

REPORT OF THE ACADEMIC PROGRAM REVIEW PANEL

Faculty of Engineering and Applied Science Memorial University of Newfoundland

Introduction

The site visit for the Academic Program Review in the Faculty of Engineering and Applied Science (hereinafter referred to as the Faculty of Engineering) took place on Thursday and Friday, 10 and 11 July 2003. The Panel consisted of:

- Dr. John Christian, Professor, Civil Engineering, University of New Brunswick
- Dr. Doug Ruth, Dean of Engineering, University of Manitoba
- Dr. John Gale, Professor, Earth Sciences, Memorial University
- Dr. Maureen Volk, Professor, School of Music, Memorial University (Chair)

During the site visit, the Panel met with:

- the Vice-President (Academic), Vice-President (Research), Dean of Record, and Associate Dean of Graduate Studies
- the interim dean and associate deans of the Faculty of Engineering
- faculty members from each of the four disciplines within the Faculty: Mechanical Engineering, Civil Engineering, Ocean and Naval Architecture Engineering, and Electrical and Computer Engineering
- two faculty members who requested individual meetings
- the Faculty of Engineering Co-operative Education Manager and Coordinators
- members of the technical and administrative staff of the Faculty
- representatives of graduate students in Engineering
- representatives of undergraduate Student Societies A and B
- Diane Taylor-Harding from the QEII Library
- representatives of the Faculty of Arts and the Faculty of Business Administration
- representatives of the departments of Computer Science, Earth Sciences, Physics, Chemistry, Mathematics and Statistics, Philosophy, and English
- the Director General of IMD (Institute for Marine Dynamics)
- the Vice-President of C-CORE
- representatives of MEAAC (Memorial Engineering Alumni Advisory Council)
- representatives of EASAC (Engineering and Applied Science Advisory Council)
- representatives of APEGN (Association of Professional Engineers and Geoscientists of Newfoundland)

In addition we received written input from the Interim Director of Co-operative Education and Academic Experiential Learning.

We very much appreciate the cooperation and assistance provided by everyone with whom we met. We would especially like to thank the Academic Program Review Coordinator, Joan Bessey, for making our work as convenient and efficient as possible.

The Panel's impression is that the Faculty of Engineering has many strengths and much potential. It offers a strong undergraduate program, whose graduates are highly regarded, both within the province and throughout Canada. Its faculty expressed to the Panel a strong commitment to undergraduate teaching; many of them are also engaged in first-rate research. The Faculty has taken strong steps to develop internationally recognized graduate programs, especially in the area of Ocean and Naval Architectural Engineering, and is working to build a stronger research profile. Although we were told that the Faculty has had a reputation in the past of not cooperating well with other academic units at Memorial, the external representatives to whom we spoke told us that they were very pleased with their recent collaborations with the Faculty of Engineering and were looking forward to strengthening and expanding their collaborative efforts.

Overall, we see the Faculty moving in a positive direction. We trust that our recommendations will help the Faculty continue to move forward.

1. Governance and Departmentalizing

There is considerable discussion within the Faculty about the advisability of adopting a formal departmental structure to replace the present discipline-based structure of the Faculty. There is some division on this issue along discipline lines, with stronger support for departmentalization among faculty in Electrical and Computer Engineering than among the other disciplines. The Panel heard many arguments for and against departmentalization. Those in favor argued that:

- The current disciplines need more control over budgets.
- Departmentalization would lead to a more collegial style of governance within the Faculty, instead of concentrating all power in the dean's office.
- There are clear variations in performance between disciplines, but the present faculty structure averages performance parameters. Present statistical analyses fail to recognize the research productivity of some disciplines, but more importantly, do not flag the poorer performance of other disciplines.
- Collaboration between different disciplines within Engineering is less visible and is not recognized by the senior administration in the same way as collaboration between departments in departmentalized Faculties.
- Departmentalization would mean that Academic Program Reviews would be conducted individually for each discipline, resulting in more meaningful and useful reviews.

