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MEMORANDUM

ATTENTION	Senate	**DATE**	November 15, 2010
FROM	Jon Driver, Vice-President, Academic and Provost, and Chair, SCUP	**PAGES**	1/2
RE:	Faculty of Applied Sciences: External Review Report of School of Engineering Science (SCUP 10-79)		

The Senate Committee on University Priorities (SCUP) has reviewed the External Review Report on the School of Engineering Science, together with responses from the School, the Dean of Applied Sciences and input from the Associate Vice President, Academic.

Motion:

That Senate approve the recommendation from the Senate Committee on University Priorities to implement the Action Plan for the School of Engineering Science that resulted from its External Review.

Following the site visit the Report of the External Review Team* for the School of Engineering Science was submitted in June 2010.

After the Report was received a meeting was held with the Dean of Applied Sciences the Director of the School and the Director of Academic Planning (VPA) to consider the recommendations. The School then prepared an Action Plan based on the Report and these discussions. The Action Plan was then submitted to the Dean in October 2010. The Dean has endorsed this Action Plan.

The Review Team members stated that that 'in the face of many challenges, ENSC has achieved success in many areas'. The Team went on to identify strengths and weaknesses in the under graduate, graduate and research areas and recommended a number of improvements for each area.

SCUP recommends to Senate that School of Engineering Science be advised to pursue the Action Plan.

Attachments:

1. Department of School of Engineering Science - Action Plan
2. External Review Report – June, 2010

*** External Review Team:**

Javad Mostaghimi (Chair): Distinguished Professor in Plasma Engineering, Director, Centre for Advanced Coating Technologies, Faculty of Applied Science and Engineering, University of Toronto

Nadia Bhuiyan: Associate Professor, Department of Mechanical and Industrial Engineering, Director, Master of Aerospace Engineering Program, Associate Director, Concordia Institute of Aerospace and Design Innovation, Concordia University

Shankar P. Bhattacharyya: Professor, Department of Electrical Engineering, Texas A & M University

CC Nimal Rajapakse, Dean of Applied Sciences
Mehrdad Saif – Director, School of Engineering Science

2010 EXTERNAL REVIEW REPORT

SIMON FRASER UNIVERSITY

SCHOOL OF ENGINEERING SCIENCE

Submitted by

Dr. Javad Mostaghimi, University of Toronto (Chair)

Dr. Shankar Bhattacharyya, Texas A&M University

Dr. Nadia Bhuiyan, Concordia University

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INTRODUCTION

The School of Engineering Science (ENSC) at Simon Fraser University (SFU) has undergone many changes in recent years. This has created many challenges as well as many opportunities. These major changes are the result of the Double the Opportunity (DTO) initiative, which started in the fall of 2002. This external review was conducted in order to assess the quality of the ENSC programs, the quality of faculty research, the role of Department members in the administration of the School, and the conduciveness of the environment to the attainment of the objectives of the Department. A set of six issues of particular interest to the School were outlined as being the most important areas to assess.

In this report, we will provide our evaluation of these issues, draw out their strengths and weaknesses, and we will then present our recommendations on the future directions that we feel should be taken by the School.

This review was made possible through a three-day visit to SFU from April 7-9, 2010, where we visited both the Burnaby and Surrey campuses, and met with faculty, staff, and students. In order to complete this review, we were also provided with various reports which we reviewed prior to the visit. While the visit was quite intensive, it was by no means an exhaustive review of the School; in light of this, the committee hopes to have addressed the requirements of the Terms of Reference in as much detail as possible, and as objectively as possible.

We would like to thank Dr. Glynn Nichols, Director of Academic Planning & Budgeting, for organizing our visit to SFU. We would also like to thank all members of SFU that have taken the time to meet with us, provide us with information, and offer their help, insights and support before, during, and after our visit. Very special thanks go to the internal member of our committee, Dr. Ze-Nian Li from Computing Science, who provided us with much help and wisdom throughout our visit. His input was invaluable during our visit.

The following sections describe our assessment of six issues considered to be of importance to the School.

A. QUALITY OF UNDERGRADUATE AND GRADUATE EDUCATION

Undergraduate Program

The School of Engineering Science offers two undergraduate programs, the Engineering Science (ENSC) Program, offered at SFU Burnaby, and the Mechatronic Systems Engineering (MSE) program, offered at SFU Surrey. In this section of the report, we will outline what we viewed as being the strengths and weaknesses of the undergraduate programs. In order to gather data and information in this section we met with the following groups: biomedical, communications, microelectronics, systems, and mechatronics, as well as the ENSC lecturers, the co-op and recruitment team, the office and technical support staff, and undergraduate and graduate students.

Strengths

The ENSC undergraduate programs have seen a large increase in enrolment due to the Double the Opportunity (DTO) initiative. The consequences of this initiative have been manifold. First, the School has seen an increase in its enrolment from 490 students to 1137 since 2002, which has been the major positive outcome of this initiative.

Another impact of the DTO initiative on the undergraduate program is that class sizes have increased. Increased enrolment will also cause multiple offerings of courses. This in turn will give students greater flexibility to stay within the prescribed course sequence, thereby shortening the time required to graduate.

One of the strengths of the curriculum offered in the ENSC is that it has a strong high technology focus, with specializations in electronics engineering, computer engineering, engineering physics, systems, biomedical engineering, and mechatronic systems engineering.

One of the unique aspects of this program is the open lab concept, where teaching laboratories are open to students around the clock. The students highly appreciate the flexibility offered by this setup.

Another strength of the program is the mandatory co-op program, which is a requirement for the undergraduate degree in ENSC. Students must take a minimum of 3 co-op terms. The program gives students excellent experience and an edge over students who have not been exposed to industrial settings. Although it is becoming increasingly challenging to find work terms for students, given the large influx of students due to the DTO program, and the limited numbers of co-op coordinators for ENSC, it still remains an essential aspect to the undergraduate program. With the adverse impact of the economic crisis, creative solutions are being sought by the co-op staff to deal with the large number of work terms needed, such as having professors hire students to work on projects, sending students on overseas work terms or exchanges, etc.

Mandatory tutorials will be put in place for each technical course in the program, to be taught by the instructor. This will be especially beneficial for those students who may require further assistance in keeping up with the Honours-level program. This may help reduce the attrition rates.

Another strength of the program is the intensive Communication Program that was designed to hone the students' skills in problem analysis and critical thinking, and communication in oral, written, and graphical form, in individual and in team settings. In every year of the program, a different course is offered which is designed to complement a technical course, thus allowing the student to directly apply the communications course to an engineering course. A total of 5 courses are required as part of the undergraduate program. It appears that this program has benefitted the students: it has been said that the industry tends to hire more students from SFU than from other local universities.

