## Department of Mathematical Sciences

**To**: Christa Slaton, Dean, Arts and Sciences
**From**: Joseph Lakey, Academic Department Head
**Date**: 30 November 2012
**Subject**: Department Summary

### Mission Statement

The Department of Mathematical Sciences provides core education in mathematics and statistics that prepares graduate and undergraduate students to be knowledgeable and responsible citizens of the world. It does this by conducting research, scholarship, and teaching, including teaching service courses for other programs, to fulfill the land grant mission of the university.

### Personnel Changes

The relative accomplishments of the department have to be put in the context of its recent personnel changes. The department lost two very active senior faculty, David Pengelley and Dave Finston, due to retirements, Pengelley at the end of 2011 and Finston in May 2012. With the central confiscation of the lines vacated by Sikora, Nguyen and Alvarez and of an open line to be shared with Education in July 2010, the death of Sweezy in Fall 2010, and the resignation of Mariani in Summer 2011, this puts us at a net loss of 7.5 tenure-track lines since summer, 2010 and of 8 lines going back to 2008. On the plus side, Bill Bramlett (0.5 FTE), Marta Reece (0.5 FTE), Abby Train (1.0 FTE), Laura White-Hosford (1.0 FTE) and Maribeth Olberding (1.0 FTE) are all previously regularized College Faculty who have been placed in funded lines since 2011. These additions have helped us to do an adequate job of meeting demand for general education instruction with quality instructors. They represent a net gain of 0.75 FTE among these faculty, although we did also lose the College Faculty line vacated by Larry Hughes when he took over as MSC Director in 2011.

### Accomplishments

**Externally Funded Activities**. The faculty members in the Department of Mathematical Sciences were involved in diverse externally supported work. In many cases the work was interdisciplinary or multi-institutional or both. *Mathematically-Connected Communities* ($MC^2$), a

professional development program for public school math teachers and their administrators funded by NM Public Education Department, continued under leadership of Doug Kurtz (co-PI) and collaborators in the College of Education with an annual budget of approximately $1.5M funding a staff of about 25. The last $MC^2$ award was funded from April 2010 to September 2012 with $2.8M total funding and Kurtz's research credit over $1.4M. The program has trained approximately 700 schoolteachers and administrators statewide. Pat Morandi is PI of the *Learning Institutes for Teachers* (LIFT) program that is funded by NSF from July 2009 to June 2014 with total funding just under $5M. LIFT funds courses that lead to a Master of Arts in Teaching degree in the College of Education. The first LIFT cohort graduated last year. In addition to Kurtz and Morandi, $MC^2$-LIFT actively involves the tenured Mathematical Sciences faculty members Mary Ballyk (on $MC^2$) and Bruce Olberding and Ted Stanford (LIFT) and the College Faculty members Linda Zimmerman (on $MC^2$) and Maribeth Olberding (LIFT). Department faculty members also participate in other teaching related grants. Susana Salamanca-Riba is funded for teacher development by a grant through the Institute for Advanced Study/Park City Math Institute through 2013, and through the NSF Noyce program. Jerry Lodder was PI on an NSF grant for Learning through Primary Historical sources ending in 2012. Guram Bezhanishvili was also funded by this project, which was collaborative with the Computer Science Department and involved several institutions nationwide. A workshop in conjunction with this program was held in Las Cruces in April. Mary Ballyk and Ernie Barany are co-PIs together with three faculty members in Biology on an NSF grant for undergraduate research mentoring in mathematical biology, funded through 2013. Ballyk is also co-PI on a second NSF grant with Biology whose purpose is to integrate more mathematics into the Biology curriculum. Ted Stanford is a co-PI on three grants, the NSF funded *MathSnacks* grant in the College of Education, A U.S. Department of Education sponsored *Math Games for Early Learners* grant in ACES and a second NSF grant through ACES also geared toward learning through technology.