Those opposed to departmentalization were concerned that departmentalization would:

- Result in an increased faculty work load because of the requirement that each department establish its own committees, such as promotion/tenure and search committees, in addition to service on Faculty and University level committees. This would be a particularly onerous burden for the smallest disciplines, such as ONAE.
- Increase administrative costs and aggravate space problems as each department would require its own office and support staff.
- Reduce collegiality because the department head would be a "boss", whereas as the discipline chair is currently viewed as a colleague.

- Create walls between the departments, reducing informal contacts between members of the Faculty and making interdisciplinary collaboration more difficult.
- Require more management talent than might be available in the Faculty at any given time, since heads must deal with more difficult management and personnel issues.

One issue that arose repeatedly in our meetings with faculty was concern about the inadequacy of communication between the dean's office and the faculty. Many of the cases related to us seemed to involve a lack of clarity in the communication route from the dean to faculty (and vice versa) via the discipline chairs. The Panel does not believe that changing discipline chairs to department heads will improve communications within the Faculty. Nor do we believe that a departmental structure would give programs more budgetary control. Even within a departmentalized Faculty, the Dean holds ultimate control of budgets and faculty appointments. We feel that these concerns reflect a desire for a change in management style, rather than a need for fundamental changes in how the Faculty is organized. We also believe that recent governance changes designed to make decisions within the Faculty more collegial could accomplish most of the desired objectives without changes in the Faculty structure, provided that:

- the crucial communications role of discipline chairs is clearly articulated and supported;
- means are found to identify the individual performance of each discipline; and
- interdisciplinary collaboration within the Faculty can be recognized and made visible.

Recommendation 1.1: The current discipline-based structure should be maintained. However, the terms of reference for the Faculty Management Group (FMG) should be amended to make explicit the critical role of the discipline chairs regarding communication between the FMG and their respective disciplines.

Recommendation 1.2: The University should develop a means to recognize the individual performance of teaching/research units, such as the disciplines in the Faculty of Engineering. For example, CIAP should collect and publish statistics on teaching and research productivity, differentiated by discipline.

Recommendation 1.3: The University should develop means to recognize the interdisciplinary nature of much work done within the Faculty. For example, programs that fund interdisciplinary work should recognize such work within the Faculty.

Recommendation 1.4: Further devolution of appropriate components of budget and academic controls to the discipline chairs is strongly encouraged. Such devolution will achieve the positive effects of departmentalization without the associated negative effects.

2. A More Pronounced Research Thrust

The Faculty currently has an uneven publication record, both among individual faculty members and between disciplines. Both members of the Faculty and of the University administration have identified a stronger research thrust as an objective of the Faculty of Engineering. However, there are a number of systemic problems that negatively impact this objective:

- The traditional high undergraduate teaching loads were appropriate when research was not a priority. The teaching of four undergraduate courses leaves little time and energy for the development of a strong graduate program and independent research.
- Inadequate recognition for the teaching of graduate courses as part of the work load discourages the development of a structured graduate curriculum.
- The lack of recognition for graduate student supervision as part of the work load discourages the development of strong research groups.
- The low levels of University funding for graduate students and daily research consumables (e.g., strain gauges) results in a substantial drain on the resources of individual faculty members' grants, particularly those from NSERC.
- The Faculty does not appear to have a well articulated plan for academic hiring and succession planning. Without such a plan, orderly development of areas of research expertise is not possible.
- The salary structure may not presently be competitive with other Canadian universities. This could make the hiring and retention of the best new faculty members difficult.
- The absence of significant start-up funds will make the hiring and retention of the best new faculty members difficult. Furthermore, it will severely hamper the development of the research programs of staff that the Faculty does hire.
- The provincial government does not fund engineering research to the same extent as most other provincial governments, although some funding is available through ACOA.
- The Faculty has been remiss in not taking full advantage of the CFI New Opportunities Grant program.
- The Faculty has not taken full advantage of opportunities for joint work with such organizations as C-CORE and IMD. Although roughly one-quarter of all graduate students are currently affiliated with IMD and C-CORE, there is capacity within these organizations for participation from a larger number of faculty and students. Representatives from IMD and C-CORE mentioned additional opportunities in Civil Engineering in particular.
- The lack of an overhead policy that encourages contract research seriously discourages contract-type projects. A meaningful overhead policy must return a significant portion of the overhead to the control of the individual researcher so that he/she can maintain and further develop the capacity to do such work.
- As the Faculty continues to move from a primarily undergraduate teaching institute to a fully integrated undergraduate/graduate school, academic staff are not always aware of the expectations that they are required to fulfill. In particular, during this period there may be differing expectations on those academic members developing a research program and those concentrating on teaching.