The Mechatronics and Systems Engineering (MSE) program is excellent. It has seen outstanding results in a short period of time under the leadership and dedication of Dr. Farid Golnaraghi. There are currently 10 faculty members and collectively they have brought in over $5.5 million in research funding. In just a matter of three years, the program has approximately 250 undergraduate students and 43 graduate students. Our visit to the Surrey campus left us extremely impressed with many aspects of the program. The faculty members are enthusiastic and energetic and have dedicated themselves to ensuring the success of the program through courses, lab setup, and active recruiting. While the MSE is sorely lacking in space, the faculty, staff, and students exude optimism, satisfaction and much energy. The enrolment statistics and the increase in faculty in this program speak to its success. Once again it should be noted that the

evolution of the program on the Surrey campus took place in a short period of time of only 3 years.

Summary of Strengths:

- Mandatory co-op for all students.
- High-tech focus in curriculum.
- Open-lab concept.
- Excellent MSE program.
- Integration of communication program.
- Increasing enrolment.
- Mandatory tutorials for technical courses.

Weaknesses

The effects of the DTO initiative are both positive and negative. In this section, we discuss the negative impacts. While the School has become much larger in size, as hoped, this is countered by the fact that the program is no longer an elite program since the quality, academic background, and strengths of the incoming students is now quite varied. The admission average from high school applicants is 80%, with a recently reduced requirement of maintaining a 2.0 GPA in order to stay in the program. Thus, the uniqueness of the elite program has considerably been diffused, and the perception of the school as one of high repute, has changed.

Although a relatively major revision was implemented in 2006 after the DTO initiative, a major overhaul to the current curriculum has not been done for 15 years. Since the curriculum was originally designed for high quality students, the content of the program is demanding and thus does not cater to the large percentage of students with weaker averages. As a result, the attrition rates are quite high in later years of the program: the attrition rate from the first to second year is 30% and as high as 50% of students leave the program after 3 years. Fortunately, a committee has been formed to revise and update the curriculum in hopes of reducing attrition rates.

One of the major problems currently facing ENSC is the impact that budget cuts have had on the teaching assistant (TA) budget. The amount of TA support provided to instructors in ENSC has been reduced by 67% ($/student), and this, given a 92% increase in undergraduate

enrolment. This has two impacts. Firstly, insufficient TA support means that the faculty members lack the resources to assist them in their courses, which is significant given that the class sizes have become quite large: as a result, professors and lecturers have to find ways to help reduce the burden of their TA's, for example, by offering fewer assignments, or correcting only half of the questions assigned on a particular assignment, or putting more students per group for labs. This, in our view, highly compromises the quality of the education offered at the ENSC. However, there seems to be no other way to deal with this issue if more TA'ships are not allocated to the ENSC. The other impact is on funding of graduate students, which we will discuss in the next section. In our opinion, the lack of sufficient number of TA's has a serious negative impact on the ENSC and its budget should be considerably increased.

While the open-lab concept described earlier is highly regarded by the faculty and students, there have been many complaints about the maintenance of the equipment. Students have complained about equipment failing, or malfunctioning of equipment at the hands of less serious, less experienced students, and so on. Since the teaching labs are critical, this poses a serious problem. This is again related to budget cuts which do not make allowances for much needed equipment maintenance and renewal in engineering labs. Given that a quality engineering education is highly dependent on experimental work done in laboratories, this issue should be given serious attention, especially because the Canadian Engineering Accreditation Board (CEAB) will consider poorly maintained labs to be a major weakness of the ENSC, which may negatively affect the accreditation of the programs.

The large class sizes resulting from the influx of students has caused problems, both for students and teachers. The students do not feel connected to their teachers, do not feel that they are maximizing their learning experience, and often do not feel the need to go to class as they are lost in a sea of students. Teachers complain about the low rate of attendance in lectures, and this may be one reason for this. This problem may be dealt with by cutting the classes in half, thus offering two sections of the same course. However, in some cases, reducing a class of 200 students down to 100 may not necessarily address the problems associated with large classes.

The ENSC provides much flexibility in completing the undergraduate degree in that students can take courses in the sequence that suits them best, and they can also take more than the minimum number of mandatory co-op work terms. While this has its advantages in terms of flexibility, the big disadvantage is that students end up completing their degree on average in

15.5 semesters in 2009 because they often have to wait a full year to take a required course which may not be available, and they tend to fall out of sequence. The result of long graduation times does not reflect well on the School; the typical completion time for mandatory co-op programs is 14 semesters.

In a related issue, the number of co-op placements from industry has dropped by approximately 26%. This is creating a major challenge given the sharp increase in enrolment expected in the coming years, and the large number of students already in the program. students who are not placed in a work-term may considerably delay their graduation. This can be avoided to some degree if the co-op staff is increased in order to support the students.

The availability of courses is another problem. Required courses are not always available on a regular basis, mostly due to the lack of resources.

The Biomedical Option has recently been facing problems of enrolment. Currently, only 30 or so students are enrolled in this program. While the program is excellent, with a high level of involvement from the Faculty of Applied Sciences, the decline in student interest is putting the program in danger. The program is very challenging. To begin with, once a student has entered the program, they do not have the flexibility of transferring out of the program; if they do transfer, they must start the new program from scratch. There is also the requirement of maintaining above 3.0 CGPA for graduation with Honours, which is quite high compared to the 2.0 CGPA required for a Major degree. It must be noted that there are approximately 500 companies in biomed in BC, thus there are good prospects for students who take biomed, and therefore the ENSC should look into ways of revitalizing the program.

Summary of Weaknesses:

- Curriculum has not been revised for some time.
- Laboratory equipment maintenance badly needed.
- Insufficient number of TA's.
- Large class sizes.
- Poor attendance in larger classes.
- Limited course availability.
- Long graduation times.
- Difficulties in recruiting students into Biomed option.

- Attrition rates are very high.
- Difficulties in obtaining co-op placements.

Recommendations for the Undergraduate Program

Based on the assessment of strengths and weaknesses, our recommendations are as follows:

- Substantially increase the TA budget.
- Improve the quality of the lab equipment maintenance, better supervision of students using equipment, more scheduled lab sessions in combination with open labs.
- Revise the biomed option to make it more flexible for students to opt out.
- Find ways to increase enrolment in the bio-med option (for example, modify the requirements for the program, allow students to transfer out of the program without penalty, advertise more aggressively).
- Offer some courses as Honours courses to challenge the better students while accommodating the weaker students.
- Implement smaller class and room sizes to reduce poor attendance and to allow for better student/teacher interactions.
- Offer more 8-month co-op terms to allow students to gain deeper experience. This will require careful planning of undergraduate offering so as not to negatively impact graduation times.
- Increase co-op staff to help support the large influx of students.
- Implement more projects in courses; students appreciate having projects and tend to attend classes that offer projects more than those that do not.
- While there is potential for growth in enrolment, given the lower entrance standards (introduction of the lower 2.0 GPA continuance standard for the Majors B.A.Sc. program), care must be taken to grow the program in relevant areas in order to accommodate such growth.

