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Review of Graduate Degree Programs in Mathematics, 2005-06

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Preamble

The goal of our review has been to identify some of the strengths, weaknesses, needs and significant changes in the three graduate mathematics degrees offered by the UAF Department of Mathematics and Statistics: MS Mathematics, MAT Mathematics, and PhD Mathematics.

These three graduate mathematics degree programs are built from a common set of courses and faculty, but they are otherwise very different from each other. Each of the sections below will be headed by comments which apply to all degree programs and then by comments for each degree program separately.

Many strengths, weaknesses, and needs of our program will be drawn from the recent history of our programs. The period from Fall 2000 to date has been one of enormous change. Our current program has 12 graduate students, 6 in the MS program and 6 in the PhD. Since Fall 2000 there have been 7 MS Mathematics graduates (but no PhD graduates). By contrast, in Fall 1999 there were *zero* students in any graduate mathematics degree program.

Furthermore only *one* member of the tenure-track (in Mathematics) faculty who were present in the Spring of 1998 remains on the faculty now. That is, the Mathematics faculty in the Department has seen the turnover of 7.5 out of its current 8.5 tenure-track or tenured positions.

Strengths

Strengths of all degree programs : *Course offerings* : The Department of Mathematics and Statistics offers five 600-level graduate courses in mathematics on a regular two-year cycle (Math 615 Applied Numerical Analysis, Math 631 Algebra, Math 641 Real Analysis, Math 645 Complex Analysis, Math 651 Topology) and two courses yearly (Math/Phys 611/612 Mathematical Physics I/II; by alternating the instruction with the Physics department). Enrollment in these courses is shown in Appendix 10.

In addition, the Department has offered six more catalog-listed courses in the period since Fall 2000 (Math 600 Teaching Seminar, Math 608 Partial Differential Equations, Math 630 Advanced Linear Algebra, Math 655 Algebraic Topology, Math 660 Advanced Mathematical Modeling, Math 661 Optimization). See Appendix 10.

Finally, since Fall 2000 the Department has offered graduate seminars (692) in three different subjects, special topics courses (693) in two different subjects (Probability; Control and Inverse Problems in Partial Differential Equations), and independent studies (697) in three different subjects.

Given that these courses are distributed among only 8 regular faculty who we believe *have the highest undergraduate teaching loads* in the college, the offering of this range of

courses is one of our **strengths**. (The number of student credit hours offered by the Department of Mathematical Sciences is largest in the college, though tied with Biology and Wildlife; DBW has far more faculty, many with joint appointments. Note that the service load DMS carries, as non-major credit hours per faculty member, far exceeds any other CNSM department.)

Success at funding of graduate students : As noted, there are 12 current students in the MS Mathematics and PhD Mathematics programs (see Appendix 6). In addition, since 2000 there have been 7 MS Mathematics graduates (see the same Appendix). Of these 19 students we have records of the following funding sources:

a. 11 students have been funded during the academic year by DMS Teaching Assistantships;
b. 6 students have been funded during the academic year by research grants (NSF, NASA, and DARPA);
c. 3 students have been funded by UAF Graduate School Fellowships during the academic year;
d. 5 students have been funded during summer terms by research grants;
e. 9 students have been funded during summer terms by teaching for UAF Summer Session.

The teaching assistantships mentioned above are of three types:

1. grading and MathLab tutoring;
2. "recitation sections" for calculus (Math 200);
3. lecturing at the 100 level (especially Math107, 108, and 161).

The Department depends on these teaching assistants to meet its very substantial teaching obligations in service courses and provide tutoring necessary for large lower division courses with historically high failure rates.

Thus a **strength** of our graduate programs is a demonstrated ability to fund our graduate students both through teaching assistantships within the department and research (and teaching) assistantships from institutions inside (the Graduate School; Summer Sessions) and outside (NSF, NASA) UAF.

Strengths of the MS program : As noted, seven MS students have graduated since Fall 2000 (see Appendix 6). All of these students were admitted in Fall 2000 or later. Of these graduates, four completed the program in two years, one in 2.5 years, one in three years, and one in 3.5 years; these figurescount only regular semesters and not summers. That is, the average time to completion of the MS program, for students who have completed it in the period under review, is 2.4 years. Of the current MS students, the earliest began the program in Fall 2003, and so there are no current students who have been in the program longer than 2.5 years. Thus a **strength** of the MS Mathematics program has been its basic ability to get students through in a reasonable number of semesters.

Of these seven MS graduates, two currently work as instructors in mathematics at the college level:

- Bowman is an instructor in Mathematics in DMS here at UAF,
- Carlson is an instructor in Mathematics at North Country Community College, State University of New York.

The remaining five are in PhD programs of the highest quality:

- Averina is in a PhD Applied Mathematics program at the University of Minnesota, Twin Cities,
- Belov is in a PhD Mathematics program at Duke University,
- Filipov is a PhD Economics program at Ural State University, Russia
- Korotiaev is in a PhD Mathematics program and the Courant Institute of Mathematical Sciences, New York University,
- Nikolsky is in an Interdisciplinary PhD program in Geophysics and Mathematics here at UAF.

This is evidence of the success of our MS graduates and, at least in part, represents a **strength** of the MS program.

Of the seven MS graduates mentioned above, three have published in peer-reviewed journals or peer-reviewed conference proceedings (see Appendix 11). Additionally, one current MS student has a publication (same Appendix). There are a total of eight such publications.

Publications in mathematics at the MS level are uncommon although their frequency increases as the mathematics becomes more applicable. A **strength** of the MS program is the record of peer-reviewed publication at this level.

In addition, a **strength** of the MS program, revealed by listing these papers, is the level of collaboration outside of mathematics which occurs in the department and includes graduate students. Of the eight publications listed in Appendix 11, only two *do not* include authors outside of mathematics.

The above-listed strengths of the MS program relate primarily to *output*. In addition, we should consider the strength of our *process* and *curriculum*.

Though the catalog does not currently reflect this (see Weaknesses below), the

- standards for admission,
- required course work,
- comprehensive examination content and standards, and
- standards for projects and theses

are each agreed upon among the mathematics faculty in DMS.

The standards for admission are modest and flexible. The department follows the university-wide MS admission standards (with regard to GPA and existing degrees) and does not require GRE (general or subject), though it is of course recommended. In the applicant's record we look for performance in post-calculus mathematics courses, and at least five such courses. In particular, we expect applicants to have strong grades (A's

plus and occasional B, etc.) in junior-senior level mathematics courses involving proofs. Such courses are typically titled "advanced calculus", "abstract algebra", "advanced linear algebra", "topology", "real analysis", "complex analysis", "number theory", and other standard titles. Students not possessing at least a course in advanced calculus (or real analysis) and in abstract algebra are usually only admitted with deficiencies.

The department follows the University-wide requirement for TOEFL for foreign students from non-English-speaking countries. Spoken English proficiency is especially important for students expecting Teaching Assistantship support.

Thus a **strength** of the MS program is a reasonable and agreed-upon standard for admission.

MS Mathematics students are expected to take the following four courses, each of which is very-proof intensive and each of which is 4.0 credits:

- Math 631 Algebra
- Math 641 Real Analysis
- Math 645 Complex Analysis
- Math 651 Topology

The content and texts for these four courses are agreed among the faculty, as is the *core* nature of these four subjects. It is, in particular, important for students expecting to work as *applied* mathematicians to have exposure to these modern viewpoints. Indeed (and this may surprise non-mathematicians but it is utterly standard), until a mathematics student takes courses such as these, he or she is likely to have seen essentially none of the mathematics of the twentieth century.

It is worthwhile to compare the above list of core courses to the MS course requirements of departments of mathematics at the three universities identified as comparable institutions in our Outcomes Assessment Plan (Appendix 4):

- The *University of Idaho* does not specify courses as core for MS candidates but requires at least 6 courses: "A minimum of 30 credits is required for the degree, with at least 18 credits (6 courses) in mathematics at the 500 level ..."
- The *University of North Dakota* requires two full-year sequences from a list of five such sequences: "A major of 30 (thesis) or 32 (non-thesis) credits or a major with a minor or cognate. Two full graduate sequences of the five available: [Modern Analysis I and II], [Applied Mathematics I and II], [Algebra I and II], [Topology I and II], [Linear Statistical Models and Advanced Topics in Statistics and Probability]. 3. At least one additional mathematics graduate course."
- The *University of Wyoming* specifies seven courses for all MS candidates: "Candidates for the master's degree must complete at least 30 hours of course work. Candidates must also obtain a grade of A or B in a set of seven specific courses. These are as follows: [Real Variables I, Complex Variables I, Methods of Applied Mathematics I, Methods of Applied Mathematics II, Advanced Linear Algebra, Abstract Algebra I, and Point-Set Topology]."

A **strength** of the MS program is the high but achievable standards reflected in these core course requirements.

Starting in 2000, and with the encouragement of the Dean of CSEM among others, the DMS faculty agreed upon a new *written comprehensive examination* policy for MS students.[1] The comprehensive exam policy is described by the exam information sheet in Appendix 12. The exams consist of separate 1.5 hour exams on three areas chosen by the student of which at least two must be chosen from the above list of core courses. The third exam may come from a 600-level mathematics elective. Of the ten students who have taken the exam since 2000

- *six* passed all parts the first time
- *four* failed one of three parts, were required to retake that part, and passed the second time, and
- *none* failed two or three of three parts.

A **strength** of the MS program is the high, but achievable, standards reflected in this comprehensive exam requirement.

Strengths of the MAT program : The Mathematics Master of Arts in Teaching (M.A.T.) degree was created to offer a Master's level degree to students interested in teaching K-12 mathematics. Clearly such students exist, but it is not clear that the degree as now structured meets the needs of students in Alaska.

There are no current MAT students and there have been none in the period under review. Therefore a **strength** of the MAT program is the fact that it absorbs no Department or University resources.