Recommendation 2.1: The Faculty must complete the teaching equivalency exercise as soon as possible so that graduate teaching and graduate student supervision is properly recognized as a component of the work load.

Recommendation 2.2: The Faculty should develop a plan that identifies the staffing levels required to deliver the accredited undergraduate program. The plan should also identify the

human resources necessary to support areas of research expertise and graduate study that the Faculty identifies. The development of this plan should be based on a process of open consultation within the Faculty, as well as between the Faculty, C-CORE and IMD. The University must recognize that with a progression from a primarily undergraduate teaching program to an integrated undergraduate/graduate program, more academic staff are essential.

Recommendation 2.3: The Faculty should develop a standard start-up funding package for new hires that is competitive with other Canadian universities. Typical packages across Canada range from \$20,000 to \$60,000.

Recommendation 2.4: The Faculty should ensure that every new academic staff member is supported in applying for a CFI New Opportunity Grant.

Recommendation 2.5: The Faculty should systematically investigate additional opportunities to collaborate with organizations such as IMD and C-CORE. This may require improvement of some facilities in Engineering, such as the geotechnical teaching and research laboratories, to enable the Faculty to take full advantage of these partnerships and the resources that they bring to the University.

Recommendation 2.6: The Faculty should aggressively pursue an overhead policy that encourages participation in contract-based research and development.

Recommendation 2.7: We note that the Faculty has recently developed more detailed criteria for Promotion and Tenure in accordance with the collective agreement. We recommend that these criteria be revisited in order to make explicit the necessity for publication and graduate student training as essential components of research productivity.

Recommendation 2.8: Without devaluing the contribution of teaching staff, the Faculty should take full advantage of changes in the collective agreement with MUNFA to assign additional teaching to faculty who are not active researchers in order to provide teaching relief to new faculty members, with care being taken to ensure that the overall quality of teaching is not compromised.

3. Graduate Students Issues

The Panel identified a number of issues that relate directly to graduate students, including the following:

- There was an apparent low level of morale among the graduate students interviewed.
- In general, funding levels for graduate students are low and disparities in the funding levels of different students are demoralizing. The fact that a high percentage of graduate students in Engineering are foreign students who are not permitted to work off-campus aggravates the funding problem.
- Graduate students resent working beyond their assigned TA hours because of the low pay levels, but are sometimes reluctant to refuse.

- There is a shortage of funding for travel to conferences. Costs for travel off the island are generally higher than for other locations in Canada.
- There is a lack of opportunities for informal collegial interaction between students and academic staff.
- Students have a desire for more hands-on, laboratory based research.
- The reputation of the graduate program in areas outside of Ocean and Naval Architectural Engineering was questioned.
- Lack of resources, rather than poor recruitment, seems to be the primary impediment to increasing graduate enrolment. The Faculty currently receives many more applications for admission to its graduate programs than it can accommodate.