Graduate Program

Strengths

As a result of the DTO initiative, there has been a 76% overall increase in graduate enrolment. The DTO mandate was to increase enrolment to achieve 150 graduate students (MASc and PhD combined); in 2009, 180 students were enrolled in these two programs. The quality of graduate students in the ENSC is exceptional. The engineering students do particularly well in obtaining scholarships; in fact, they are the best in the university. Over the past 5 years, seven PhD students became professors in renowned academic institutes, two PhD students received Governor General's Medals for Outstanding Doctoral Thesis, and many students received best paper awards in international conferences.

Summary of Strengths:

- Increasing enrolment.
- Exceptional graduate students.
- Great research output.

Weaknesses

While the students are doing well academically, they are very dissatisfied with the level of funding they receive, which, in many cases, is none. Other sources of funding are TA assignments (which are severely limited), fellowships, and scholarships. These financial limitations create anxiety and often prevent students from completing their degree in an acceptable timeframe, or even completing it at all. Unfortunately, the university itself does not receive sufficient funding through the provincial government. Faculty members are not receiving enough funding through grants or through industry, which is quite limited, to help fund all graduate students. Given the research-intensive graduate program, this issue requires serious attention. This funding problem may also create a negative impact on future enrolment.

There are not enough TA-ships offered to graduate students. This is surprising considering the high number of students in the program. At this point, given the increase in enrolment and budget cuts, it has reached crisis point. In 2008-09, ENSC spent approximately $345K on TA budget. In 2009-10, even though enrolment has increased, ENSC spent $269K and

expects to spend only $216K in 2010-11. It appears that the TA budget in ENSC is disproportionately small compared to other programs at SFU. For example, in the Faculty of Science, in Physics and Mathematics in particular, there are half the number of students and yet double the number of TA-ships are available. This is an issue that needs to be addressed. The graduate students not only miss out on much-needed financial support, but they also do not get to benefit from having teaching experience which is also a very important component of graduate studies.

The graduate programs have expanded rapidly without any consideration for funding and space requirements. Furthermore, there is a very limited number and limited availability of graduate courses. This is because faculty is offering large undergraduate courses without proper TA support. Having said this, we feel that the course load that the faculty has at the ENSC is lower than the average across Canadian universities: at the ENSC, professors have an average of 2.5 courses per year, whereas in other universities, the average is 3.0 to 3.5 courses per year.

It appears that students in the MASc program are taking an average of 3 years to graduate; this is too long.

In recent years, there has been a substantial decline in the MEng program enrolment (67% decline since 2002). This program caters to professionals. While the current economic situation and the tuition increase are among the reasons for the decline, this should be investigated further, otherwise the viability of the program is in danger. Further discussion of MEng program is presented in part D.

Summary of Weaknesses:

- Not enough funding for graduate students.
- Not enough TA-ships.
- Fast expansion of graduate program without consideration of funding and space requirements.
- Long graduation times.
- Attrition rates are high.
- Limited number and availability of graduate course offering.
- Decline in MEng program enrolment.

Recommendations for the Graduate Program

Based on the assessment of strengths and weaknesses, our recommendations are as follows:

- Provide adequate funding for doctoral students; ENSC should ensure that PhD students have a minimal level of funding which should be sufficient to cover living expenses and tuition.
- Funding mechanism should be transparent to students.
- Advertise the MEng program more widely, locally, nationally, and internationally; review the quality of the program; and review the fee structure of the program.
- Reduce the graduation time for MASc students.
- Short annual progress reports should be submitted by graduate students to their supervisors in order to help keep them on track.
- Create an annual awards day to honour graduate students for their accomplishments.
- The potential for growth in the graduate program hinges greatly on the level of funding offered to potential students. As such, this issue should be addressed in priority.

B. UNDERGRADUATE STUDENT EXPERIENCE

Strengths

In a meeting with a group of undergraduate student representatives, overall, they expressed much enthusiasm about their experience at the School of ENSC.

The students expressed particular satisfaction with the co-op program, which they feel gives them a definite edge over other graduates from other universities in BC. They would like to have more co-op work-terms that extend to 8 months as this would enable them to gain a deeper experience in industry.

Students highly support the open-lab concept, where undergraduate labs are open for students to use every day of the week, 24 hours a day. This concept is advantageous in that it allows students to access labs at their convenience and to interact freely with other students and continues to be as popular as when the program was an elite one.

Because the Engineering School, unlike other programs, is subject to accreditation by the CEAB, they are required to ensure a minimum standard in many different aspects of the program. As such, having sufficient design content in the curriculum is important and the School meets the criteria. The curriculum exposes students to a number of projects with design content, such as the capstone project design course, among others. MSE has two capstone courses.

Student advisers provide guidance to students on course and option selection, university rules and regulations, career related choices, and they ensure proper program completion for each student. Currently, the advising role is taken on by the Lecturers at ENSC. Students have expressed satisfaction with the advising that they receive by the Lecturers, whom they particularly appreciate, as well as processes to resolve concerns/complaints. These lecturers play an important role in undergraduate education and are of high quality.

Summary of Strengths:

- Enthusiastic response from undergraduate students regarding their experience, especially with co-op.
- Students love the open labs.

- Sufficient design content in the curriculum.
- Satisfaction with student advising on curriculum matters by lecturers, as well as processes to resolve concerns/complaints.

Weaknesses

The undergraduate labs are now used by a very large number of students, and as such, the equipment is handled by many users of varying experience and responsibility. Despite the fact that they love having open labs, the students that we met feel that their laboratory experience could be considerably improved through better maintenance of the equipment, saying that the labs are "falling apart". They also would like to see better supervision of the students, expressing their dissatisfaction with the lack of respect and attention by many students towards the equipment. Some labs are also overloaded, a point expressed by faculty members as well, and often, large groups must be formed to complete a particular laboratory. This reduces the quality of the labs since too many students within a group will retract from the learning experience of some students.

The students were clearly not happy with the large class sizes; they commented that it is difficult to maintain interest in the lectures with such minimal interaction with the teacher. In many of the courses offered in the early stages of the program, students admitted that many do not attend classes, partly because they could cover the material on their own, partly because the class sizes are so large that do not feel that they are benefiting from attending class.

It was stated that the courses that have projects tend to hold student interest more than those that do not, and as such, it was suggested that more courses offer projects.

Students feel that there is insufficient mentorship/counselling available to them. While they benefit from the guidance of the Advisors, they feel it would be highly beneficial for new students to be paired with senior students, or even more preferable would be a pairing with a professor from the start of their program.

Summary of Weaknesses:

- Lab experience could be considerably improved through better maintenance of the equipment, better supervision of the students.
- Large class sizes.