There is also considerable funded activity in the department whose primary purpose is to produce original mathematical research. Dan Ramras had an NSF research grant end in 2012. Tiziana Giorgi holds an NSF research grant to study properties of liquid crystals through 2014. Louiza Fouli was awarded a grant from the Simons Foundation in 2012 primarily to support travel and collaborative activities in association with her research through 2017. Fouli also held an NSF grant that ended in January 2012 for the purpose of hosting the 2011 Southwest Local Algebra Meeting. Other faculty members are supported externally by grants outside NMSU. Guram Bezhanishvili is supported by two research grants through the Georgian Shota Rustaveli National Science Foundation, one for his ongoing work in modal logic and one to co-supervise a Georgian PhD student. In addition to these funded programs, ten tenure-track faculty members reported submitting funding proposals that are either still under review or were not funded. All but four of the twenty tenured or tenure-track faculty were either funded, or had funding proposals under review in 2012. At least one of these four planned to submit a proposal in the near future. It is a very realistic goal for the department to have its entire tenure-track faculty either funded or having proposals under review.

**Research Activity 2012**. Counting papers is not always the most meaningful way in which to gauge creative output. Nonetheless, 41 items appear in MathSciNet, the publication database of the American Mathematical Society, with associations to NMSU in 2011–2012 (26 for 2011;

note that there is often a delay for items to appear). A lot of other creative work done by our faculty members, particularly in the areas of Math Education or Statistics, does not show up in MathSciNet.

The majority of tenure-track faculty were actively involved in text-based scholarship in 2012. Fourteen of the 20 tenure-track faculty had papers either published or accepted for publication, and all but three had papers either published, accepted, or submitted. The other three faculty members were very active in other ways. All but four of the tenure-track faculty presented their creative work at national or international conferences and workshops or colloquia and seminars at major universities outside the region. The locations of international presentations in 2012 give an impression of the global scope of the research done by the Mathematical Sciences faculty: Baggett (Daejeon Korea (2), Seoul); Bezhanishvili (Oxford); Fouli (Genoa); Harding (Oxford); Lakey (Newcastle AU); Lodder (Daejeon (2), Seoul); Olberding (Rome); Ramras (Newfoundland (2), Banff), Salamanca-Riba (Xian and Tianjin) and Wang (China – many, Taipei, Bangkok).

**Awards and Recognitions and Leading Professional Service.** While Mathematics is not a discipline replete with national and international awards, there were some noteworthy items for our faculty in 2012, and a number of faculty members continued to serve key roles in professional decision-making.

Louiza Fouli was recognized and partly funded as a *Research Member* of the *Mathematical Sciences Research Institute* in Berkeley CA. In this capacity Louiza attended several multi-week workshops as part of a special year in her research focus area, Commutative Algebra. Louiza served on a panel *Connections for Women* at the *Joint Workshop on Commutative Algebra and Cluster Algebras*. Tony Wang continued in his status as *Visiting Chair and Houji Scholar* at Northwest A&F University in Xian, China, a position that he holds through December 2013. Tony spent most of summer 2012 in China in relation to this position. Joe Lakey was named to the inaugural class of *Fellows of the American Mathematical Society* in 2012.

Several math faculty members participated in reviewing grants and contracts in 2012. Tiziana Giorgi and Susana Salamanca-Riba participated on *NSF panels* for highly competitive research proposal reviews in their respective areas of specialization. Lakey (NSF and New Zealand Ministry of Science), Lodder (Shota Rustaveli Foundation, Georgia) and Olberding (Louisiana Board of Regents Support Fund) participated in research proposal reviews for state or national funding agencies. Harding served as an external reviewer for two tenure or promotion cases.

