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Department of Applied Mathematics

Applied Mathematics Department Publications

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2010-06

## Department of Applied Mathematics Academic Program Review, Self Study / June 2010

Borges, Carlos F.

Monterey, California, Naval Postgraduate School

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# Department of Applied Mathematics Academic Plan

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## VISION

We will provide a solid mathematical foundation for our students as they make the transition into graduate curricula. We will provide high-quality instruction in all our courses, giving emphasis to relevant and modern mathematical techniques in our advanced courses. We will encourage our students to develop and utilize skills in analysis, reasoning, creativity, and exposition as they acquire knowledge of mathematics and its applications.

We will maintain active research programs, making a special effort to respond to the needs of the NPS, DoN and DoD communities. By adhering to the most stringent standards of scholarship, we will ensure that NPS continues to hold the respect of the community of scholars worldwide.

We will continue to serve the NPS community by keeping active in the governance of the School. We will serve our client curricula by ensuring, to the best of our ability, that our service courses meet their needs. We will serve our profession, not only through scholarship but also by our involvement in professional organizations and by our editorial and administrative contributions to the growing body of mathematical knowledge.

## MISSION

The NPS Applied Mathematics Department is committed to excellence. Our purpose is to provide an exceptional mathematical education focused on the unique needs of our students, to produce relevant research, and to provide quality service to the community. Furthermore, we are committed to maintenance of a well-designed curriculum and a supportive environment for our students.

## PROGRAM QUALITY

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### METRICS OF TEACHING EXCELLENCE

- Student Opinion Forms
- Classroom visits by mentor faculty
- Review of course materials
- Direct feedback from students

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### METRICS OF RESEARCH EXCELLENCE

- Marto report
- Peer reviewed publication
  - Journal quality (impact factor, editorial board, etc.)
  - Sole/Lead authorship
  - Citations
- Books
- Conference presentations (requires travel funds)
- Research relevance
- Distinction in professional societies

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## CORE COMPETENCY AREAS

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- Applied Analysis (near term hiring priority – Game Theory)
  - Numerical Analysis / Scientific Computing
  - Discrete Mathematics

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## WORKFORCE

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### FACULTY

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We currently have sixteen tenure track faculty and one distinguished visiting faculty covering three focus areas.

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#### APPLIED ANALYSIS

- 
- Don Danielson
  - Chris Frenzen
  - Wei Kang
  - Art Krener
  - Guillermo Owen
  - Clyde Scandrett
- 

#### NUMERICAL ANALYSIS / SCIENTIFIC COMPUTING

- 
- Carlos Borges
  - Fariba Fahroo
  - Frank Giraldo
  - Bill Gragg
  - Beny Neta
  - Hong Zhou
- 

#### DISCRETE MATHEMATICS

- 
- David Canright
  - Hal Fredricksen
  - Raluca Gera
  - Craig Rasmussen
  - Pante Stanica

In addition we have three non-tenure track faculty.

- Les Carr
- Doyle Daughtry
- Bard Mansager

These faculty are retired O5's (from the US Navy, US Air Force, and US Army respectively) who have appointments as lecturers. Les Carr has a doctorate from NPS and Bard Mansager is currently working on a doctorate from NPS. We also have access to Emeritus Professor Art Schoenstadt who sometimes teaches for us on a contract basis. Prof. Schoenstadt is a Schieffelin Award winning instructor with over 30 years experience at NPS. Getting him into rehired annuitant status is a priority action item for the department.

Of the sixteen tenure track faculty one is on leave of absence (Fahroo) and one is serving as Chair (Borges).

Assuming an average teaching load of 4.5 sections per year we can cover 70 sections per year with the remaining 14 tenure track faculty. Looking back at AY08 confirms this as the tenure track faculty taught exactly 70 of the 86 sections offered. That gives a teaching distribution, by sections, of 81% taught by tenure track and 19% taught by non-tenure track. Breaking it down by weighted teaching credit gives a distribution of 83% taught by tenure track and 17% taught by non-tenure track.

We believe that no more than 30% of teaching should be done by non-tenure track faculty and are happy with the current size and mix of faculty. We do, however, have a fairly pressing need to put Prof. Art Schoenstadt on rehired annuitant status so that we can access his services on short notice. This need often arises when a faculty member has a sudden research opportunity or during the summer and fall quarters when the department typically has a very high teaching load. We currently contract for his services when this happens but the contracting process can be tedious and difficult.