One of the current MS students (Amy Keith; see Appendix 6) is on leave from teaching Middle School mathematics. She may be an example of a K-12 teacher for whom a MS is actually preferred, but it is also possible that a restructured MAT would fit her needs and preferences well.

Strengths of the PhD program : The Ph. D. in Mathematics currently has 6 enrolled students. It is likely that this is the largest number of Ph. D. students the Department has ever had at one time. (As noted, there were no Ph. D. students in 1999.) Thus the most important **strength** of the Ph.D. program is its current size, which is quite large when considered relative to the size of the faculty and the non-graduate obligations of the faculty.

[1] The history of the MS-level comprehensive exam is roughly as follows: through the early 1990s a written examination was standard for all students but in the 1990s a number of oral comprehensive exams were given.

Weaknesses

Weaknesses of all degree programs : The primary **weakness** of our graduate program is the small size of the faculty. The 8.5 FTE tenure-track and tenured faculty, along with 2 permanent instructors are, in total, in charge of five degree programs (BA, BS, MS, MAT, and PhD in Mathematics) and teach the largest load of service courses in the College and possibly the University.

During the fall of 2005, prompted in part by recent faculty turnover and in part by this review process, the Department of Mathematics and Statistics has engaged in sustained discussions on the direction of the department, and in particular on the direction and focus of the graduate programs we offer. A wide range of opinions have been put forth, from growing the Ph.D. program to eliminating it, to focusing on the Master's degree. There is not widespread consensus on the best future for graduate programs, though all members of the department agree that small *faculty size limits our options*. See Appendix 9 for results on an informal survey on the future of graduate programs in mathematics.

The current catalog descriptions of the mathematics graduate degree programs are included as Appendix 8. They are not particularly helpful and they reflect a correctible **weakness** of our program. In particular, they do not reflect the recently (i.e. in last few years) agreed-upon identification of Math 631, 641, 645, and 651 as core. They also do not recommend electives for various areas of interest, and finally they do not mention the comprehensive exam at the MS level.

One of the most common complaints of students is the lack of elective offerings. These electives are shared among the MS and PhD programs, of course, but are all definitely within reach of successful MS students. The small number of electives, compared to most PhD-granting Mathematics departments nationwide, reflects the above-mentioned small size of the faculty. In addition, however, the recent high turnover of faculty suggests a re-assessment of these electives. Let us review the offerings.

The following elective courses are offered relatively *frequently* (i.e. at least every two years) and have at least one clear faculty champion:

- Math 608 Partial Differential Equations
- Math/Phys 611 Mathematical Physics I
- Math/Phys 612 Mathematical Physics II
- Math 615 Applied Numerical Analysis

Note that the last three of these courses are service courses in that the majority of students are not Mathematics students.

The following elective courses are *infrequently* offered, but each of these courses *has faculty champion(s)* and/or *is recognized as filling a realistic student need*:

- Math 600 Teaching Seminar
- Math 630 Advanced Linear Algebra
- Math 655 Algebraic Topology
- Math 660 Advanced Mathematical Modeling

- Math/CS 661 Optimization [cross-listed]
- Math 663 Applied Combinatorics and Graph Theory

Prioritization of these courses is appropriate and ongoing. It is possible that several of these courses could be collected with other subjects into a regularly-offered "Topics in Applied Mathematics" course at the graduate level. It is possible that Math 630 could be replaced by a "Numerical Linear Algebra" syllabus if the undergraduate linear algebra curriculum were modified to include a significantly proof-based course.

A final correctible **weakness** is the presence in the catalog of elective courses which have not been taught in the last nine semesters (see Appendix 10):

- Math 621 Advanced Applied Analysis
- Math 632 Algebra II
- Math 642 Real Analysis II.

The high turnover rate of faculty (see "Recent Significant Changes" below) has meant that faculty who were previous champions of these courses are not present.

In any case, the new faculty sees Math 621 and 642 as low priorities. In particular, there is consensus among the analysis faculty that a new Functional Analysis course should replace Math 642 and should be a regularly-offered elective. Math 632, on the other hand, has some faculty support. We return to the topic of course offerings in the "Needs" section below.

Weaknesses of the MS program : A **weakness** of our MS program is that significant and already agreed-upon requirements of the program, with regard to core courses and comprehensive exams in particular, have not been formalized. Some of these requirements have not been clearly communicated to students, though Appendix 12 shows a standard form of yearly communication to students in the form of a sign-up sheet for MS comprehensive exams which summarizes expectations in that regard.

In any case, many agreed-upon requirements do not yet appear in the catalog. They also do not yet appear online, and our procedures for funding teaching assistants also do not appear online. These deficiencies are easily remedied but must be remedied.

Weaknesses of the MAT program : This program has no students and no faculty champion. Furthermore it is not clear that the program, as currently structured, meets the needs of the target audience of K-12 teachers. Indeed, there are at least two concrete **weaknesses** of the program with regard to this audience:

1. An M.A.T. is supposed to be attractive to students possessing a Bachelor's degree but lacking a teaching credential. However, the M.A.T. in DMS, as currently structured, does not include the attainment of such a credential.
2. In-service teachers need courses to be offered in evenings and in summers and, other than 100-, 200- and 300- level courses (which are useless to graduate students even if they cover desirable material), DMS does not offer such courses.

Weaknesses of the PhD program : The primary **weakness** of this program, in addition to the small size of the faculty mentioned above, is that at present only one faculty member

is actively advising Ph.D. students. As reflected in the survey of mathematics faculty opinions in Appendix 9, there are at least two other faculty members inclined to do such advising, however. There are several faculty not inclined to advise PhD students. (The primary motivation for not doing such advising, at least for some of this latter group of faculty, relates to structural issues in the department and not just personal disinterest or unwillingness to work on behalf of graduate students.)

There is no clarity on PhD exams, and this is a **weakness**. There is general agreement that the MS comprehensive exams are necessary for PhD students, but also that they are not sufficient. That is, they serve as PhD "qualifying" exams but this is nowhere officially stated; see Appendix 12. Most importantly, it is generally assumed that all PhD students will take an oral exam on subjects closer to their research (than would be covered in a "comprehensive"). However, none of the current PhD students have gone through that process.

Service Course Issues

It is very important for readers of this review who are not in the department to understand that *even at the graduate level, DMS has a significant service role*. In particular, the courses

- Math/Phys 611 Mathematical Physics I
- Math/Phys 612 Mathematical Physics II
- Math 615 Applied Numerical Analysis
- Math 660 Advanced Mathematical Modeling

are all *primarily* service courses in that the majority of the students in each of these courses are not Mathematics students. Furthermore, none of these courses is core to either the MS or PhD program in mathematics. In addition, the following 400-level courses are widely used by graduate students in non-Mathematics degree programs:

- Math 421 Applied Analysis
- Math 422 Complex Analysis
- Math 460 Mathematical Modeling.

All seven of these above 600- and 400-level courses are service courses in an intrinsic sense: *they are not fundamentally proof-based courses* though there may be many assigned proofs in homework and exams. The point of all of them is to teach ideas and techniques, and only secondarily to integrate the material of the course into the *deductively consistent whole of mathematics*. This fact is reflected in the lack of a requirement of a proof-based prerequisite (Math 308 Abstract Algebra and/or Math 401 Advanced Calculus, in particular).

There are additional desires, on the part of other departments, for DMS to offer service courses. For example, Sergei Avdonin in DMS has talked to faculty in Electrical Engineering about the creation of a mathematical Signal Processing course. This kind of course is a service course in the just mentioned sense: if it is to be useful to graduate students in Engineering then the level of rigor, especially the number of proofs demanded

of students, must be reduced, and this reduces the utility of such a course to those who need training in creating new mathematics, that is, to Mathematics graduate students.

In conclusion, we note that even if DMS ceased to offer graduate degree programs in Mathematics, other departments would still need these service courses at the graduate level.

Recent Significant Changes

As noted previously, in Fall 1999 there were zero graduate students enrolled in the Mathematics MS and PhD programs. There are currently six students enrolled in each of these programs. This is one of two **most significant changes** experienced by our graduate programs.

Since 1997 the Mathematics faculty in the department have experience *profound* turnover and is the other **most significant change**. In particular, of the 8.5 tenure-track or tenured positions in mathematics (counting the mathematics education half-position in DMS), 7.5 have changed occupants in this period. This is the result of many retirements and several resignations.

A historical note may be useful here. When the mathematics PhD program was first approved in 1983 the proposal included the hiring of three additional positions. In particular, the proposal was to hire a senior research mathematician, and two assistant professors with significant research potential, all of whom would have reduced teaching loads to build a graduate program. An offer for the senior position was made to an outstanding mathematics researcher, who initially accepted but eventually declined the position. At the same time, UAF suffered significant budget cuts. As a result none of the three promised positions were ever recruited and filled so the PhD program never got the chance to develop.

With something of the same intent, but nearly twenty years later, a initiative process in 2000-2001 led to the hiring of Prof. Sergei Avdonin in May 2001. The position announcement created as a result of the Initiative sought an applicant with "... a proven record of recruiting and mentoring graduate students ..." and "... a demonstrated record of recruiting graduate students is essential, as is as a proven commitment to working with students at the graduate level." The position announcement noted that the "department is currently in the process of enhancing its graduate program, which offers both masters and doctoral degrees."

Prof. Avdonin has more than satisfied the spirit and the letter of this hiring initiative. At this time Prof. Avdonin is the advisor of all five (of six) current Ph.D. students who have an official advisor. Furthermore, he has taught an average of one graduate course per semester since his hire. Finally, he has procured research grant funding for most of his advisees in most semesters; the remainder have been funded through Teaching

Assistantships and other research grants. Prof. Avdonin's presence in the department is itself a **significant change**.