Several members of the department of mathematical sciences serve as editors or associate editors for international journals in their respective areas of specialization, including Bezhanishvili *(Journal of Language, Logic, and Computation*, *Tbilisi Mathematical Journal*, *Studia Logica*), Harding (*Order*), Morandi *(Journal of Algebra and Computational Applications*), Olberding (*Communications in Algebra* and *Journal of Commutative Algebra*) and Staffeldt (*Journal of Homotopy and Related Structures*). In addition, a number of faculty serve on scientific advisory boards for journals and professional organizations, including Tony Wang (*Journal of Management Sciences and Statistical Decision*) Harding (*Mathematica Slovaca*), Morandi (*NSF Math Science Partnerships Planning Committee*), Salamanca-Riba (*NSF DRK-12* collaborative research project), and Stanford (*Partnership for Assessment of Readiness for College and Careers* consultant). Mathematical Sciences faculty members have been

recognized locally at NMSU for their contributions. Morandi was named a *Distinguished Achievement Professor*. Doug Kurtz was awarded an *NMSU Research Achievement Award* "In recognition for your research & development contributions to New Mexico State University." Faculty were also involved in local scientific panels. Giorgi served on the *NMSU ADVANCE Research Best Practices for Research and Funding in STEM* in February and Olberding served as a panelist for the *Open Access Best Practices* session during the NMSU Library's Open Access Week in November. Smits gave an *A&S Colloquium* in April.

Four Mathematical Sciences faculty were awarded *Arts and Sciences Travel Grants*, including Bezhanishvili, Fall 2011, used for conference travel to Oxford, Olberding, Spring 2012 used for conference travel to Rome, Staffeldt, Spring 2012 used for collaborative research in Osnabrueck, and Fouli, Fall 2012 used for extended travel to Berkeley. Fouli was also awarded an Arts and Sciences Course Release Award in Spring 2012, used in Fall 2012 for extended travel to MSRI in Berkeley. A graduate student, Lokendra Paudel, was also awarded an Arts and Sciences Graduate Student Travel Award in Fall 2012, used to present his research at an American Mathematical Society meeting in Ohio in Fall 2012. The Dean's office also generously provided funding for the *Graduate Women in Math* (GWM) Program.

The department also benefited from use of the *Walker Endowment*. Funds from this account were used in 2012 to enable three PhD students to present their work at professional meetings (Savic at the *Research in Undergraduate Mathematics Education* in Portland and Kengwoung-Keumo and Hren at the *Joint Math Meetings* in Boston). The account also sponsored three faculty members to attend professional meetings (Ramras, AMS meeting in Honolulu, Fouli, AMS meeting in Salt Lake and Giorgi, ICIAM in Vancouver), and it supported three colloquium speakers (James Madden, Fred Richman and Anthony Hager). The department also recognized six outstanding undergraduate tutors to whom small awards were made through the *Debra Louise Thomas* award program. They are Patrick Rooney (Best New Tutor, Spring 2012, $200), Mychael Sanchez (Best Graduating Tutor, Spring, $200), Aria Furth (Best Continuing Tutor, Spring, $400), Benjamin Standley (Outstanding Continuing Tutor, Fall, $400), Prasamsa Dhakal (Outstanding New Tutor, Fall, $200) and Efrain Garcia (Best Graduating Senior, Fall, $200). In addition, three awards were made through the Mathematical Sciences Scholarship account (Jonah Wyatt, $400, Joshua Michalenko, $ 200 and Samuel Aiyedipe, $200). Wyatt was also funded over the summer through Dan Ramras's NSF award to work with Ramras on his research.

**Student Credit Hour production**. According to IRPOA data at the September 10 Census date, the department had enrollments totaling 11,834 (+1.2%) in lower division classes, 1,302 (-1.8%) in upper division classes, and 421 (-22.0%) in graduate level courses. The percentages are relative to the September 5, 2011 data. For comparison, the 2011 data was up 3% in lower division, up 10.2% in upper division and up 4% in graduate level compared to the 2010 data. The decline in graduate enrollments happened for a number of reasons and the department is considering a couple of ways to manage enrollments more effectively, including targeting the number of funded Master's students versus funded PhD students each year, as well as moving to a model of a moderately smaller number of advanced courses covering a moderately larger number of topics that can be taken for repeated credit. In any case, the bottom line is that there has been an increase of 500 lower division SCHs and 100 upper level SCHs from Fall 2010

