, all of which are aimed at improving the Department and helping it to better achieve its mission.