The graduate students we met with also expressed concern about the number of students who do not complete their master's program in Engineering. However, information provided by the Faculty of Engineering suggests that over the last five years approximately 6% of the total graduate enrolment did not complete the program. For the most part, the reasons were related to work and family commitments, job opportunities and transfer to other graduate programs such as M.Sc. and Medicine. Approximately 0.7% of the graduate students withdrew for financial reasons and about 0.6% left for academic reasons (failed courses, thesis re-exam problems and lack of progress).

Recommendation 3.1: A review of the graduate program, including curriculum and policies, completion rates, and graduate student morale, should be conducted at the earliest opportunity.

Recommendation 3.2: New sources of student funding must be identified. The University should review the proportion of baseline funding for graduate student support allocated to Engineering to ensure that the Faculty receives its fair share in view of its recent growth in graduate enrollment.

Recommendation 3.3: It is an obligation of a University to disseminate its research findings. Graduate students should be strongly encouraged to publish their research and the University should increase support to students presenting their work in national and international forums. This is the mechanism whereby continuation of research funding is ensured.

4. The Undergraduate Curriculum

Several issues related to curriculum were identified by the Panel:

- The length of the program has been identified as a potential deterrent in student recruitment. The Panel is not convinced that such is the case because many students see the length, and resultant depth, of the program as a strength. One reason for the length of the program has been identified as the nature of secondary education in the Province of Newfoundland and Labrador.
- Given the length of the program, the Faculty has taken steps to increase flexibility by allowing adequately prepared high school students to enter the program directly (omitting Terms A and B), and by introducing fast-track admission to the graduate program for

- undergraduates in their final year.
- There is a sense in the Faculty that some students are admitted who do not have a high potential to complete the program. This leads to a waste of the students' time and the resources of the Faculty.
- There are clear indications that the Faculty cannot meet the demands of the present student population given its present resources. This is symptomized by a shortage of laboratory and computer stations and overloaded classrooms.
- A shortage of tenure-stream faculty often leads to excessive sessional appointments or the canceling of elective courses. Faculty members in Engineering currently teach material that is often taught in the Faculty of Science at other universities; this aggravates the problem.
- There appears to be a serious shortage of funds to renew both computer equipment and laboratory equipment.
- There appears to be confusion regarding the interpretation of CEAB requirements regarding complementary studies electives among faculty and students. In particular the exclusion of courses in such Faculties as Business and Music seems unnecessary.
- Representatives from APEGN expressed concerns that students receive insufficient exposure to the issues surrounding professionalism and ethics.

Recommendation 4.1: The Faculty should review the program with the goal of removing duplication between Terms A & B and Terms 1 & 2, and optimizing the effectiveness of these four terms in light of recent changes in the high school curriculum. Care must be taken that any revisions comply with the CEAB's current interpretations of Basic Science and Engineering Science, and that the present high quality of the educational experience afforded the students not be diluted.

Recommendation 4.2: CIAP should be asked to conduct a study of student success as a function of grades on admission after Term B. The results of this study should be the basis for future decisions regarding admission standards.

Recommendation 4.3: The Faculty should determine the optimum enrollments in the undergraduate programs in the context of available human, physical and financial resources.

Recommendation 4.4: The Panel applauds the Faculty's initiatives aimed at allowing adequately prepared students to complete the program in less than six years. We encourage continued efforts to increase this kind of flexibility to the extent that it can be done without reducing the overall strength of the program.

Recommendation 4.5: Consideration should be given to making better use of teaching staff in other Faculties to allow more flexibility within the Faculty of Engineering.

Recommendation 4.6: The Faculty should aggressively pursue funding, from all possible sources, to renew the computer and laboratory equipment.

Recommendation 4.7: The Faculty should reconsider the list or lists of courses available as complementary study electives. By properly structuring these offerings, it should be possible to meet both the requirements of CEAB and the desire of students for more flexibility. The Faculty is strongly advised to consult with CEAB to ensure that any changes conform to CEAB criteria.

Recommendation 4.8: The Faculty should strengthen professionalism and ethics instruction through a possible expansion of current work term seminars, a series of lectures, a web-based program of study, or a mandatory course module.