In the past four years the mathematics faculty have agreed upon four courses at the graduate level as the MS level *core*: Math 631 Algebra, Math 641 Real Analysis, Math 645 Complex Analysis, and Math 651 Topology. Each of these is 4.0 credits and each is very proof intensive. The decision that these four courses are required of all MS level students (who have not already taken equivalent course) is a **significant change**.

As detailed in Appendix 12, the Department requires a written comprehensive exam at the MS level which requires students to pass exams in at least two of the just-mentioned core subjects. This is a **significant change** from the late 1990s when an oral exam was required for MS students.

Finally, the previous Department of Mathematical Sciences comprised of mathematics, computer science and statistics was partitioned into two departments; The Computer Science Department and the Department of Mathematics and Statistics. A major consequence of this change was a loss of space in Chapman Hall, with the creation of two department offices where there was one previously. (See "Needs" below.) Among the many minor consequences of this change is the need to rethink the offering of the cross-listed course Math/CS 661 Optimization and (perhaps) consider a new cross-listing for Math 663 Applied Combinatorics and Graph Theory.

Current Plans

There are many informal plans by various members of the department to make changes in the near term (some a result of this program review process). In this short section we include three current plans which have advanced to written and agreed upon changes:

1. At the last department meeting (3 November 2005) the faculty voted to change the entrance requirements of the PhD Mathematics program by adding the requirement: *Complete the following admission requirement: Complete a Master's degree in Mathematics or Applied Mathematics, or the foreign equivalent thereof.* There is a UAF precedent for such a requirement: the PhD program in Fisheries requires that applicants "Complete a master's degree in a fisheries related field." In any case, such a requirement is a natural result of our small size, with concomitant slim choice of advisors at the PhD level. An entering PhD student possessing only a Bachelor's degree may be able to choose among a large selection of advisors and fields of specializations in a large PhD program even after completing the basic coursework. Here at UAF, however, the successful PhD student must obviously, at the point of starting serious research, have interests which closely match the few available PhD advisors among the faculty.
2. Math 663 Applied Combinatorics and Graph Theory is scheduled for Spring 2006. This course has at least two champions on the current DMS faculty, and the successful offering of this class would add a highly desirable graduate elective

course to our offerings. (There are, as well, faculty in the Department of Computer Science who would be highly qualified to teach this course. It is, therefore, a candidate for cross-listing if both faculties were so inclined.)

3. A revision of the catalog descriptions of the cross-listed courses Math/Phys 611/612 is underway. Agreement between the faculties on a written draft has already occurred; a formal change to the catalog remains to be submitted. The new catalog descriptions in the Mathematics and Physics listings will, in particular, match. (This year-long course is taught in alternate years by DMS and Physics faculty. Both departments regularly offer graduate comprehensive exams covering this material.)

Needs

As noted many times above, the greatest **need** of this department is *an increase in the size of its faculty.*

A comparison to other PhD-granting mathematics departments (in the lowest tier as rated by the American Mathematics Society) is illuminating. See appendix 7, which reports an informal survey of the sizes of these departments.

With regard to the graduate programs, the greatest benefit of a larger faculty would be to cover more areas within the extraordinarily broad intellectual territory of modern mathematics. As it stands we simply do not cover any significant fraction of the following important fields within mathematics (listed alphabetically):

- algebra
- dynamical systems
- logic (and set theory and other foundations)
- number theory
- probability
- topology (point-set and algebraic)

One concrete reason for the importance of covering a broad range of fields, especially with regard to the PhD program, is this fact: The *vast majority of PhDs in Mathematics go to teaching positions* where there are expected to *teach a broad range of courses* at the undergraduate and graduate levels. Most undergraduate Mathematics programs in the US teach at least one course in each of the above-mentioned areas. So most PhD programs, in particular, teach at least one course in each of the above-mentioned areas so as to prepare future faculty.

Only in the following significant fields are there multiple faculty members in DMS:

- mathematical biology
- functional analysis
- graph theory and combinatorics
- partial differential equations

Certain other significant fields, like complex analysis, differential geometry, numerical analysis, and algebraic geometry are covered by single faculty or "fractions thereof".

Besides getting better coverage of mathematical subjects, the other obvious benefit to our graduate program of adding faculty would be the addition of potential advisors. Also, the current faculty are straining to cover the few graduate courses we now offer (which, importantly, include a significant fraction of service teaching at the graduate level and to graduate students).

The just-mentioned reasons related to graduate programs may not even be the most important reasons for increasing the faculty. Indeed, a very important reason is to fully meet the needs of undergraduate majors and to fulfill the department's service teaching role. As an example, 100-level courses are essentially never taught by PhD-possessing

faculty because that faculty is fully engaged at the 200-, 300-, 400-, and 600- levels. (See the separate undergraduate program review.)

Supposing the faculty were to grow, there is already a common sense among the mathematics faculty of what additional courses are essential. The needs are especially critical for a higher quality PhD program, and thus the greatest impetus for the creation of *new* courses naturally comes from those faculty who are currently advising PhD students. An example prioritized list is:

1. Functional Analysis (replaces Math 642, in particular)
2. Operator Theory
3. Probability
4. Numerical Linear Algebra

and so on. There are, in particular, many courses at the graduate level which are taught at (for instance) the Universities of Idaho, North Dakota, and Wyoming which we do not teach because of a simple lack of faculty.

Distinct from the need for a bigger faculty is the **need** for more physical space. First of all, we do not have an office in Chapman Hall for even one more faculty member. In part this lack of space has been a problem for years. For example, three years ago we sacrificed a small classroom (Chapman 303C) for faculty space, so that Chapman Hall now has only 3 classrooms, one of which has a capacity of only 15 or so (Chapman 107). The vast majority of mathematics courses are taught elsewhere, in Gruening, Duckering NSF, and Bunnell, in particular. The lack of space was made more severe by the splitting of the previous Department of Mathematical Sciences into the current DMS and the Department of Computer Science. In particular, the only conference room and seminar space in the building (Chapman 202) has become the Department office for Computer Science. Currently, DMS is adding a conference table to a storage room to "replace" Chapman 202. On the other hand, we only have space in Chapman Hall for Mathematics and Statistics graduate students who are TAs, and they are given a desk in a crowded office without partitions. RAs are simply not given space in Chapman Hall; two Mathematics RAs (Godabrelidze and Stroh) currently have offices on West Campus.

An additional **need** for DMS is to have a competitive salary scale. As shown in Appendix 13, our salaries are close to national averages, they are not quite at the average. Below-average faculty salary is a significant problem in recruiting new faculty, because applicants correctly expect Alaska to have a higher cost of living than the national average, among other reasons. Below-average salary is equally a problem in retaining faculty, or more so. A significant amount of our recent turnover can be attributed to this cause, as a majority or significant reason for departure. UAF has taken steps to improve our salary competitiveness, and, in fact, in 2004 seven DMS faculty received raises based on below-national-median salaries. Though an essential step, this response does not suffice to fix the above-mentioned recruiting and retention problems.

Other needs identified by faculty members include:

- lack of a colloquium budget in some years,
- little travel budget, and

- weakness of mathematical journals collections in the library.

A final **need** relates to the dormant M.A.T. program. If this program is to be revived, or if a replacement program is to exist, there clearly must be support for it in the form of additional Mathematics Education faculty. As it stands DMS has 0.5 FTE faculty in Mathematics Education, namely Tony Rickard who has a joint 50/50 position between DMS and the Department of Education. Rickard teaches Math 205 and Math 206 each year, however, and thus his DMS teaching workload is already fully allocated. Presumably an active M.A.T. (or equivalent) program would involve multiple courses in DMS at the graduate level and thus additional faculty are needed. Evidently, a commitment to reviving or replacing the M.A.T. must be a collaborative commitment including DMS and the Education Department.

Appendix 1 – Headcount of Majors

UAF Program Review 2005-06
College of Natural Science and Mathematics
Headcount of Majors

Department	Major	Degree	Fall 2000	Spring 2001	Fiscal Year 2001	Fall 2001	Spring 2002	Fiscal Year 2002	Fall 2002	Spring 2003	Fiscal Year 2003	Fall 2003	Spring 2004	Fiscal Year 2004	Fall 2004	Spring 2005	Fiscal Year 2005
CNSM Mathematical Sciences	Mathematics	BA	5	6	6	7	7	9	4	5	6	9	6	9	5	4	7
		BS	25	24	36	26	35	36	39	38	45	33	34	41	37	30	42
		MS	4	6	6	6	7	8	6	3	8	2	1	4	5	5	6
		PHD	1		1				1	2	2	4	5	5	6	6	6
	Statistics	BS	2	2	2	1		1	1	1	1	1	1	1	1	1	1
		MS				4	6	7	9	9	10	4	5	8	4	6	5
	Premajor - Mathematics	BI													2	2	3
	Premajor - Statistics	BI										1	1	1	1	1	1
CNSM Mathematical Sciences Total			37	38	49	44	55	61	60	58	72	53	52	69	58	51	69
College of Natural Science and Mathematics		BA	28	28	36	29	34	41	34	34	43	42	35	44	38	38	53
(distinct headcount by degree type)		BS	582	558	685	580	554	671	602	557	688	622	611	717	608	552	688
		MS	127	128	152	138	138	162	157	147	184	159	154	188	169	174	206
		PHD	108	106	125	103	97	115	112	107	127	106	116	125	128	129	141

Note: Headcounts within degree programs are generally summable as students are unlikely to seek a double degree within the same program. Headcounts across programs are not summable because some students seek double degrees causing headcount duplication.