to Fall 2012, but a decrease of 100 graduate SCHs during the same period. The decrease in graduate SCHs is consistent with the decrease in tenure-track faculty lines since July 2010. The increase in lower division credits has been accompanied by an increase in permanent funding for college-track faculty. By comparison, in Fall 2012 there were 21 sections of Math or Stat taught by temporary, adjunct, or visiting faculty or otherwise unfunded GAs and fourteen sections taught by funded GAs. In Fall 2010 there were 23 sections taught by non-regularized instructors not on permanent funds and nineteen taught by funded GAs and in Fall 2009 there were 26 sections taught by non-regularized instructors not on permanent funds and 22 sections taught by funded graduate assistants. The non-reliance on soft funds, even with a net increase of 500 SCHs and a net loss in tenure-track faculty has been accomplished in large part by an increase in SCHs per faculty. In Fall 2009 there were no large sections of MATH 210G or MATH 142G. Now all of those classes are taught in large sections, cutting down the total number of sections by 12–15 from fall-to-fall. While this saves NMSU some money, it affords students less personal contact with instructors, and puts a tremendous burden on those instructors of large sections.
The following faculty generated essentially 1000 or more SCH in MATH/STAT courses in 2012: Cohen (1092), Fulte (1083), Mostafa (>1200), Stuart (961), Train (1065), Voges (1533), White-Hosford (1026), and Zimmerman (1632).

**Student Learning Outcomes.** Faculty in the Department of Mathematical Sciences took evidence of student learning seriously. Without giving an exhaustive list of contexts in which student learning was considered, here are several: MATH 121G: Bramlett, Fulte, Mostafa, Train, and White-Hosford, among others, looked closely at student performance on a couple of items on the final exam. Mostafa also considered student performance on items on a final exam in MATH 190G and she is a member of the university committee on the Assessment of Student Learning. Debra Zarret and Marta Reece used similar forms of outcomes assessment in their Calculus courses. Several instructors also used similar forms in more advanced courses including MATH 392 (Staffeldt) and MATH 480 (Harding and Ramras). Other 392 instructors collected data on final exams in conjunction with program outcomes for math majors. Some instructors asked students for their own views on what and how they learned beyond standard questions on student course evaluations. Baggett did this with her students in MATH 112/512 and 313/513. Bezhanishvili used a similar approach in conjunction with data gathered for reporting purposes on the Learning via Historical Sources Program. Several faculty assessed student learning by analyzing samples of student writing on group projects or in constructing mathematical proofs, including Maribeth Olberding in MATH 215, Lodder in MATH 291G, Ballyk in MATH 332 and Salamanca-Riba in MATH 411V. The most scientific, in-depth study of student learning outcomes in the department was undertaken by Giorgi and Smits in STAT 251G. Their goal was to measure increase in basic understanding of statistical concepts from taking the class, and to measure whether two moderately different approaches could yield significantly different results. The report that they provided on this experiment is a good initial draft of a model for evaluating student learning outcomes.

**Majors and Degrees.** The Bachelor of Science in Math program currently has 68 majors and there are seven students currently enrolled in the Supplementary Major in Applied Math