- Insufficient mentorship/counselling

Recommendations to Improve Undergraduate Experience

Based on the assessment of strengths and weaknesses, our recommendations are as follows:

- Improve maintenance of lab equipment in undergraduate labs.
- Increase supervision of student supervision in undergraduate labs.
- Reduce class sizes to provide a better student experience.
- Offer more projects in classes.
- Provide mentorship/counselling resources to students, either through senior students or research faculty and lecturers.
- Create an annual awards day to honour students for capstone projects.

C. MECHATRONIC SYSTEMS ENGINEERING AND BIOMED OPTION

Mechatronic Systems Engineering (MSE)

The MSE program is a newly established program which was launched in Fall 2007. The program will be considered for accreditation in 2010. This is a truly multidisciplinary engineering program which integrates a number of engineering disciplines and trains the students in the development and design of computer controlled electro-mechanical systems. There is a rapidly growing market for engineers trained in this field and SFU is only one of very few select Canadian universities that have developed such a comprehensive program in this area.

To date, the MSE program has hired ten tenure or tenure-track faculty members. An additional five more faculty positions are expected to be filled in the very near future. The program is in high demand by both graduate and undergraduate students. The newly hired faculty members are full of enthusiasm and have been very successful in securing funding for their research projects (approximately $5.7 M in less than three years). The start-up funding of $110 k for the newly hired faculty, particularly at the Assistant Professor level, is reasonable and will help them greatly in establishing their research program. Another very positive aspect of MSE is its team of enthusiastic support staff. Support staff plays an important role in smooth operation of any enterprise and contribute to its success or failure.

The number of undergraduate and graduate students has been rapidly increasing in the MSE program. There are currently 46 graduate students and half of them are registered in the doctoral program. This is almost 5 graduate students per faculty member, which is very respectable. Indeed, this is even more impressive considering the relatively young age of the MSE faculty members.

One of the issues that MSE is currently facing is the quality and the size of available space for undergraduate labs and research labs. According to the Self-Study report, MSE's available space is at least 1/3 less than the national average. This problem is only going to worsen by the hiring of the five new faculty members and increase in enrolment of both undergraduate and graduate students. The current space for some of the laboratories is simply not suitable. For example, as reported in the Self-Study report, the load on floors is limited to 50 lbs/ft^2 which limits the type of equipment that can be placed in these labs. Another example

would be the sensitive nature of some experiments to vibration. The current space is not suitable for such activities. Other very important issues are related to the difficulty in installing essential pieces of equipment such as fume hoods.

We understand that a new building might be constructed within the next five years. We hope that this will be a reality and that the space problem for MSE will be solved. We would like to emphasize that the availability of proper space is imperative since further expansion and success of the program will critically depend on this issue.

The MSE program has some interesting and unique features including the double Business/MSE degree which is a five-year co-op program. This program was created to prepare the graduates for engineering managerial positions. We would like to add that this program may also prepare the students to become successful entrepreneurs if they choose to start their own businesses. The double Business/MSE degree is a five year coop- degree program where students take all MSE and Business course. This program will be implemented once the SFU Senate has approved it. This committee strongly recommends the approval of the double Business/MSE degree program.

Another interesting feature of the MSE program is its joint program with the Kwantlen Polytechnic University. This program offers the students the option to get hands-on design and manufacturing experience at Kwantlen Polytechnic University.

Summary of Strengths:

- Excellent MSE program.
- State of the art facility.
- Passionate, enthusiastic, and dedicated Director as well as faculty and staff.
- Excellent teamwork on everybody's part to get the program to its present state
- High enrolment.
- Excellent administrative and technical support.
- Administrative and technical staff is highly appreciative of the faculty members, and vice versa.
- Excellent classes.
- Quality of students is high.
- Shared sense of pride in the program by everyone.

- Good class attendance (likely due in part to the smaller class sizes).

Summary of Weaknesses:

- Space limitations and space quality must be addressed.
- The TA budget is extremely low. This has to be corrected.
- Research funding should be improved to support the needs of a rapidly growing program.
- As with other programs at SFU, there is no minimum guaranteed funding for doctoral-stream students. The average funding in 08-09 is reportedly $13,222. This is certainly not enough to cover tuition and living expenses.
- Teaching loads are relatively high due to the limited number of faculty members. This should be resolved once the additional five positions are filled.
- Limited number of graduate courses offered.
- Insufficient number of TA's.
- Technical and administrative support is stretched to the limit.
- Only 1 advisor/recruiter available that comes once a week.

Recommendations for the MSE Program

- Hire the remaining 5 faculty positions as soon as possible. To maintain balance, some of these positions should be filled at a more senior level, i.e., Associate or Full Professors.
- Resolve the space problem.
- Increase TA budget.
- Share technical resources with Computing Science (physical location is ideal).
- Separate into its own department within the next 3-5 years.
- Have an advisor/recruiter come more regularly.

Biomedical Engineering Option (BME)

The Biomedical Engineering Option was established within ENSC program in Fall 2006 one year prior to the establishment of the MSE program. This option substituted the *Biomedical Stream* within the ENSC. BME option involves the School of Engineering Science and the

Department of Biomedical Physiology and Kinesiology (BPK). This program is only offered as an honours degree. In its first year, the option accepted 15 undergraduate students with the target of admitting 30 undergraduates per year within five years and having a total of 40 graduate students in this option. It should be noted that biomedical engineering has emerged as a very important engineering discipline across Canada and many Canadian universities have been investing in this area. In principle, this option should be in high demand but, surprisingly, it has had difficulty in attracting enough students at SFU.

Biomedical engineering is described as the "*second*" area of priority within the School of ENSC. As it stands, the program is in dire need of a strategic plan which spells out the vision for growth and success. Presently, the most important task facing the option is to figure out how to recruit a greater number of students into this option. Although there are a number of faculty members in School of Engineering Science, Computing, and the Department of Biomedical Physiology and Kinesiology, with biomedical engineering expertise, Engineering Science still needs up to 3 more faculty members in this area.

Although Biomedical Engineering option has been offered for a few years, lower than expected enrolment in this option has been a problem. There may be several reasons for this including:

1. The minimum CGPA requirement 3.0 or higher for graduation with Honours, which is significantly higher than the 2.0 required for graduation with a Major degree.
2. Lack of formal relationship with a medical school or a teaching hospital.
3. Specialized core courses for BME option students that need to be taken early.

One of deficiencies of the BME option, which was repeatedly stated in our interviews by the students, is the poor quality and the lack of maintenance of the laboratories. No one is responsible for the upkeep of the laboratories.

Summary of Strengths:

- Honors program for very select students.
- Strong commitment from the ENSC faculty involved in the program.
- Co-op.
- Excellent prospects upon graduation.

- In five years, strong graduate program.
- Good interdisciplinary program.