## FACULTY RESEARCH FUNDING

Currently five of the fifteen tenure track faculty (this count excludes Fahroo who is on loan to AFOSR) have external research funding. Of these one can cover only the two month intersessional period and therefore will teach five classes under the 10 month model, two can cover three months of salary which allows them to teach just four classes under the 9 month model, and one is able to cover six months of salary which allows him to teach just two classes under the 9 month model. The remainder of the faculty generally teach five classes under the 10 month model and take two months of unpaid leave during their intersessional during which time they work on unfunded research.

This distribution of external funding (one third of faculty having summer support) is slightly above average for Mathematics departments across the United States.

## FACULTY HIRING

We have recruited four new faculty over the last few years and, at the current time, we have no need for further recruiting. Continued declining enrollments in GSEAS strongly suggest that prudence is the rule of the day in terms of hiring. We do have a number of faculty members who are eligible for retirement; as they retire we must be prepared to respond based on enrollment trends within GSEAS and in technical programs at NPS in general. Currently, however, none of our faculty has any retirement plans prior to 2013.

## FACULTY CAREER ISSUES

In order to succeed in the profession, we must publish. This activity is fostered and publicized by attendance at conferences, presentations at other universities, and other research related travel. Very few of our faculty members have sufficient external funding to support such travel and hence the primary avenue we have to support such travel is our limited OPTAR budget. The result of this is that many faculty are rarely able to participate in conferences or other external research interactions. This is a very serious issue for us and needs to be addressed.

Another very serious issue is the teaching profile in the department. In particular, Math faculty teach a disproportionate number of classes at the 1000 and 2000 level. There is almost no opportunity to teach at the 4000 level which has a very negative impact on the ability of faculty to develop and maintain active research programs. The table below summarizes the distribution of teaching (by weighted teaching credit) at the various levels across four GSEAS departments (MA, PH, MAE, EC) for AY08.

	MA	PH	MAE	EC
<b>4000</b>	7%	24%	43%	31%
<b>3000</b>	25%	37%	40%	37%
<b>2000</b>	14%	23%	16%	32%
<b>1000</b>	54%	16%	1%	0%

The contrast in teaching profiles is both clear and critical. The Department of Applied Mathematics is unique in that we do nearly 70% of our teaching at the first and second year undergraduate levels (1000 and 2000). This impacts faculty careers in two ways. First, the extremely limited graduate level teaching makes it far more difficult to develop and maintain an active research program. Second, the importance of effective undergraduate level teaching makes classroom excellence a far more critical issue in promotion and tenure decisions than it is in other departments.

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## RESEARCH STAFF

We currently have no research staff. We do, however, regularly have Postdoctoral fellows working in the department.

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## ADMINISTRATIVE STAFF

Our current staffing of one ASA and one OA is adequate for our needs. Unfortunately, there is insufficient staff labor budgeted for us to pay the staff. This is an ongoing problem and needs to be addressed school wide.

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## MILITARY FACULTY

We currently have none, and are seeking none.

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## ACTION ITEMS

- Improve the teaching profile of the department – increase the percentage of graduate level teaching by tenure track faculty.
- Ensure appropriate budget is provided to support staff labor.
- Secure regular internal funding for faculty travel to conferences and workshops.
- Place Professor Art Schoenstadt in re-employed annuitant status.
- Track retirement plans of senior faculty.

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## LABORATORY AND INFRASTRUCTURE SUPPORT

None is required beyond basic office computing capabilities that support both research and teaching.

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## FACULTY RESEARCH EXPECTATION

The Marto report provides an appropriate template for measuring faculty research productivity throughout NPS. This also applies within the MA department and, moreover, every tenure track faculty member was hired under this model. As a general rule, Mathematics departments judge research output almost exclusively in terms of peer-reviewed publications, but this model does not fit well within NPS, where the need to address DoD-relevant problems tends to preclude faculty members from developing traditional research programs.

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## SPECIFIC STEPS TO ENHANCE THE DOCTORAL PROGRAM

There are various issues that must be addressed in order to expand the Doctoral program to include civilian students. Most critical is addressing the issue of SECNAVINST 1524.2B ("Programs of education shall not be offered at the NPS if programs of comparable cost, quality, and focus are readily available at other institutions."). This instruction appears to specifically preclude us from offering a civilian PhD in Applied Mathematics.