Appendix 2 – Student Credit Hours

UAF Program Review 2005-06
College of Natural Science and Mathematics
Student Credit Hours without audited hours

Dept	Subj	Subject Descr	Level	Fall 2000	Spring 2001	Summer 2001	Fall 2001	Spring 2002	Summer 2002	Fall 2002	Spring 2003	Summer 2003	Fall 2003	Spring 2004	Summer 2004	Fall 2004	Spring 2005	Summer 2005
CNSM Mathe-matical Sciences	MATH	Math	LD	2,585	2,581	545	2,725	2,602	420	2,784	2,606	539	2,888	2,593	557	2,766	2,479	407
			UD	425	356	78	405	313	128	473	443	117	485	463	105	626	539	87
			GR	56	63		67	89	9	59	53	3	103	54	4	74	125	1
	STAT	Statistics	LD	312	383	72	300	338	61	312	372	51	372	369	39	312	369	72
			UD	155	208		125	263		216	237		136	290		172	246	
			GR	66	66	3	60	85		66	89	2	57	82		62	67	3
	Total CNSM Mathematical Sciences			3,599	3,769	726	3,682	3,688	700	3,910	4,000	735	4,169	3,959	713	4,012	3,909	650

Appendix 3 – Degrees Awarded

UAF Program Review 2005-06
College of Natural Science and Mathematics
Degrees Awarded

Department	Degree	Major_Description	1999	2000	2001	2002	2003	2004	2005
CNSM Mathematical Sciences	BA	Mathematics			1		1	1	2
	BS	Mathematics	5	8	8	3	9	10	8
		Statistics	1	1	1	1	1	1	
	MS	Mathematics	1				4	1	2
		Statistics				1	3	5	1
CNSM Mathematical Sciences Total			7	9	10	5	18	18	13

Appendix 4 – Student Learning Outcomes Assessment Plan

Date: February 2004

Certificate or Degree Program: Master of Science, Master of Arts in Teaching, and Doctor of Philosophy

Mission: We shall provide quality education responsive to the needs of individual students and the diverse population of Alaska.

Goal: To assure that our graduates are adequately prepared to succeed in the job market in mathematics or a closely related field.

INTENDED OUTCOMES/ OBJECTIVES	ASSESSMENT CRITERIA	IMPLEMENTATION PROCEDURES (what, when, who)
1) Our curriculum will be comparable to national standards.	Compare our program to University of Idaho, University of Wyoming, and University of North Dakota.	Every three years, the members of the Graduate Committee from mathematics will compare our program to the three specified institutions and give a report on their findings to the assessment committee to include in the annual report.
2) Our students will master a core of mathematical concepts.	All students are required to take and pass four core courses. In order to graduate, all students must take and pass a collection of exams on core subjects.	Every spring, comprehensive exams will be given, graded, and discussed by the majority of the math faculty. A summary of the results will be prepared by the members of the Graduate Committee from mathematics to be included in the yearly assessment report.
3) Our students will have the opportunity to develop the skills necessary to achieve their career goals in mathematics.	alumni survey	Every May, alumni surveys will be sent to all students who graduated with a degree in mathematics two years prior. The returned surveys will be summarized by the assessment committee in the annual report the following spring.

Appendix 4 Continued: Assessment Report for the M.S., M.A.T., and Ph.D. in Mathematics, 2004—2005

The Outcomes Assessment Report prepared in March 2005 appears on the following pages.

Department of Mathematical Sciences
Assessment Report
For the
M.S., M.A.T and Ph.D. in Mathematics
2004-2005

Introduction

The Department of Mathematical Sciences (DMS) has collected information as directed by the department's Student Learning Outcomes Assessment Plan. This includes comparison to other institutions, summary of comprehensive exam results and tracking our students after they graduate. This report concludes with a list of suggested actions for the department to pursue in the coming academic year.

Assessment Facts and Analysis

I. Comparison to Other Institutions

We examined the graduate programs in mathematics at the University of Wyoming, the University of North Dakota and the University of Idaho. These are all research universities in states of comparable size. While the size of the graduate programs varies considerably the number of math faculty in each department was pretty consistent and averages just over twice the size of the DMS math faculty. Degree requirements were generally similar to those at UAF. Graduate student stipends were comparable to the DMS stipend of $12,000 plus a tuition waver.

University of Wyoming. The math department at UW offers an M.A., M.S., M.A.T., and a Ph.D. in mathematics. Their department is a mathematics only department (as opposed to DMS) and has 18 math faculty and 3 instructors. In addition they employ 20-25 graduate assistants each year. Most first year students teach college algebra and trigonometry and advanced students teach calculus. Graduate student stipend is $10,000 to $14,000 per year plus a tuition waver.

Their program more than twice the size of our DMS and they also offer more than twice as many courses at the graduate level. The topics covered at UW are slightly broader than those offered at DMS, but UW can offer more two-semester sequences and so the depth of their program is stronger. Their MA/MS core consists of 7 courses. Four are identical to the DMS core but UW also requires a year sequence of applied courses (roughly equivalent to our Math 611-612 sequences) and a semester of linear algebra. UW requires a comprehensive exam and a project or thesis for master's degree students, as does DMS.

UW's Ph.D. program is much more developed than the DMS program and they regularly graduate Ph.D. students.

University of North Dakota. The math department at UND offers an M.S in mathematics. Their department website lists 19 faculty members. They have 9 to 15 graduate students in math, so they are of comparable size to UAF.

The M.S. program seems to be about the same size as the DMS program. Their core is more flexible than the DMS core, requiring less breadth but more depth: students must complete a year of coursework in two of five subject areas. The number of graduate courses offered is nearly the same as for DMS, but DMS offers greater breadth of subjects. Students may complete the degree with or without a thesis or project.

University of Idaho. The math department at UI offers the M.S., M.A.T. and Ph.D. in mathematics. Their department website lists 15 faculty members. The graduate student stipend begins at $12,200 plus a tuition waver. Their website indicates that all of their Ph.D. graduates in the last 16 years have sought academic positions have been hired into tenure-track assistant professor positions.

The M.S. degree is geared toward entrance into a Ph.D. program and does not require a thesis or a specific list of course, but does require a comprehensive exam that is similar to the DMS exam. This is typical of schools whose emphasis in on a Ph.D. program. All graduate students teach one course per semester. UI has several graduate courses designed specifically for the M.A.T. degree, which can be obtained through distance learning. Their course offering for the M.S. and Ph.D. program are wider than ours. The principle difference is that they can offer more depth of coursework than DMS, even though the list of topics has similar breadth.

II. Summary of the Comprehensive Exam for the M.S. in Mathematics

Each spring the DMS Mathematics Graduate Committee organizes a meeting of all members of Advising Committees to discuss the progress of MS and Ph.D. students. On the meeting of March 29, 2004 the progress of all our students was estimated as satisfactory. As part of the review, each of the graduate students gave short seminar talks on their research. This year the series of half hour seminar talks our graduate students are planned for the first part of April.

The MS level comprehensive exams process was revised in 2001. Previous to this all M.S. candidates were required to pass an oral exam. The opinion of the faculty was that this oral exam lacked the rigor and depth necessary for a master's level exam. A committee consisting of all math faculty got together in Fall 2001 and constructed a new comprehensive examination procedure, which now consists of three two-hour written exams. These exams are generally given each spring. Each exam covers one course from the student's graduate study plan. Two of these exams must be from the four "core" courses: Math 631 Algebra, Math 641 Real Analysis, Math 645 Complex Analysis, and

Math 651 Topology. The third exam may be taken from any 600-level mathematics course, as approved by the examination committee.

New exams are created for each round of comprehensive exams. Typically the faculty member who taught the course writes the exam, but a second faculty member reviews the exam before it is given to the students. If the student exam is not one of the core subjects, the student must solicit and receive a commitment from the relevant instructor to create and grade. Copies of old exams are available to students.

Two faculty members grade each exam. The results are then reviewed by the examination committee as a whole. Students must pass all three exams in order to have passed the comprehensive examination. If a student passes two of the three exams but fails a third, then the student must retake (with a new test) the failed subject in a timely manner, usually within one month of the first attempt. If the student then passes this exam, he/she is considered to have passed the comprehensive exam. If the student fails the retake, or fails two or more exams on the initial attempt, then the student is considered to have failed the comprehensive exam. The student must then wait at least one semester before attempting the complete suite of three comprehensive exams.

These comprehensive exams are required of all Ph.D. students but are not sufficient to complete the examination requirements for the doctoral degree. Further examinations, presumably oral, in the area of the dissertation are expected and are the responsibility of the student's committee. The department is in the process of reviving the Ph.D. program, and while we have several Ph.D. students none has yet reached the stage of the preliminary exam.

Two rounds of MS level comprehensive exams have been completed since our examination process was revised in 2001. In spring 2002 we had six students take them. All students passed the exam, though three students had to repeat an exam in one subject area. In Fall 2004 we had two students take them; both passed first try.

Here is the complete list of all students who have taken the new comprehensive exam. They are listed in alphabetical order with the semester the exams were taken and the subject chosen.

Victoria Averina: Spring 02; Real Analysis, Topology, Algebraic Topology
Sergei Belov: Spring 02; Real Analysis, Complex Analysis, Topology
Latrice Bowman: Spring 02; Real Analysis, Topology, Numerical Analysis
Anna Bulanova: Fall 04; Real Analysis, Complex Analysis, Mathematical Physics
Tim Carlson: Spring 02; Real Analysis, Topology, Algebraic Topology
Igor Filippov: Fall 04; Real Analysis, Complex Analysis, Mathematical Physics
Mikhail Korotiaev: Spring 02; Algebra, Real Analysis, Topology
Dmitri Nicolski: Spring 02; Real Analysis, Complex Analysis, Mathematical Physics

III. Summary of Recently Graduated Students.

Below is a complete list of graduate students in our department who have graduated since 1999. We include our expected Spring 2005 graduates. This alphabetical list includes their name, thesis/project title, date (or expected date) of graduation and if they have graduated, we indicate their current position.