Summary of Weaknesses:

- The number of faculty members has to be increased by three.
- Difficulty in recruiting UG students.
- High attrition rate.
- Quality of UG lab space and its maintenance.

Recommendations for the Biomed Option

- Hire additional faculty members.
- Further utilize the synergies between the BME and the MSE.
- Assign a person to maintain UG labs.
- Longer co-op terms (e.g., 8 months).
- Not enough support staff.

D. GRADUATE PROGRAM

The Graduate Program at the School of Engineering Science is focused on five areas:

1. Information and Communication;
2. Microelectronics, MEMs, and NEMS;
3. Intelligent Systems, Robotics and Control;
4. Mechatronic Systems Engineering and,
5. Biomedical engineering.

In collaboration with the Department of Biomedical Physiology and Kinesiology and School of Computing Science a formal graduate program in biomedical engineering is also planned.

ENSC offers three graduate programs; these are: Doctor of Philosophy (PhD), Master of Applied Science (MASc), and Master of Engineering (MEng). The first two of these programs are research intensive while MEng is designed for working engineers and can be taken on a part-time basis. Subject to certain conditions, transfer between MASc and MEng is permitted.

The graduate program at the ENSC attracts many exceptional students and this is a very positive aspect of the program. In recent years there has been a great surge in the enrolment of graduate students. This is primarily the result of the DTO initiative. There has been a 76% overall increase in graduate enrolment since this initiative was established by the BC Government. Current enrolment in each program is: 83 in PhD, 96 in MASc and 16 in MEng. While enrolment in MASc and PhD has been increasing, MEng enrolment has declined significantly. 20% of the graduate students are female while approximately 60% of PhD students are visa students.

One of the most important factors which may eventually undermine recruitment of talented students for the doctoral stream programs (MASc and PhD) is the lack of commitment by the ENSC to provide minimum funding during the students' course of study. This funding should cover both the tuition and living costs. The funds may be provided as Research Assistantship (RA), Teaching Assistantship (TA), and where applicable, scholarships and awards. As an example, University of Toronto guarantees tuition plus $15 k/year for up to five years for doctoral-stream students. Considering the very small and totally inadequate TA budget (~ 200 k), the funds will have to be primarily provided from research grants and contracts. This

lack of funding must harm the graduate education at the ENSC. It should, however, be noted that the engineering students do particularly well in obtaining scholarships; in fact they are the best in the university.

Graduate course offering should be increased. This has been recognized by the Graduate Program Committee of the ENSC and is under discussion. This committee is also going to study a number of important issues, including funding of graduate students, over the next three years. ENSC is planning to increase the enrolment in graduate program. Much of this expansion will be in the newly established MSE program. It is prudent to consider how graduate students will be funded before the proposed expansion.

One issue that is of concern is the significant drop in the MEng enrolment. This drop is attributed to the economic factors in BC. The Graduate Program Committee is studying this matter as well. In our opinion, one way to revive the MEng program is to design it so that it appeals to a bigger segment of engineers in the greater Vancouver area. For example, offer a full-time MEng program to new immigrants with valid engineering degrees. In general, these individuals need to have Canadian experience before they are seriously considered for employment by Canadian companies. A MEng degree from ENSC will certainly provide them with such experience. This kind of program can also bring additional financial resources to the ENSC.

Globalization of education, particularly graduate education, is currently an important subject on many campuses. The search for global partners, as has been proposed by the Graduate Program Committee (GPC), is commendable and must be rigorously pursued. The GPC has correctly identified both the attraction and the retention of highly qualified graduate students as a priority. Proper funding of these students will be of great importance in this matter.

Summary of Strengths:

- Quality of graduate students is exceptional.
- Number of graduate students per faculty is strong.
- Rapid growth of graduate enrolment as a result of the DTO.
- Large number of scholarship holders; indeed most successful at the SFU level.
- Great research output.
- Offering communication and writing courses to graduate students.

Summary of Weaknesses:

- While the students are doing well academically, they are very dissatisfied with the level of funding they receive, which, in many cases, is none. These financial limitations create anxiety and often prevent students from completing their degree in an acceptable timeframe, or even completing it at all.
- There are not enough TA-ships offered to graduate students. This is surprising considering the high number of students in the undergraduate program. In contrast, in the Faculty of Science, in Physics and Mathematics in particular, there are half the number of students and yet double the number of TA-ships are available. This is an issue that needs to be addressed.
- The graduate programs have expanded rapidly without any consideration for funding and space requirements.
- There is a very limited number and limited availability of graduate courses. This is in spite of the fact that the course load that faculty has at the ENSC is lower than the average in other Canadian universities. At the ENSC, professors have an average of 2.5 courses/year, whereas in other universities, the average is 3 to 3.5 courses/year.
- MEng program enrolment has declined by 67% since 2002. This program is designed to cater to professionals who enrol in it on a part-time basis. While the current economic situation and the tuition increase are reasons for the decline, this should be investigated further and the program should be redesigned.
- Long time to graduate in MASc program (average 3 years).

Recommendations for the Graduate Program

- Provide adequate funding for doctoral students; ES should ensure that PhD students have a minimal level of funding which should be adequate to cover living expenses and tuition.
- Funding mechanism should be transparent to students.
- Number of graduate level courses has to increase
- Short annual progress reports should be submitted by the students.
- Advertise the MEng. program more widely, locally, nationally, and internationally.
- Reduce the graduation time for MASc students. Currently, the average completion time is 3 years.

E. RESEARCH ENTERPRISE

The Faculty of Engineering Science is relatively young - it was started in 1983. It has grown rapidly into a quality educational institution with relatively high standards. Currently, ENSC has 29 research faculty members at the Burnaby campus with 17 Professors, 5 Associate Professors and 7 Assistant Professors. The MSE program in Surrey has 10 faculty members with 2 Professors, 4 Associate Professors and 4 Assistant Professors. In 2009-10 academic year, 35 PhD, 37 MASc and 7 MEng were admitted in the ENSC. The areas of research and teaching are focused in information and communications; microelectronics, MEMS and NEMS; intelligent systems, mechanics and control, mechatronics; and, biomedical engineering. In recent years there has been a sharp increase in graduate student enrolment at the MASc and PhD level reversing a declining trend at the MEng level. This is mainly due to the Mechatronics program which started in 2007. In the following paragraphs we outline some of the strengths and weaknesses of the research enterprise of the school followed by recommendations.

Strengths

The general level of research activity is quite commendable when measured in terms of research grants and research results obtained. Indeed the current research funding is at approximately $3M or $80K per faculty per year. The current NSERC Discovery Grants funding level is about $27K per award which is above the national average. In the last 10 years, the ENSC has obtained 19 NSERC Strategic and CRD awards, 31 NSERC Discovery awards, 6 CFI and 4 CIHR awards. We noted that almost every faculty member has some form of research funding. The rate of research publications in journals and conferences is also judged to be satisfactory and the ENSC faculty members have over a 100 patents to their credit.