program. According to COGNOS we have a diverse group of majors, including 31 Hispanic, 26 white, 4 Asian, 2 Multiracial, 1 Native American, and 4 students of unspecified ethnicity. Thirty-two of the undergraduate majors are female. Of the 20 who have a declared Emphasis of study, 11 are in Applied Math, 7 are in the General track, and 2 are in the Actuarial Studies track.
The department currently has 14 Master's and 25 Doctoral students enrolled in its programs, and one unclassified student. The graduate student body is very diverse, including 9 White, 9 Hispanic, 6 Asian, 1 American Indian, 1 African Black, and fourteen of unspecified ethnicity (of these 14, 2 are Nepalese, 5 are from other Asian countries, 2 are from Mexico, and one from Belize, two are Jordanian and one is new Mexican). Twelve of the 40 graduate students are female (nationally the percentage is about 25% female).
A total of twenty-eight MATH degrees were awarded between Fall 2011 and Summer 2012, including 17 Bachelor of Science, 5 Master's and Doctoral degrees. During the corresponding period last year, there were 10 Bachelor's, 8 Master's and 4 PhD's awarded in MATH, so the increase this year comes mostly from growth in the undergraduate program. The PhD recipients in 2012 were Zuhier Altawalbeh (Lodder, currently in Egypt), Luke Diaz (Staffeldt, employed by NSA), Jean-Jacques Kengwoung-Keumo (Ballyk, tenure-track Assistant Professor at Cameron University), Phan Nguyen (Lakey, currently Visiting Assistant Professor at Loyola in New Orleans), Dilia Rueda (Finston, currently seeking employment), and Milos Savic (John and Annie Selden, Postdoc at Michigan State). While only one of our PhDs this year was female, the average over the three prior years was 50%, which still leaves us well above the national average of female PhDs in Math which is below 30%.

**University Service.** Mathematical Sciences faculty served the College of Arts and Sciences and NMSU in various ways. Pat Baggett serves on the *College Graduate Affairs Committee*. Alyne Fulte chairs the *New Mexico Math Articulation Task Force*. Tiziana Giorgi serves on the *College Curriculum and Educational Policies Committee*. Doug Kurtz serves on the *Library P&T Committee* and the *A&S College Colloquium Series Committee*. Lakey and Train serve on the *Faculty Senate*. Morandi serves on the *Psychology P&T Comm*ittee and on the *A&S Awards Committee*. Mostafa serves on the University *Committee for Assessment of Learning*. Bruce Olberding serves on the *College Planning and Budget Committee*. Susana Salamanca-Riba serves on the *Arts and Sciences College Council* and on the *College Research Affairs Comm*ittee. Robert Smits serves on the *University Research Council*. Ross Staffeldt serves on the *Graduate Council*. Ted Stanford serves NMSU as a member of the *Mathematics Teacher Education Partnership* with other APLU institutions. Several faculty members served as Dean's Representatives on graduate student exam committees and at least two faculty members also help out in advisory roles to student organizations (Train and Wang).

**Outreach**. Major funded programs in the department such as $MC^2$-LIFT are, by definition, outreach, as is Salamanca-Riba's $PD^3$ program. The $MC^2$ academies presented around the state by Doug Kurtz and his numerous collaborators inside and outside the department were of particular importance this year in preparing for statewide implementation of the common core standards for math. Other outreach involves direct work with schoolchildren. Pat Baggett organized two full day math visits by about 80 Sierra Middle school children each to the Department of Mathematical Sciences for hands on math projects in February and September.

She also had a similar field trip visit of about 30 participants through the Southern New Mexico Science, Engineering, Mathematics, and Aerospace Academy. Pat also counts her ongoing work on her Breaking Away from the Math Book website (www.math.nmsu.edu/~breakingaway/) as a form of outreach. John Harding forewent watching football on Sundays in order to volunteer about 80 hours working closely on enrichment activities with students from Las Cruces Academy and Sierra Middle School. Several other faculty participated in numerous classroom visits or math activity days in local schools including Bruce Olberding (Sonoma Elementary), Louiza Fouli (Sonoma Elementary), Maribeth Olberding (numerous visits, including ones with prospective student-teachers to Sonoma Elementary and East Picacho Elementary), Ted Stanford (J Paul Taylor Academy, Hillrise Elementary, Sonoma Elementary, Alma d'Arte Charter School, and Picacho Middle School), and Laura White-Hosford (Columbia Elementary). Other outreach included Cohen sharing kaleidoscope and harmony labs at Navajo high schools, Giorgi coaching a two girl high school team on an entry in the Siemens Math Science Technology Competition, Salamanca-Riba serving on the MIT Education Council, Abby Train participating in local Women's History Month activities, and Train and Voges participating in a GWM panel.