Victoria Averina, Thesis: Symbolic stability of delay differential equations, M.S. 2002, Advisor – Ed Bueler. Victoria is currently Ph.D. Mathematics student at the University of Minnesota.

Sergei Belov, Thesis: The trace formulas for a half-line Schrodinger operator with long-range potentials, M.S. 2002; Advisor – Alexei Rybkin. Sergei is currently a Ph.D. Mathematics student at Duke University.

Latrice Bowman, Project: Numerical Analysis of Ice Flow, M.S. Project, 2002, Advisor – Ed Bueler. Latrice is currently an adjunct instructor for UAF and College of Rural Alaska.

Tim Carlson, Thesis: Magnus' Expansion as an Approximation Tool for ODEs, M.S. 2005 (expected), Advisor – Ed Bueler

Igor Filippov, Project: Controllability of an Elastic Ring with Variable Tension, M.S. May 2005 (expected); Advisor – Sergei Avdonin.

Liane K. Hansen, Project: Numerical solutions to a weighted Hodge Laplacian on the torus, M.S. 1999; Advisor – Ed Bueler. Liane was a Ph.D. Mathematics student at Iowa State University, 2000—2004.

Mikhail Korotiaev, Thesis: Critical points of the heat kernel on a compact semi-simple Lie group, M.S. Thesis, 2002, Advisor – Ed Bueler. Mikhail is currently a Ph.D. Mathematics student at Courant Institute of NYU.

Dmitry Nicolsky, Project: Exponential Decomposition of Time Series using Linear Regression, MS 2003, Advisor – Alexei Rybkin. Dmitry is currently Ph.D. student working at the Geophysical Institute at UAF.

Jacob Stroh, Thesis – title to be determined), M.S, 2005 (expected), Advisor – Ed Bueler.

Based on these data we the DMS faculty feel that our MS is quite satisfactory. We give our students a broad mathematical background yet their thesis or project gives them the opportunity to study a particular area in detail. The majority of our M.S. graduates move on to Ph.D. programs at top-notch universities. Those interested in teaching have found instructor positions.

Our Ph.D. program is now at the stage of reconstruction. Currently we have four Ph.D. students. Valeriy Groshev and Elchin Jafarov work on mathematical modeling and inverse problems in glaciology. Their Ph.D. theses are expected in 2008. Anna Bulanova works in sampling and interpolation problems in signal processing and she is expected to finish in 2007. Victor Mikhailov works on control problems for partial differential equations and he is expected to finish in 2007. All of these Ph.D. students are advised by Sergei Avdonin. We expect that at least two more Ph.D. students will join us in Fall 2005.

Actions Taken

As has been outlined above, the actions taken within the department concerning our M.S. and Ph.D. programs over the last several years are:

- We have completely revised our comprehensive examination procedure.
- We have formalized our M.S. degree requirements. We now explicitly require that all students complete the four core courses of: Real Analysis, Complex Analysis, Algebra and Topology.
- The Ph.D. program has been revitalized. We now have 4 Ph.D. students, up from zero just two years ago.
- We have instituted a formal yearly review of each of our graduate students.

Suggested Actions

Below is a list of issues that the faculty hope to take action on.

- We hope to further improve recruitment in order to grow our masters and Ph.D. programs.
- The formalized M.S. degree and comprehensive exam requirements should be made explicit in the catalog. Thus far they are internal to the department.
- The syllabus of our core Topology course could be revised to include a more modern treatment that includes manifold theory.
- We need to formalize the Ph.D. requirements and state them in the catalog.
- The M.A.T. degree has not had students for several years. The faculty should consider dropping the degree, especially since it is not supported by the education department, and there is little interest among the math faculty in offering this degree.
- Teaching is an important skill that our graduate students, especially our Ph.D. students need to gain experience in. As our comparison to UW, UI and UND shows, most graduate programs in mathematics require their students to teach courses. We need to encourage more graduate students to teach. We anticipate increasing the number of graduate students who are given full responsibility for courses such as Math 107X and Math 108.

- As is noted in part I the Universities of Idaho, Wyoming and North Dakota are in states of comparable size to Alaska, yet the number of math faculty in these institutions is more than twice that for UAF. The small size of our faculty makes the job of running a graduate program, especially a Ph.D. program, very labor intensive. A major goal of the DMS should be to increase the size of the math faculty, to bring it in line with similar programs across the country.

Summary

Our M.S. program in Mathematics is strong and growing. Despite the small size of our faculty, we produce strong masters level students and most of them move on to a Ph.D. either within the department or elsewhere at top ranking institutions. Our Ph.D. program continues to strengthen and we support the efforts of our faculty, especially Sergei Avdonin, in this area. We are very active in efforts to adapt and improve our curriculum as the needs of the program change. These changes have been internally motivated by the need of our program and students. The one area of concern is the M.A.T. degree in Mathematics. As outlined above, it is time to consider deleting this program.

Jonathan Wiens
Sergei Avdonin
Ed Bueler

15 March, 2005

Appendix 5 – Responses to a survey of recent MS alumni

In Summer 2005 an alumni survey was sent to graduates of the M.S. program with graduation dates between 2000 and 2004. (There were no M.A.T. or Ph.D. graduates in this period.) This survey is part of the department's assessment plan (see Appendix 4).

Five surveys were sent and four returned for a return rate of 80%. The responses follow on the next eight pages.

Department of Mathematics and Statistics **Master's Degree Program**

The purpose of this survey is to collect information from our graduates in order to improve our program. Your name is not requested on this form so your responses are anonymous. Only summaries of responses will be reported and used for curricular improvement and for institutional accreditation purposes.

Current date: 09/09/2005

UAF Degree(s) earned and year: Masters (MS) in Mathematics, 2002

Are you

- ☐ Employed in a math-related field
- ☐ Employed in a non-math related field
- ☑ In graduate school in mathematics
- ☑ In graduate school in an area other than mathematics (area Applied Math)
- ☐ Other, please describe _____

Name of employer or graduate school: University of Minnesota, Twin Cities

What topics in your degree program were the most beneficial?

Real Analysis, Numerical Analysis, Statistics

What topics in your degree program were the least beneficial?

Algebraic topology (but that's only because I don't use it in my research!)

What additional topics do you wish you had the opportunity to learn while in the UAF Math program?

Topics in Applied or Pure Math (Some survey of open questions in different areas);
PDEs, Dynamical Systems

For each of the following fields, please indicate your response to the statement "The UAF Math program adequately prepared me in _____"	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Applicable
Abstract Algebra	☐	☐	☑	☐	☐	☐
Real Analysis	☑	☐	☐	☐	☐	☐
Topology	☐	☑	☐	☐	☐	☐
Complex Analysis	☐	☐	☐	☑	☐	☐

If you marked "Disagree" or "Strongly Disagree" in any of the above categories, please give details:

I've learned only basic techniques and didn't see deep connections to other topics (like real analysis, number theory). It's a beautiful subject but the course didn't push me enough to discover that.

Please indicate your response to the statement below:	Excellent	Very Good	Good	Fair	Poor	Very Poor
The quality of teaching in the math courses I took was _____.	☑	☐	☐	☐	☐	☐

Do you have any other comments on your years in the UAF math program? Any suggestions? Any things you particularly liked?

The two years at UAF have been the most unforgettable experience of my life! Words cannot do justice describing how much I learned about math and about myself, what I am capable of.
I will never forget strong support from the professors at the department. ~~Didn't tell any~~ the department is small, so you get to know everyone very quickly and professors are always accessible to students. Alaskan nature added romantic and pioneering spirit to the experience making it incomparable to any other program in the world.
Suggestions: offer some internships or summer schools (@ grad. level,

Department of Mathematics and Statistics

Master's Degree Program

The purpose of this survey is to collect information from our graduates in order to improve our program. Your name is not requested on this form so your responses are anonymous. Only summaries of responses will be reported and used for curricular improvement and for institutional accreditation purposes.

Current date: 7/20/2005

UAF Degree(s) earned and year: BS Math 1999, MS Math 2002

Are you

- [x] Employed in a math-related field
- [ ] Employed in a non-math related field
- [ ] In graduate school in mathematics
- [ ] In graduate school in an area other than mathematics (area _____)
- [ ] Other, please describe _____

Name of employer or graduate school: UAF

What topics in your degree program were the most beneficial?

Real Analysis, I enjoyed this class and feel that this is one of the ones that I got the most information out of.
I also enjoyed Topology

What topics in your degree program were the least beneficial?

Complex Analysis – I don't feel that I got as much out of this course as I did from many of the other courses, much of the stuff in this class was directly from the book, no extra examples or extra thought was given as needed. I felt class time was wasted regurgitating the book and exams were often on material not covered

What additional topics do you wish you had the opportunity to learn while in the UAF Math program?

More Graph Theory
more Numerical Analysis (methods)
maybe a little more computer programming or computer related mathematics

For each of the following fields, please indicate your response to the statement "The UAF Math program adequately prepared me in _____"	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Applicable
Abstract Algebra	☐	☐	☒	☐	☐	☐
Real Analysis	☐	☒	☐	☐	☐	☐
Topology	☐	☒	☐	☐	☐	☐
Complex Analysis	☐	☐	☐	☒	☐	☐

If you marked "Disagree" or "Strongly Disagree" in any of the above categories, please give details:
(See least beneficial)
I don't feel that I learned anything in this class... I do know the book well but if asked to elaborate on any of the topics, I don't think I would be able to.

Please indicate your response to the statement below:	Excellent	Very Good	Good	Fair	Poor	Very Poor
The quality of teaching in the math courses I took was _____.	☐	☒	☐	☐	☐	☐

Aside from Complex

Do you have any other comments on your years in the UAF math program? Any suggestions? Any things you particularly liked?