Regarding quality of research, SFU has been ranked first in the number of citations per paper in Engineering (as well as Physics and Economics) albeit in a somewhat dated survey. Furthermore, in a recent McLean magazine ranking of Canadian Universities, SFU has been ranked in first place in the Comprehensive Universities category and has been among the top 4 several times. The new Dean Prof. Nimal Rajapakse and the Director of the ENSC, Prof. Mehrdad Saif are both active in research despite their administrative duties. This example from

the leadership should spur higher levels of research activity. The new Dean should also be an effective voice to represent the interests of the ENSC to the University senior administration.

We point out several relevant facts pertinent to the research enterprise, specifically external visibility, and engagement with the community.

Three faculty members are Fellows of professional societies. Of these two are IEEE Fellows. Two faculty members have received awards from the Michael Smith Foundation for Health Research. One faculty member received the Colton Medal for Research Excellence for Microsystem Design, and another faculty member received the Manning Innovation Award as well as the Industrial Innovation Award. There are also an NSERC Innovation Challenge Award, an NSERC University Faculty Award, a Creative Engineering Award a British Columbia Council Award, a Canadian Pacific Railway Medal, an MIT Teaching Award and the Luigi Napolitano Award from the International Astronomical Federation.

The Dean is an internationally renowned scholar with several awards including the prestigious Alexander von Humboldt Award to his credit. The Director of the School is highly visible and active in the IEEE Control Systems Society and has received appreciation from the B.C. Science Council. Many faculty members (23 to be precise) are in journal and conference editorial boards. Several of these are in the prestigious IEEE Transactions as well as IEEE Conferences. An ENSC faculty member was one of 6 BC inventors profiled in the November 2007 of BC Business.

Many faculty members are in Who's Who listings for Science, Technology and Engineering. The above facts and data show that the ENSC is visible, productive and engaged with the scientific community as far as its research enterprise goes.

Summary of Strengths:

- 4th in engineering in Canada
- Highly active in research
- $3M in grants ($80k/faculty member on average)
- High enrolment in MASc and PhD programs
- 3 CRC's
- 2 Michael Smith Foundation Awards
- Microfabrication facility

- Manning Foundation awards
- Several NSERC strategic, CHRP grants and others
- Dean and Director of ENSC are both active in research and teaching despite their administrative duties.
- New Dean should be an effective voice for engineering at the Senior Administration level.
- Relatively low teaching loads should allow more time for research.
- Good quality of the research infrastructure in terms of equipment.

Weaknesses

The attrition rate of graduate students is generally too high. The funding available to support graduate students, stated to be at 83% for PhD' s and 70% for Masters' is low. The number of Post Doctoral Fellows (15 in the last 10 years) must be improved. Collaboration with the local BC industry has been difficult as there are limited opportunities. Space for research labs is limited. In a tour of the labs, it was surprising to see how many faculty members' labs are so limited by space.

Summary of Weaknesses:

- Space for research labs is limited. This is going to be even more severe for the MSE program.
- Limited collaboration with local industry since there are limited opportunities.
- University policy on intellectual properties and invention may hamper collaboration with industry
- Very few postdoctoral fellows.
- High attrition rate.
- No policy for graduate student funding.
- A number of faculty members have no NSERC Discovery Grant.

Recommendations to Improve Research Enterprise

Based on the assessment of strengths and weaknesses, our recommendations are as follows:

- The ENSC should not enter into new areas of research and teaching at this time of financial constriction. It should concentrate on strengthening its current areas of activity and in this regard can consider implementing a number of steps, including what follows.
- Implementation of a Distinguished Lecturer Program which would bring in, say, 8 internationally renowned scientists every year to the campus for 1-2 days of research discussions and interaction. This will benefit the Faculty as well as graduate students.
- Creating more links internationally so that the faculty can engage in joint research, academic visits and exchange students.
- Attempting to increase and diversify graduate student enrolment. Reaching out to good schools in Europe and Asia with recruitment posters and publicity could improve the quality and quantity of the school's research output.
- Hosting international conferences in the field as well as offering workshops to industry.
- Instituting a regular program of internal research seminars by faculty and graduate students to increase awareness of peers' research and increase collegiality.
- The upper administration needs to better recognize that Engineering has special needs due to the laboratory-intensive curriculum, accreditation requirements and industry internships. Thus ENSC should not be treated at par with other Schools and Engineering should receive proportionately more resources than say, liberal arts.

F. ENGAGEMENT WITH THE LOCAL AND INTERNATIONAL COMMUNITY

The ENSC faculty members have been trying to engage the local industry for some time. Traditionally, they have had a strong tie to industry. Because of the recent economic crunch they have had less success as there are limited opportunities in the high tech fields in the BC area. Despite this, the faculty has been interacting with the local BC community [see the specific items above related to this (Prof. Bird's inventor award and Prof. Saif's recognition by the BC Science Council)]. It could be productive to start collaborating with faculty at University of Victoria and University of British Columbia on research and academics. For example the Biomedical Engineering could profit from joint research with the Medical School at UBC.

Internationalization and globalization is another very important area of future growth. The School intends to seek partnership and exchange programs with good universities from China, India, Iran, etc. Such agreements will ensure the recruitment of high quality graduate applicants. Finally, placing more undergraduate students for their co-op in other countries can tremendously boost international recognition of the School.

Summary of Strengths:

- Some successful industrial collaborations
- International placement of co-op students

Summary of Weaknesses:

- Difficult to collaborate with local industry since there are limited opportunities.
- Intellectual property policy should be reviewed and revised to enhance collaboration with industry.
- Although many faculty members are trying to engage the local, national, and international industry, the effort could be more successful.

There is also a need to engage with the international community in the respective fields by starting a program of scholarly exchanges of faculty and students and diversification of international graduate student recruitment. We have already made suggestions regarding the

hosting of a Distinguished Lecturer Program as well as a program of conferences and workshops. This would engage the international academic and engineering communities with ENSC and SFU. ENSC should formulate a systematic procedure to try to elect faculty members as Senior Members and Fellows of their respective Societies and to place them in administrative assignments in the Society and other organizations such as NSERC. This would increase the School's visibility and influence.

Recommendations to Engage with Community

- Faculty should increase interdisciplinary research and collaborations with other universities. particularly with UBC and UVIC.
- Host Distinguished Lecturer Program and a program of conferences and workshops.
- Increase faculty participation in important organizations.
- Establish an awards committee that meets regularly and identifies faculty members that can be nominated for provincial, national, and international awards. The committee should help candidates in preparing their nomination forms. Increasing the number of awards will greatly promote the ENSC.