Furthermore, expansion of the Doctoral program to include civilian students will require extensive retooling. Common to most of our presumed peer programs is a degree of disciplinary heft that is largely lacking in NPS programs, including our own. If we want to compete with civilian schools, we need to significantly upgrade our program, starting at the foundation level with a new stratum of PhD-level courses. In order to accomplish this GSEAS will need to provide:

- One time faculty labor to support development of the courses we would need to have a competitive civilian PhD program.
- Ongoing additional faculty labor to support the teaching of small enrollment classes that will need to be taught to support a civilian PhD program. This will likely include a number of sections which will be taught solely to civilian students and we would need official sanction that this is an acceptable use of Navy resources.
- Ongoing financial support for civilian PhD students.

## PLANS FOR IMPROVING THE VISIBILITY OF PROGRAMS

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- While we now have a USN sponsor, we are still working toward having our MS program reinstated by the Navy. This will restore our visibility within the DoN, where we had dropped from sight. If and when the program itself is reinstated, our first priority will be to strengthen the program.
- Place news items in quarterly research notes.
- Improve our web presence
- Improve our visibility by increasing our participation in conferences and workshops. This will require budget for travel support.

## PLANS FOR INCREASING ENROLLMENT

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We continually work to increase enrollments of officers in our Master's program. We do this both by reaching out to the various branches (we have regular inputs from the Army, some from the Air Force, and we are working on the Marine Corps and Coast Guard). A significant limiting factor has been the lack of an officially approved curriculum for Navy students in Applied Mathematics. This program was shut down by RADM Ellison in 2001 and has yet to be reinstated after seven years. We have a small number of Army students, several dual-degree students, and a number of PhD students from other programs who pursue the minor in Applied Mathematics. Nevertheless, the program is still operating on the margin and we are still in the position of offering under-enrolled courses so the students that we do have can finish their programs. Our experience shows that a robust MS program must be a prerequisite to a PhD program. To focus on bringing in PhD students first would put us in the position of teaching advanced courses with small enrollments, a practice for which the funding has been withdrawn. The PhD program must come later.

Given our small program, we must ensure that the requirements of incoming students can be met by the courses that we have in place, taught at their regular times.

## STEPS TO ENHANCE INTERDISCIPLINARY RESEARCH AND CURRICULA

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Position Applied Mathematics as the host for regular colloquia of interest to GSEAS.

## INTERACTIONS WITH NAVAL WARFARE SYSTEMS CENTERS

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We have begun to establish small-scale collaborations with NRL (e.g., including NRL scientists as PhD committee members). Currently, there are collaborations between the MA department and NRL (ONR-funded projects), and we hope to further strengthen these ties.

## INTERACTIONS AND PARTNERSHIPS WITH CIVILIAN UNIVERSITIES

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Interactions at the faculty level are good and we promote them as we can. Several faculty have co-advised PhD students at other Universities (e.g. UC Santa Cruz). Moreover, many faculty have active collaborations with researchers at other institutions.

Interactions at the department level have generally failed.

## DISTANCE LEARNING PROGRAMS

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Although the number of success stories in asynchronous DL mathematics is small, we have had some success with synchronous VTC distance learning courses (video-teleconferencing courses) which are very similar to on-site courses delivered in the traditional lecture manner. The Department remains open to participating in programs that require DL mathematics courses, and could possibly use VTC courses to bolster enrollment at the 4000 level. We have also begun to explore the possibility of offering DL certificate programs.

## PROGRAM ASSESSMENT AND ACCREDITATION

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Curriculum Reviews: ABET is irrelevant, but we are in favor of regular independent program reviews conducted by faculty from other universities.

Sponsor Requirements: We have a new sponsor, and there will be discussions aimed at identification of ESRs and program design.

## SUMMARY OF ACTION ITEMS AND FIVE-YEAR MAP

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- Secure an official reinstatement of the 380 curriculum for Navy students and become the primary educational resource for 4100P billets.
- Improve the teaching distribution of the department by significantly increasing the percentage of graduate level teaching by tenure track faculty.
- Ensure appropriate budget is provided to support staff labor.
- Secure commitment from the GSEAS Dean to provide regular internal funding for faculty travel to conferences and workshops as well as support for an ongoing colloquium series. A clear statement of lower bounds for such funding is essential.
- Place Professor Art Schoenstadt in re-employed annuitant status.
- Continue to carefully analyze our faculty strength, and make plans to hire in areas in need of reinforcement. The department sees no current need to hire, but anticipates future need for hires in Game Theory and Numerical Analysis / Scientific Computing.
- Track retirement plans of senior faculty.