I enjoyed taking classes within this department. However I felt that the MS program was rather rushed. It seemed as though I was not encouraged to take many classes that would make my degree take longer than 2 years. [redacted], that was the main reason I did not do a thesis and ended up doing a project. I think this might be something to encourage more in the future especially if some of the other classes will tie into what they want to do in the future.

Department of Mathematics and Statistics **Master's Degree Program**

The purpose of this survey is to collect information from our graduates in order to improve our program. Your name is not requested on this form so your responses are anonymous. Only summaries of responses will be reported and used for curricular improvement and for institutional accreditation purposes.

Current date: _____*11/01/05*_____

UAF Degree(s) earned and year: _____*MS Mathematics 2003*_____

Are you

- ☐ Employed in a math-related field
- ☐ Employed in a non-math related field
- ☐ In graduate school in mathematics
- ☐ In graduate school in an area other than mathematics (area *Interdisciplinary*_____)
- ☐ Other, please describe _____

Name of employer or graduate school:_____*UAF, GI*_____

What topics in your degree program were the most beneficial?

Real Analysis, Time Series Analysis, Topology, Mathematical physics(even though I took it before in my previous univ.)

What topics in your degree program were the least beneficial?

Everything not included above

What additional topics do you wish you had the opportunity to learn while in the UAF Math program?

Linear algebra, operator theory, perturbation analysis, partial differential equations

For each of the following fields, please indicate your response to the statement "The UAF Math program adequately prepared me in _____"	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Applicable
Abstract Algebra	☐	☐	☐	☐	☐	☐
Real Analysis	☐	☐	☐	☐	☐	☐
Topology	☐	☐	☐	☐	☐	☐
Complex Analysis	☐	☐	☐	☐	☐	☐

If you marked "Disagree" or "Strongly Disagree" in any of the above categories, please give details:

I have no competence to answer above questions, since I do not work in the Math related field any more. In the field I am working in right now, it is more than enough. I wish I could study Sobolev spaces in more details.

Please indicate your response to the statement below:	Excellent	Very Good	Good	Fair	Poor	Very Poor
The quality of teaching in the math courses I took was _____.	☐	X Core	☐	☐	X Non-Core	☐

Do you have any other comments on your years in the UAF math program? Any suggestions? Any things you particularly liked?

Department of Mathematics and Statistics

Master's Degree Program

The purpose of this survey is to collect information from our graduates in order to improve our program. Your name is not requested on this form so your responses are anonymous. Only summaries of responses will be reported and used for curricular improvement and for institutional accreditation purposes.

Current date: _*08/11/05*_____

UAF Degree(s) earned and year: ___*MS,2002*_____

Are you

- ☐ Employed in a math-related field
- ☐ Employed in a non-math related field
- *X* In graduate school in mathematics
- ☐ In graduate school in an area other than mathematics (area _____)
- ☐ Other, please describe

_____

Name of employer or graduate school:____*Duke University*_____

What topics in your degree program were the most beneficial?

real analysis, teaching seminar, numerical PDE (615)

What topics in your degree program were the least beneficial?

none

What additional topics do you wish you had the opportunity to learn while in the UAF Math program?

advanced linear algebra

For each of the following fields, please indicate your response to the statement "The UAF Math program adequately prepared me in ____"	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not App
Abstract Algebra	☐	☐	X	☐	☐	☐
Real Analysis	X	☐	☐	☐	☐	☐
Topology	☐	X	☐	☐	☐	☐
Complex Analysis	☐	X	☐	☐	☐	☐

If you marked "Disagree" or "Strongly Disagree" in any of the above categories, please give details:

real analysis by Ed Bueler with weekly hwk assignments and in-class tests gave a very good basis.

Please indicate your response to the statement below:	Excellent	Very Good	Good	Fair	Poor	Very I
The quality of teaching in the math courses I took was _____.	☐	X	☐	☐	☐	☐

Do you have any other comments on your years in the UAF math program? Any suggestions? Any things you particularly liked?

Comparing to Duke, UAF MS math program is at a solid upper undergraduate level: it gave me a good preparation to enter the Duke's program but not enough to get credit for any graduate classes I took at UAF.

I liked to work in the MathLab - this was helpful to refresh Calc 3, linear algebra & diff. eq., as well as a perfect place to improve my english.

I liked the atmosphere at UAF: freedom and care about the students. Everyone was VERY helpful and supportive. I felt as I was a child of the department. :) These 2 years at UAF were my best years!

I still dream about coming back one day.

Appendix 6 –Current Students and Recent Graduates (since 2000)

Alphabetical list of current students with admission semester ("S0x" for Spring or "F0x" for Fall), degree program, and advisor (if chosen) :

Anthony, Amy (F05, MS); *on leave Fall 2005*
Bulanova, Anna (S03, PhD); *Avdonin*
de Forest, Russell (F05, MS)
Godabrelidze, Vasil (F05, PhD); *Avdonin*
Groshev, Valeri (S04, PhD); *Avdonin*
Jafarov, Elchin (F03, PhD); *Avdonin*
Johnston, Andrew (F05, PhD)
Kallen-Brown, Jed (F04, MS); *on leave Fall 2005; Bueler*
Keith, Amy (F04, MS); *Faudree*
Luz, Robert (F04, MS)
Mikhailov, Victor (F04, PhD); *Avdonin*
Stroh, Jacob (F03, MS); *Bueler*

Graduates (descending by year; alphabetically within year) with project or thesis title and advisor :

- Carlson, Tim (MS 2005); Thesis: Magnus' expansion as an approximation tool for ODEs; *Bueler*
- Fillipov, Igor (MS 2005); Project: Controllability of an elastic ring with variable tension; *Avdonin*
- Nicolsky, Dmitry (MS 2003); Project: Exponential decomposition of time series using linear regression; *Rybkin*
- Averina, Victoria (MS 2002); Thesis: Symbolic stability of delay differential equations; *Bueler*
- Belov, Sergei (MS 2002); Thesis: Trace formulas for a half-line Schrodinger operator with a long-range potential; *Rybkin*
- Bowman, Latrice (MS 2002); Project: Numerical analysis of ice flow; *Bueler*
- Korotiaev, Mikhail (MS 2002); Thesis: Critical points of the heat kernel on a compact semi-simple Lie group; *Bueler*

Appendix 7 – An informal survey of PhD-granting Mathematics department sizes

Appendix 9 is a survey of UAF DMS faculty opinions on, among other topics, the necessary and desired size of a PhD-granting department in Mathematics. Note that PhD students in Mathematics must select a research area from a wide list of essentially separate research areas (e.g. analysis, algebraic topology, algebra, differential geometry, probability, logic, among others). Furthermore, PhD students in Mathematics at US universities traditionally take many (e.g. 10 to 20) graduate-level courses. They do so in part to prepare for research, and in part to prepare for the wide-spread undergraduate teaching obligations (e.g. in the areas mentioned above).

One faculty member, in responding to a question in the anonymous survey in Appendix 9, did an informal survey of department sizes for PhD-granting institutions, as follows:

> To convince myself that [a size of around 15 tenure-track or tenured mathematicians] is reasonable, I looked at a group of schools ranked by the AMS in the lowest tier (of three) of PhD granting math departments. These are schools such as University of Wyoming (group III), not University of Oklahoma (group II) or University of Oregon (group I). In an unscientific fashion, I visited each department's home page and attempted to count the number of PhD possessing tenure track faculty in mathematics (but not computer science or statistics); it wasn't a very exciting job, but it didn't take all that long. I tried to count conservatively, so the true sizes might be a bit larger. The spreadsheet is [below]. Only 5 of 27 had a faculty size under 15 (one each at 7, 8, 10, 12, and 14). It should be noted, though, that UT Dallas with 7 math PhD faculty (as part of a larger math/stats department with 20 professors and instructors) offers an applied math PhD and seems surprisingly productive. Regardless, somewhere around 15 seems to me like a reasonable minimum size to support a mathematics PhD program.

In particular, the numbers on the next page *do not* include Instructors.

School	Math faculty	Comments
		(+ indicates estimate is probably very conservative)
University of Alaska, Fairbanks	**8.5**	one faculty member has joint appointment with Education
Bowling Green State University	16	
Clarkson University	10	
Colorado School of Mines	8	
Drexel University	15	+
George Washington University	18	
Howard University	28	
Idaho State University	19	
New Mexico State University, Las Cruces	24	
Northern Illinois University	21	+
Ohio University, Athens	20	+
Old Dominion University	17	specializes in applied math, teaching, stats
Southern Illinois University, Carbondale	30	
Southern Methodist University	20	very applied focus
St. Louis University	28	
Stevens Institute of Technology	15	+ postdocs
University of Alabama, Huntsville	12	PhD in applied math only
University of Alabama, Tuscaloosa	29	
University of Louisiana, Lafayette	18	
University of Maryland, Baltimore	16	
University of Mississippi	14	
University of Missouri, Rolla	16	- (might include statisticians)
University of Rhode Island	18	
University of South Florida	20	+
University of Texas, Dallas	7	PhD in applied math only, graduating ~1 per year!
University of Wisconsin, Milwaukee	20	+
University of Wyoming	20	
Western Michigan University	19	(not counting the math ed faculty, which support a separate math ed PhD)

Appendix 8 – Current UAF catalog descriptions

B.A., B.S., M.A.T., M.S., Ph.D. Degrees

Minimum Requirements for Degrees: M.A.T.: 36 credits; M.S.: 30-35 credits; Ph.D.: 18 thesis credits

The number of new fields in which professional mathematicians find employment grows continually. This department prepares students for careers in industry, government and education.

The M.S. in mathematics prepares students for Ph.D. work, in addition to providing a terminal degree for those planning to enter industry or education. The M.A.T. degree prepares graduates to teach secondary school mathematics. The aim of the Ph.D. program is to provide the student with the expertise to accomplish significant research in applied or pure mathematics, as well as to provide a broad and deep professional education.