G. OTHER COMMENTS

The Review Committee strongly recommends that SFU carefully reviews its reward and compensation policy, in particular as it relates to the professorial staff. This should be a high priority for the administration given the distortions produced by the salary ceiling and the resulting compression (and even inversion) that it can produce. The senior faculty, of which there are a significant number, are affected by salary caps which result in salary compression. Many remain unrewarded monetarily despite several years of above average performance. Finally, over 95% of the ENSC budget is committed to the salaries. This leaves very little room to have any initiative. Since 2002, there has been $1.1 M cut to the base budget. This cannot continue. Indeed, we recommend finding ways to restore these cuts.

CLOSING REMARKS

In the face of many challenges, ENSC has achieved success in many areas. The DTO challenge created opportunities for expansion, but along with this came growing pains. In order to continue to succeed and to be among the top universities in Canada, the University and ENSC need to seriously consider how to alleviate these pains in order to achieve once again a high level of excellence. Although the School has been faced with severe budget cuts, it appears that ENCS should be perceived by the University in a more realistic manner: in other words, the engineering programs are ones that require intensive experimental work, that are subject to rigorous accreditation requirements, and that are facing increasing enrolment, and as such, resources should be appropriately allocated to maintain these programs.

The committee believes that the priorities for ENSC at this time should be to address the issues of increased enrolment and the associated needs for new faculty, support staff, space, equipment maintenance, and funding for graduate students. It is our belief that these are the most urgent issues at this time.

The committee would like to take this opportunity to once again thank everyone at SFU for their assistance before, during, and after their visit and would like to wish ENSC luck and much success in its future endeavours.

EXTERNAL REVIEW – ACTION PLAN

Section 1 – To be completed by the Responsible Unit Person e.g. Chair or Director

Unit under review	Date of Review Site visit	Responsible Unit person,	Faculty Dean
School of Engineering Science	April 7-9, 2010	Mehrdad Saif	Nimal Rajapakse

Note: It is not expected that every recommendation made by the Review Team needs to be included here. The major thrusts of the Report should be identified and some consolidation of the recommendations may be possible while other recommendations of lesser importance may be excluded.

External Review Recommendation	Unit's response notes/Comments (if any)	Action to be taken	Resource implications (if any)	Expected completion date
1. Undergrad. Education Substantially increase the TA budget.	The School has been struggling with shrinking and historically low TA budget.	While managing our resources in best possible way, we will continue making our case for increased TA funding.	Directly related to resources made available to the School.	Unknown.
2. Undergrad. Education Improve the quality of the lab equipment maintenance, better supervision of students using equipment, more scheduled lab sessions in combination with open labs.	We fully agree with this recommendation as stated in Sections 4.3.3 and 4.9.4 of the Self Study Report.	In 2009, two new committees, Curriculum Reform Committee (CRC) as well as Biomedical Option Curriculum Committee (BOCC) were struck. CRC will review and make recommendations for a major curriculum revision and reform of all engineering options. However, since biomedical option is the newest option and has its own challenges, different from other established options, BOCC was created to work in parallel and in collaboration with CRC to consider issues relevant to the biomedical option. The hope is that these two committees will make recommendations to our Undergraduate Curriculum Committee (UCC) that would result in curriculum innovation and	For scheduled labs more TA and faculty instruction time is required. Lab equipment renewal is a problem due to lack of base budget funding. One-time funding such as supplemental funding due to over-enrollment has been used to address urgent issues.	Plan of action for curriculum changes: Committee Recommendations: May 2011 Implementation: September 2011 Completion: December 2012

		wholesale revision of our programs. It is hoped that CRC and BOCC recommendations will address many of the issues raised by the external reviewers in their report. Specifically, to address the issue raised by the reviewers, ENSC 220 (Electric Circuits I) is the first ENSC course in our Burnaby campus, which now includes scheduled labs. Also ENSC 215 (Microcontroller Interfacing and Assembly-language Programming) now has scheduled labs. We are also considering scheduled labs for ENSC 225 (Microelectronics I) as well. For higher level courses, a combination of scheduled and open labs is under consideration by UCC and CRC as per External Review Committee's recommendation.		
3 **Undergrad. Education** Revise the biomed option to make it more flexible for students to opt out.	Being considered. See previous reply.	The Biomedical Option Curriculum Committee (BOCC) is working on this and will report its recommendations to Curriculum Reform Committee (CRC) for further discussion. The final recommendations will be considered by UCC.	Not known.	Recommendations: May 2011 Implementation: September 2011 Completion: December 2012
4. **Undergrad. Education** Implement smaller class sizes to reduce poor attendance-more projects courses.	We agree with the first recommendation as stated in Sections 4.9.5 and 9.5. Also, many ENSC courses have lab/project components already.	Class sizes will be reduced starting Fall 2010 by offering multiple sections of high enrolment courses.	Increased faculty teaching load which has been approved.	Immediately (Fall 2010).

5. **Undergrad. Education** Offer more 8-month co-op terms to allow students to gain deeper experience.	Positive aspects: Deeper experience to students; Less work for coop staff; Attractive to employers. Negative aspects: Students may find it harder to get back to studies after being away from SFU for a long period of time. Multiple offering of courses is needed to implement this recommendation.	CRC will consider replacing the current three 4-month coop terms, with one 8-month and one 4-month coop terms. This requires careful scheduling of course offerings as well.	Positive impact on resource requirement, as each student will require two coop placements in the course of their education, rather than three.	Plan of action: Jan 2011 Start of Implementation: Fall 2011 Completion: Fall 2012.
6. **Undergrad. Education** Increase co-op staff to help support the large influx of students.	We are currently adequately staffed. MSE may, however, need a full time PA (currently half time) in future.	We will monitor the workload of the co-op office.	Requires additional financial resources to implement.	Ongoing.
7. **Undergrad. Education** With lower entrance standards care must be taken to grow the program in relevant areas.	Entrance standards are consistent or remain higher than many other engineering Schools. They are also in line or higher than University graduation requirements.	Given the demand for our programs, the School has raised its entrance requirements this year and will re-evaluate its admission policy once again after we have a clear picture of freshman enrollment levels this fall.	None.	January 2011
8. **Graduate Education** 1) Provide adequate funding for doctoral students; and 2) Funding mechanism should be transparent to students.	1)ENSC is a research intensive unit and this is a very important and complex issue that requires creative solutions.2) We already have published on our web site ENSC criteria	This is a complex issue that requires meaningful discussion and dialogue between faculty supervisors, School, FAS Dean and Dean of Graduate Studies to arrive at a reasonable solution. The graduate program committee will initiate discussions and various possibilities such as considering allocating all our available Graduate Fellowships to doctoral students in	Some commitment and support from the University for doctoral students.	Fall 2011 Ongoing.