5. The Co-operative Education Format

The co-operative education format is strongly supported by everyone from students to the industrial advisor team. It is viewed as a valued and essential component of the Memorial program and adds to the overall value of the undergraduate experience. The following issues were conveyed to the Panel:

- The general feeling is that the current high level of student enrollment coupled with the downturn in the markets for co-op placements is having a serious impact on the success of the format.
- Concerns were expressed about the nature of placements in the early work terms. In some cases the positions had little apparent relation to the engineering profession.
- The students are supportive of the full six work terms but students from outside of St. John's find the length of the program less advantageous because of the added costs.
- Significant opportunities, such as a more systematic development of technical communication skills and the teaching of professionalism and ethics, are being missed. Taking advantage of these opportunities would allow the co-op format to more completely integrate with the overall programs.
- Since the introduction of the Co-op format at Memorial approximately 30 years ago, other Co-op models have been developed at universities across the country. It is time for the Faculty of Engineering to review its program in the context of these newer models, to determine whether its Co-op format needs updating.
- The University has recently created a new position entitled Director of Co-operative Education and Academic Experiential Learning. The mandate of this position is unclear, and there is concern that the new office may duplicate and interfere with, rather than facilitate, the work of the Co-op staff within the Faculty. The one area in which the new office might play the most constructive role is in market development, i.e., expanding co-op placements.

Recommendation 5.1: The Panel supports the mandatory co-op format.

Recommendation 5.2: The Panel considers six work terms to be a strength of the program. Nonetheless, we encourage the Faculty of Engineering to review Co-op models elsewhere to see if they offer ideas for possible improvement. In particular, consideration should be given to a detailed definition of the learning objectives for at least one of the earliest work terms.

Recommendation 5.3: The work term reports offer an excellent opportunity for students to develop their writing skills. The Faculty should take advantage of the resources of the Writing Centre and the potential contribution of retired engineers to enable feedback on and rewriting of work term reports to maximize the effectiveness of instruction in technical communications. The Faculty should consider possible advantages of numerical grades rather than pass/fail.

Recommendation 5.4: The Faculty should consider having the Program Manager, Co-operative Education report to the Associate Dean (Undergraduate). We believe that this would facilitate communications between the co-operative education activities and the remainder of the undergraduate program.

Recommendation 5.5: The mandate for the Director of Co-operative Education and Academic Experiential Learning should be clarified and communicated to the University community as soon as possible. The University should take care to ensure that this office does not duplicate the work of Co-op staff within individual units, but rather provides services that complement and facilitate their work.

6. Collaboration

On many fronts, from departments in Science to the Faculty of Business, the Faculty of Engineering has been moving toward strengthening collaboration with other units. For example,

- The serendipitous discovery of course overlap has led to shared teaching between Physics and Engineering.
- The Faculties of Business and Engineering have initiated discussions on the development of a Masters program in Engineering Management.
- The Faculties of Science and Engineering are working cooperatively to redevelop the core program in Terms A&B and Terms 1&2.
- Cooperation between individuals in Engineering and Computer Science has strengthened both programs. Software Engineering is no longer seen as a divisive issue. However, space limitations persist as an irritant between the two units, and while individual faculty members in these two units do work together well, attempts to formalize these informal collaborations remain problematic.

Recommendation 6.1: The Faculty should systematically explore opportunities to share courses and research programs with other Faculties and Departments across the University.

Recommendation 6.2: When current professors in Engineering whose primary duty is the teaching of mathematics courses retire, consideration should be given to having these courses taught in the Faculty of Science and replacing these positions in the Faculty of Engineering with faculty whose teaching and research can strengthen its capacity in engineering disciplines.

Recommendation 6.3: The University must seek ways to resolve the issues of space shortage in both the Faculty of Engineering and the Department of Computer Science.

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Summary of Recommendations

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