In addition to the major programs, the department provides a number of service courses in support of other programs within the university. Current and detailed information on mathematics degrees and course offerings is available from the department.

The department maintains a math lab for all students studying mathematics at the baccalaureate level.

The Department of Mathematical Sciences also offers programs in computer science and statistics (see separate listings).

Graduate Program--M.A.T. Degree

1. Complete the following admission requirements:
    a. The department does not require any GRE, but recommends applicants provide GRE general scores.
    b. Complete and submit a TOEFL score of at least 600 (this requirement is only for foreign applicants who seek a teaching assistantship).
    c. The department gives preference to foreign applicants who also submit results of the Test of Spoken English (TSE).
2. Complete the general university requirements.
3. Complete the M.A.T. degree requirements.
4. Complete the following:
   MATH courses* 18
5. Minimum credits required 36

   ** At least 12 credits must be at the 600-level.*

Graduate Program--M.S. Degree

1. Complete the following admission requirements:
    a. The department does not require any GRE, but recommends applicants provide GRE general scores.
    b. Complete and submit a TOEFL score of at least 600 (this requirement is only for foreign applicants who seek a teaching assistantship).
    c. The department gives preference to foreign applicants who also submit results of the Test of Spoken English (TSE).
2. Complete the general university requirements.
3. Complete the master's degree requirements.
4. Complete mathematics courses and electives.
5. Complete a project or thesis.
6. Minimum credits required 30-35

Graduate Program--Ph.D. Degree

1. Complete the following admission requirements:
    a. The department does not require any GRE, but recommends applicants provide GRE general scores.
    b. Complete and submit a TOEFL. (For teaching assistantship consideration, foreign applicants whose native language is not English. Score of at least 600.)
    c. The department gives preference to applicants who also submit results of the Test of Spoken English (TSE).
2. Complete the general university requirements.
3. Complete the Ph.D. degree requirements.
4. Minimum credits required 18

Appendix 9 – Responses to a survey of DMS faculty on the future of Mathematics graduate programs

On 18 October 2005, one faculty member created the survey which follows and sent it to all tenured and tenure-track faculty in Mathematics. All replied. The replies appear on the next page. They have been made anonymous.

The purpose of the survey was to explore the current state of opinion on our graduate programs and the extent of each faculty member's commitment to each program in terms of advising students.

A summary of those opinions which are either unanimous, or reflect a majority opinion in the department, includes the following:

- A strong majority of the faculty either are currently MS advisors or are willing to be at the present time.
- If the department is to remain a PhD granting department then it must grow. Growth by a factor of two, or at least to greater than 12 faculty members, is essential.
- No department member expects the department to devote the majority of its resources to a PhD program. (There are varying opinions on the optimal fraction of department effort which should be devoted to this program.)
- A majority either do not know what is expected of MAT students and/or would not choose to advise such a student at the present time.

On other issues addressed in this survey there are substantially various opinions. This is the reason the answers are presented in their original form.

With regard to the ***teaching*** of graduate courses there is an **established tradition of sharing across the whole department.** In fact, suppose we denote by the letters "a" through "f" the tenure-track or tenured Mathematics faculty who were employed by DMS at some time between Fall 2000 and Spring 2005 *and* who remain on the faculty. (This lettering scheme is unrelated to the numbering scheme in the survey responses on the next pages.) These faculty taught the following Mathematics graduate courses:

a. 608, 641, 645, graduate seminars, reading courses
b. 615, 630, 641, graduate seminars, reading course
c. 631, 600, graduate seminar
d. 631, 600, reading course
e. 641, 651, graduate seminar, reading course
f. 611, 612, reading courses

Note that 631, 641, 645, and 651 are 4.0 credit courses while 608, 611, 612, 615, and 630 are 3.0 credit courses and 600 is the 1.0 credit Teaching Seminar

Survey:

*1. How *big a (mathematics) department do you want*, given the current size of UAF, whether or not we want a PhD program? (That is, how many permanent PhD-in-Mathematics-possessing tenure-track faculty?)*

I: 12 to 16 such faculty
II: 15-20
III: 15
IV: 18
V: The numbers suggested in the mid-teens sound great to me. But this is, in some sense, a selfish want, and I'm still not sure how big a math department UAF needs.
VI: Mid-teens. This is assuming that we continue to have permanent instructors like [our current two instructors]. Otherwise, mid- to upper-teens.
VII: Mid teens sounds about right, but I'm not sure how realistic it is unless money becomes flush.
VIII: I'm not sure how to answer this question without knowing in which direction we are to expand. In general, the typical math department of a university of our size is twice as big and has at least twice as many grad students. Would we be able to recruit that many quality students even at the master level? I have some doubts. If we keep fewer but better students we are much more attractive to quality applicants.
IX: 12-15

*2. If the mathematics part of the department were as large as you desire, and supposing this department had a PhD Mathematics and/or PhD Applied Mathematics program, what maximum *percentage of the total of all department workload* should be for this program? Minimum percentage?*

I: Maximum of 20%. Minimum of 0%. (Re minimum: If the dept. were this big I would still be happy with just an MS. Also, with a sufficiently large department I would be willing to have a PhD program on the books "just in case" because we would have the power to support it.)
II: 10-25%
III: I'm not sure how to answer this. For example at most PhD granting institutions I know of, new faculty get a lighter teaching load, no service expectations, etc in order to get a sufficiently big research program going. So even though workload might be 50-50 teaching/research the research is in essence part of supporting the graduate program...
IV: 0-50% - all faculty should still do some teaching at lower levels as well as service.
V: In a healthy PhD program a majority of faculty (60%?) would have a student, and several would have more than one. I don't know how to quantify this in terms of workload.
VI: A fixed amount of credit should be given for advising theses. The department should decide what amount is appropriate.
VII: Given the other needs to be served (so assuming finite but large resources), probably a max of 1/4.

VIII: I'm not sure what to answer this one either. Under which category advising should actually belong to - teaching, research, or service? Strong research oriented students can help with research, while never graduating students waste advisor's time from all three components. (I have not heard if we ever had such students but some other department do and in quite large number)

*3. Would *you* be willing *now* to supervise an MS student who had abilities in the range of those of our current graduate students and was interested in working in your general area of expertise?*

I, II, III, IV, VIII: Yes.
V: Not quite yet. I'm struggling to establish my own research program after graduation, and I don't have good ideas for masters projects right now. This needs to change, and I would expect that my answer to this question would be an unqualified yes before this time next year.
VI: I have no idea about the abilities of our current graduate students so can not base an answer on that. "Yes" on general principle. I would like my workload to be divided to reflect this however.
VII: Yes, but I really have no idea what the range of current students is.

*4. Would *you* be willing *now* to supervise an MAT student who had abilities in the range of those of our current graduate students and was interested in working in your general area of expertise?*

I: No. (At this point I am not clear enough on what that degree means, and I don't know that I have the expertise to do it.)
II: No
III: maybe. with [a mathematics education faculty member] as co-supervisor.
IV: not alone, but if working with an ed person (includiing tr) then why not?
V: No. But I liked [IV's] and [III's] answers to this question that raised the possibility of working with someone else who was an expert in math ed, and this is something I'd be more open minded about.
VI: Probably. It's a tall order though. Seems very, very unlikely that such a student would come along.
VII: Yes, with some assistance from a mathematics education faculty member] to ensure they were doing something useful for a teacher. But from my inqueries, it seems unlikely the MAT program will draw any students with its current setup.
VIII: Yes
IX: I would be happy to work with MAT students should any materialize, but as I've shared before, I think it's unlikely we'll get any given the current configuration of the program.

*5. Would *you* be willing *now* to supervise a PhD student who had abilities in the range of those of our current graduate students and was interested in working in your general area of expertise?*

I: No. (I am not productive enough in research terms nor well-enough connected. Also I think we cannot serve the best interests of such students because of our lack of sufficient faculty and thus courses, etc.)
II: Yes
III: No. I don't do enough research. In my area, there are too many other places with more opportunities (more faculty, more students, more seminars, more RA's etc) AND that are in need of good students.
IV: sure. Under limited circumstances. But in most cases a student's Interests would be better served going somewhere else for a doctorate.
V: No.
VI: Given the right student at the right time under the right circumstances, "yes".
VII: Possibly, but with no direct contact with grad students here yet, I have no idea what the range of abilities is, or what student goals are. My concern is primarily with whether the student will be prepared well for the career they are shooting for, and I need a concrete student to be able to answer that.
VIII: Yes, I would for a right grad student.
IX: ... it is very unlikely that I would be working directly with Ph.D. students in math (given my background at the research and doctoral level in math ed.). ... My hunch is that prospective students interested in pursuing a Ph.D. in math here can only do this now within a narrow range of topics (e.g., within [II's] and [VIII's] research areas?). If this is the case, than our program is pretty narrow in scope and a larger faculty is clearly needed -- I think this line of reasoning was implicit in several collleagues' responses, but may not have been stated explicitly.

6. Would you like to keep the existing PhD program in Mathematics if our faculty remains the same size as it is now (i.e. 8.5 permanent PhD-in-Mathematics-possessing tenure-track faculty)?

I: No.
II: Yes. If at least three of us would take an active part in this program we could (partly) compensate a shortage of graduate courses by individual work with students. Notice also that [I and V] (I believe, they do not like to keep the program *now*) are very active in teaching graduate courses, and their example is very encouraged.
III: No.
IV: yes. But my answer is really dependent on others....mostly [II]. If Some want to continue vigorously working with PhD students, I say let them.
V: I don't think so. Our department is too small, and perhaps more importantly, there are no mathematical resources near Fairbanks to supplement what we cannot offer. But I do not support dropping the program without first answering for ourselves whether or not [II's] vision of a department offering an applied math PhD with strong ties to the research institutions is something we want to try to build and work towards.
VI: I don't know enough to answer this question as well as I would like. I do not think it is a good idea to eliminate a Ph.D. degree from the books. Having the Ph.D. as an option makes for a more flexible program.