	based on which we adjudicate Graduate Fellowship applicants. In line with TSSU guidelines there is also a transparent process for TA application and allocation.	their second to the fifth year. We expect our Graduate Program Committee to have some recommendations after considering this issue in depth with all involved. We will update or revise the ENSC graduate fellowship adjudication criteria on the web as necessary.		
9. **Graduate Education** Advertise the MEng program more widely, locally, nationally, and internationally; review the quality of the program; and review the fee structure of the program.	Student demand for M.Eng. programs vary widely between regions and disciplines.	We will revise our web site. We will create student handbook that includes the pre-requisite structure of graduate courses. We will disseminate our graduate program brochure to the local industry. We will also re-visit the MEng's mandate and consider opening the program to international students/partner institutions.	None anticipated.	Summer 2011
10. **Graduate Education** Reduce the graduation time for MASc students. Short annual progress reports should be submitted by graduate students to their supervisors in order to help keep them on track.	Annual reports are already being done. However, we will re-visit and revise some of our current measures and will perhaps introduce new measures to address this issue.	We will track and follow up on students who have exceeded a specified time limit in the program. We will revise our annual progress report, and seek justification from the student and the supervisor on the degree completion time. We will strictly enforce the rule that students missing the annual progress report will be not eligible for graduate fellowships, scholarships, or other benefits.	Increase workload for our already over loaded graduate secretary.	Spring 2011
11. **Graduate Education** Increase grad level	This will naturally happen with increase in MSE faculty.	Grad course offering is on the rise already. We will explore the possibility of offering more	None anticipated.	Ongoing.

courses.		cross-listed senior-undergraduate/graduate courses.		
12. **Student Experiences** Provide mentorship/counseling resources to students.	Fully agree.	Currently three full-time lecturers are providing academic advising to undergraduate students and some mentoring and counseling when students are in difficult academic situations. The plan is for all five lecturers to engage in such activities. For MSE, due to the relatively smaller number of students and faculty this duty will be handled by the Systems One advisor (to be hired) in the first year, and in the later years, by individual faculty members.	Increased faculty (lecturer) workload.	Fall 2010 or Spring 2011
13. MSE **Program** Hire the remaining 5 faculty positions as soon as possible, some at a more senior level, i.e., Associate or Full Professors.	We are hiring them based on our position approval plans.	Two faculty members have been hired. One already is on board, and the other will join in January 2011. The remaining 3 (or 2 based on the budget) will be hired in 2011 or later after BOG approves these positions.	Funding already in place. One position may be lost due to budget cuts over the past two years.	By January 2011
14. MSE **Program** Resolve the space problem.	Very urgent issue.	The School will continue working with the University on this very important and urgent issue. The MSE program has serious and urgent need for additional and proper space for the program.	A new building is required to meet the needs of Mechatronics as well as other programs in Surrey.	Ongoing.
15. MSE **Program** Increase TA budget.	This is an issue for all of ENSC and as such was addressed before.	Unfortunately, the budget of Mechatronics program was not protected from cuts although the program is still under development. As a result, limited funding is available for TAs. The program is due for its first accreditation visit in February 2011 and there are serious resource issues with respect to the number of technical staff, TA and equipment budget and space.	Restoration of cuts to the Mechatronics budget over the past 3 years.	Unknown.
16. MSE **Program** Have an	Being addressed through Systems One staff	A Faculty-wide re-organization of student affairs is in progress and a new hire for Systems One	Supported from Systems One budget	December 2010

advisor/recruiter come more regularly.	position.	will be in place before the end of 2010.	allocation from VPA.	
17. Biomed Program 1) Hire additional faculty members.2) Further utilize the synergies between the BME and the MSE.3) Not enough support staff.	1)No resources available at this time for this. 2) Already done. 3) We have very limited number of staff for all our programs. No program has its own staff.	Biomedical engineering program is a joint program between ENSC and BPK Department. We believe that between ENSC, MSE, and BPK, there are enough faculty members to support this option.	Current resources are adequate compared to our overall priorities.	None.
18. Research Enterprise The upper administration needs to better recognize that Engineering has special needs due to the laboratory-intensive curriculum, accreditation requirements and industry internships. Thus ENSC should not be treated at par with other Schools.	We fully agree.	We hope the new budget process will address some of these issues.	-	Unknown.

The above action plan has been considered by the ~~Unit under~~ review and has been discussed and agreed to by the Dean.

Unit Leader (signed)	Date
Name Mehrdad Saif Title Professor & Director	Oct 20, 2010

Section 2 - Dean's comments and endorsement of the Action Plan :

This is the first external review of the School of Engineering Science after the completion of DTO expansion. The reviewers have commented positively on School's activities including its highly regarded technical communication program, mandatory co-op program, open-labs and new Mechatronics Systems Engineering program. The general level of research activity is found to be quite commendable when measured in terms of research grants ($80K per faculty per year) and research results. The school should be congratulated for the positive evaluation by the reviewers. With regard to the recommendations and action plan outlined by the Director, I am in full agreement. My comments on key topics of the review report are given below.

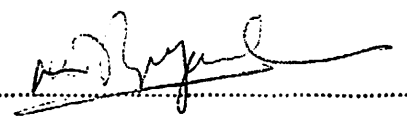
Undergraduate Curriculum Revision and Student Experience: The action plan is acceptable and practical. The issues concerning student experience will be addressed during the curriculum review.

Graduate Student Funding: Although the reviewers have commented critically on this issue, the School is doing its best to support graduate students. The main problem is relatively low TA support per student compared to other units. According to data the prepared by the Dean of Graduate Studies, the school ranks second at SFU in terms of the total research funding ($1.47M) directed for graduate student support. I recommend discontinuing the practice of accepting international PhD students without funding. The school should develop a strategy to attract more NSERC scholarship recipients.

Mechatronics Systems Engineering Program and Space: This is a very successful program with high student demand. The first accreditation visit will take place in February 2011. The program needs a stable budget to complete its development. The space available in Surrey for Mechatronics is still inadequate although the program recently received some new space.

Research: There is room to attract more research funding by pursuing large team grants and collaboration with regional universities. The School has strong ties to industry and should develop a strategy to attract more research funding from industry.

Budget Issues: Many comments of the reviewers are related to the school budget (e.g. TA, laboratory equipment, student advising, etc). Although the DTO Program brought additional resources to the School, the increase in undergraduate and graduate enrollment has been very large (approximately 80 undergraduate students per year in the pre-DTO era to nearly 250 students per year in 2010 and nearly 300% increase in graduate enrollment). This is causing substantial pressure on every aspect of the school. To put this issue in proper context, I have looked at data published by Engineers Canada for Canadian engineering programs. Engineering Science at SFU is 40% below the average space allocation for engineering programs in Western Canada and 30% below the Canadian average for $$ per FTE undergraduate student.

Faculty Dean	Date
	October 20, 2010