**Progress on Goals**: Department goals for 2012 included looking at the sequence 192–392 in teaching, maintaining a high rate for publication, and increasing presence on college and university committees.

Regarding 192–392, the department did conduct textbook searches for the courses in question and ended up choosing to continue with new editions of the texts currently in use. These decisions were not unanimous, but in the end faculty were not prepared to devote a huge amount of energy to making wholesale changes. Regarding popularity of these courses, MATH392 exceeded capacity in Spring 2012. According to Cognos data collected August 9, there were 165 students enrolled in 4 sections each capped at 40 students, in MATH 291 there were 114 students enrolled in three sections each capped at 40 students and in MATH 192 there were 236 students in six sections each capped at 40 students. In Fall 2012, as of November 26 there were 202 students in MATH 192 (net cap 200), 202 students in MATH 291 (net cap 120) and 160 students in MATH 392 (net cap 160) so we are meeting or exceeding the nominal capacity in each of these courses.

The Mathematical Sciences faculty continues to publish at a respectable rate, with a total of 32 faculty names appearing on papers reported as having appeared in print, 23 in professional journals. However, nearly half of these were due to two faculty members. More faculty members have their work in Math Education in press.

Regarding College and University Committee membership, Mathematical Sciences faculty are listed eight times on the A&S website as members of A&S Committees or as A&S representatives on University bodies, out of 76 such listings. None of our College Faculty members are listed there, although Abby Train serves as a College Faculty representative on the Faculty Senate.

**Opportunities for improvement** taken from the Dean's Appraisal of the Department for 2011 included further strengthening of departmental goals with additional detail, writing in metrics for success in making 192–392 more attractive, clarification of the role of the Student Liaison

Committee, and opportunity for faculty members to frame the annual discussion of their scholarship using the Boyer framework. Clarifying that there are opportunities to tie these points into requests for resources including requests for faculty lines is one area in which the department head has failed to communicate effectively with his faculty.

**Mathematical Sciences Goals for 2013**:

Teaching Activities: Track completion rates in our General Education courses MATH 120, 121G, MATH 190G–291G and STAT251G. Continue work on documenting teaching effectiveness and student learning outcomes.

Goals: Seek a 75% successful completion rate for students in "G" courses relative to a course readiness metric. This goal is consistent with new common core college readiness standards. Begin to quantify skills that we want students in Gen-Ed math courses to have acquired and agreed upon metrics for demonstrating those skills. Survey department heads and program directors in STEM specific areas regarding specific skills that they would like their students to have acquired in MATH 191, 192, 291, and 392.

Research Activities: Continue overall publication and external presentations at a rate consistent with the past few years.

Research Goals: Have each graduate faculty member have a paper either submitted or accepted in 2013. Have each faculty member address their scholarly activities within the context of the Boyer model in their annual report for 2013.

Service Activities: Continue with a high level of service in the college and university, and profession.
Service Goals: Have at least half the graduate faculty involved in a college or university committee or policy body. Have at least two-thirds of the graduate faculty involved in professional service either on professional committees or reviewing scholarly work. Have half or more of the College Faculty in the department involved in committee or policy work that extends beyond the department.

Program Activities: Recruit graduate students in order to establish a balance of about a dozen funded students in the Master's program and about 16 to 18 funded students in the PhD program. Continue to make undergraduate students aware of our major and of employment opportunities for Math Majors.

Program Goals: Have half of our current Master's degrees complete their work (or move on) in 2013. Have one-fourth of our current PhD students successfully complete their work (or move on) in 2013. Have at least a dozen undergraduate majors complete Bachelor's degrees between December 2012 and August 2013.