VII: I think it's best to officially keep it. For some students and advisors it may be effective, and it does keep options open for everyone. The question in my mind is more about how much it should be emphasized.
VIII: Yes. We have some PhD students which are both PhD material and right for our program. By talking about closing our PhD program we are actually betraying them. What if they find out that our PhD program is about to go bankrupt? I personally feel very uncomfortable.

6'. If the answer to question 6 is no, how many faculty would be sufficient to have a PhD program in Mathematics?

I: 13.
II: My answer to question 6 is yes, however, I agree that we should be much bigger (at least 13-15) to manage PhD program efficiently. I believe that it will be easier to extend the department if we keep the PhD program. If we eliminate the program, we have almost no chances to do that.
III: I think we need at least 4 or 5 people willing to take on PhD students. That is, people willing to chair their committees, supply reading courses / seminars on the side when necessary, get funding for assistantships.
IV: the answers given by others certainly make sense. And really apply to the MS as well. We're running with a few cylinders blown here and things need fixing.
V: I hadn't thought about this question until recently. The numbers suggested by others seemed to hover around 15. [... continued in Appendix 7]
VI: No answer because of part 6 above
VII: I'd be more comfortable with mid teens or more.
VIII: No answer because of part 6 above.

Appendix 10 – Enrollment in graduate mathematics courses since Fall 2000

Enrollment (sections) by semester 2000-2005

MATH	Fall 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	Spring 2005	Fall 2005	Spring 2006
421	21		9		8		18		24		8	
422		16		10		20		19		22		Scheduled
460	11		6		Cancel		Cancel		Cancel		Cancel	
600	7		5		4		Cancel		Cancel		Cancel	
608					3				6			
611	?		5?		?		18?		?		6	
612		?		6?		?		10?		?		Scheduled
615				10				Cancel		15		
621												
630	Cancel						9					
631	6				5				6			
632												
641	4		4				5				9	
642	Cancel		Cancel									
645				6				6				Scheduled
651						5				11		
655			5									
660		9				6						
661	1											
663				Cancel						Cancel		Scheduled

Appendix 11 – Publications by graduate students, 2000-2005

The following are *peer-reviewed journal articles and conference proceedings* of which at least one (co-)author is a graduate student in Mathematics who is either a current student or graduated after Spring 2000. They are listed in reverse chronological order and then alphabetically by first author. The graduate student authors are in **bold**.

- **Viktoria Averina**, Ilya Kolmanovsky, Alex Gibson, Gary Song, and Ed Bueler. (2005). *Analysis and Control of Delay-Dependent Behavior of Engine Air-To-Fuel Ratio.* IEEE Conference on Control Applications, August 2005, Toronto, Canada.
- Ed Bueler, Craig S. Lingle, **Jed A. Kallen-Brown**, David N. Covey, and **Latrice N. Bowman**. (2005). *Exact solutions and the verification of numerical models for isothermal ice sheets.* J. Glaciology, **51** no. 173, 291—306.
- Haitao Ma, Venkatesh Deshmukh, Eric Butcher, and **Victoria Averina**. (2005). *Delayed State Feedback And Chaos Control For Time-Periodic Systems Via a Symbolic Approach.* Communications in Nonlinear Science and Numerical Simulation, **10** no. 5, 479—497.
- **Belov, Sergei** and Rybkin, Alexei. (2004) *On the existence of WKB-type asymptotics for the generalized eigenvectors of discrete string operators.* Bull. London Math. Soc. **36** no. 2, 241--251.
- **Belov, S. M**, Avdonina, N. B., Felfli, Z., Marletta, M., Msezane, A. Z., and Naboko, S. N. (2004). *Semiclassical approach to Regge poles trajectories calculations for nonsingular potentials: Thomas-Fermi type.* J. Phys. A **37** no 27, 6943--6954.
- Eric A. Butcher, Haitao Ma, Ed Bueler, **Viktoria Averina**, and Zsolt Szabo. (2004). *Stability of time-periodic delay-differential equations via Chebyshev polynomials.* Int. J. Numerical Methods in Engineering, **59** no. 7, 895—922.
- **Belov, S. M.** and Rybkin, A. V. (2003). *Higher order trace formulas of the Buslaev-Faddeev-type for the half-line Schrödinger operator with long-range potentials.* J. Math. Phys. **44** no. 7, 2748--2761.
- Avdonina, N. B., **Belov, S.**, Felfli, Z., Msezane, A. Z., and Naboko, S. N. (2002). *Semiclassical approach for calculating Regge-pole trajectories for singular potentials.* Phys. Rev. A (3) **66** no. 2, 022713, 7 pp.

Appendix 12 – MS Comprehensive exam sign-up sheet

Comprehensive Exams for MS and PhD in Mathematics in Spring/Summer 2006

These comprehensive exams, required for all MS and PhD students, are three 1.5 hour written exams to be completed within one week. Dates and times will be determined in consultation with students.

The subjects covered on the exam must include at least two of the four core courses (i.e. at least two of: Math 631 Algebra I, Math 641 Analysis I, Math 645 Complex Analysis, Math 651 Topology). The third subject may be chosen from some other 600-level lecture or independent-study course in mathematics. The choice of exam subjects requires the approval of the student's committee. It is preferred that none of the exams cover courses in which the student is currently enrolled, but the committee has discretion on this. For each core subject, two faculty members will jointly write and grade each exam. For non-core subjects, the student's committee will be in charge of the grading of the exam.

The exams will be at most as hard as the written final for the corresponding courses, and students will be given some choice of problems. Certain problems at a prerequisite level to the graduate course in question should be expected.

If the student does not pass two or three of the exams, then he or she must wait at least one semester and must take the entire comprehensive examination (i.e. three exams) again. If a student passes exactly two of the three parts, then the student may retake the remaining part once before the start of the following semester.

These comprehensive exams are necessary but not sufficient to complete the examination requirements for Ph.D. students. Further examinations, presumably oral, in the area of the dissertation are expected and are the responsibility of the student's committee.

++

Student Name:_____ Date:_____

Semester of first enrollment in the MS/PhD Math program:_____

Do you plan to take the comprehensive exams in Spring/Summer 2006?:

Yes / No

Signature of your Committee Chair (required in either case):

_____

If "Yes" above, complete the following:

Core Subject 1:_____

Core Subject 2:_____

Other Subject:_____

(Description of third exam if not core:_____

_____.)

Signatures of two faculty members who are willing to prepare and grade the third exam (if not core):

_____

_____

Appendix 13 – Salary comparison based upon Oklahoma Survey and American Mathematical Society data

First we report the salary breakdown in DMS. Because of the small numbers of individuals involved we have been careful about what information is reported. The mean salary for full professors can be given but not the median because of the small number of individuals involved (n=3). Because there is only one assistant professor, no information is given concerning that rank.

UAF Department of Mathematics and Statistics		
	Median	Mean
Assistant Professor	-	-
Associate Professor	60,000	60,200
Full Professor	-	73,610

Next we report the "Oklahoma Survey" data. More precisely, the source is the *2004-2005 Faculty Salary Survey of Institutions Belonging to National Association of State Universities and Land-Grant Colleges (Oklahoma Survey)*. Note that UAF is classified as Carnegie Class: "Other (Doc I and II)." There are several relevant "disciplines" for mathematics and statistics (namely, 27, 27.01, and 27.0101), and we include all of these.

Other (Doc I and II) Discipline: 27. Mathematics and Statistics			
	Low	Average	High
New Assistant Professor	42,750	49,119	67,000
Assistant Professor	35,000	51,554	72,510
Associate Professor	45,817	63,151	94,699
Full Professor	45,000	84,455	151,085

Other (Doc I and II) Discipline: 27.01 Mathematics			
	Low	Average	High
New Assistant Professor	42,750	48,889	67,000
Assistant Professor	35,000	51,406	72,510
Associate Professor	45,817	63,832	94,699
Full Professor	45,000	85,650	151,085

Other (Doc I and II) Discipline: 27.0101 Mathematics, General			
	Low	Average	High
New Assistant Professor	42,750	48,705	67,000
Assistant Professor	35,000	51,043	72,510
Associate Professor	45,817	64,051	94,699
Full Professor	45,000	83,991	151,085

Finally, we report the American Mathematical Society data (*2004 Annual Survey of Mathematical Sciences*, Notices of the American Mathematical Society, Vol. 52, no 2 (2005), p. 236-251). The AMS is one of several possible sources for this data, but it is most appropriate to the largest group of faculty in DMS (namely, tripartite mathematics faculty). Here there are three "Groups" of universities to compare to. UAF is part of Group III, which are PhD-granting departments ranked too low (by AMS) to appear in Group I (Private) or Group II (Public). We also include the next two lower ranked groups for completeness.

Group III Faculty Salaries. Doctoral degree - granting departments of math		
	Median	Mean
Assistant Professor	53,630	54,349
Associate Professor	59,530	63,297
Full Professor	76,940	79,756

Group M Faculty Salaries. Master's degree - granting departments of math		
	Median	Mean
Assistant Professor	48,690	51,972
Associate Professor	58, 730	61,603
Full Professor	75,760	81,785

Group B Faculty Salaries. Bachelor's degree - granting departments of math		
	Median	Mean
Assistant Professor	47,310	48,511
Associate Professor	55,990	57,542
Full Professor	70,640	73,745

Thus, although our salaries are close to national averages, they are not quite at the average. In particular, the mean Associate professor in DMS makes $3000 to $4000 less per year than the national average.

Below average faculty salary is a significant problem in recruiting new faculty, because applicants expect Alaska to have a higher cost of living, among other reasons, and in retaining faculty. A significant amount of our recent turnover can be attributed to this cause, as a majority or significant reason for departure.