

**Report on the Unit Review of the
Schulich School of Engineering
at the University of Calgary
October 2015**

Reviewers:

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Nov. 9, 2015

Introduction

The review reported on here was conducted at the invitation of the University of Calgary as part of its Unit Review Program. We understand the purpose of the review is to help improve the quality of the programs and the operations of the Schulich School of Engineering. We commend the University for undertaking such a review and we hope that the commentary and recommendations provided here will go some way in this quality enhancement direction.

The Review Process

The review team was provided with considerable information about the University of Calgary (UofC) and its plans and about the programs, operations and plans of The Schulich School of Engineering (SSE). Of particular significance is the self-study document, prepared by the School, together with a large set of appendices containing useful data on various facets of the School.

The review team visited the School on October 18-20, 2015. In addition to a preparatory meeting of the team on the evening of October 18, we spent two days (October 19 and 20) interviewing and meeting with a wide array of stakeholders. The agenda of the site visit is attached as Appendix A.

Overview:

With approximately 150 faculty members, 3000 undergraduate students, and nearly 1000 graduate students, the Schulich School of Engineering is a medium-size school within the landscape of Faculties of Engineering in Canada. By all indications, the School is doing an excellent job in undergraduate engineering education: It attracts excellent students and provides them with excellent education as well as a variety of experiences both inside and outside the classroom. Of particular note is the very well subscribed internship program that provides the participating students with 12-16 months work

experience. The School also strives to provide the undergraduate students with an international experience through study abroad programs and international internships.

The School has been a supplier to industry of generations of successful engineers. As a result, the School enjoys tremendous community support. Both the internal and external communities are very supportive of Dean Rosehart and his leadership.

The School has a full array of graduate programs that attract good students. At 20-25% of total student enrolment, the number of graduate students is reasonable. Also, with an average of about five research graduate students per faculty member, the School falls within the acceptable level of graduate intensity in Canada.

The School has established its research priorities and they fit within three of the strategic research areas of the University. In addition to disciplinary research, a significant number of interdisciplinary and cross-disciplinary projects are underway.

The School has some excellent facilities and looks forward to the completion of a significant new building.

In summary, The Schulich School has an excellent foundation upon which to build its future. In the following we provide more details on these and other facets of the School's activities and make a number of recommendations aimed at improving the School's programs and operations.

Undergraduate Studies:

As mentioned above, a bright spot for the School is its undergraduate program. It is obvious that the School pays significant attention to its undergraduate program with very positive results. Indeed, it is the success of the undergraduate program that brings to the School the tremendous support of the local community.

Of special note is the new innovative Energy program that brings in students from SAIT and potentially other colleges. It appears to be well designed, and the transition between College and University has been treated with care through a summer bridging program. The only caution we offer relates to growing this program: *If scaling the Energy program is contemplated, the appropriate resources that will be needed and the funding model for this program should be addressed.*

We were extremely impressed with the undergraduate student leaders we met. They were a happy, proud, articulate and enthusiastic group. They praised the School administration and in particular the Dean for being very accessible and responsive to their needs. They made many positive remarks about the internship program, although some wanted the attendance at various workshops that the Internship Office provides to be made optional. Many of the students were keen on obtaining international experience either through international internships, the study-abroad programs, or international exchanges. It appears, however, that the latter are very limited. Although we appreciate the difficulty of establishing international exchanges in light of the CEAB constraints, *we urge the School to increase its offerings of international exchange programs as well as simplifying and streamlining the process for the students who seek to participate in such programs*. A metric for the School's success in this area would be the percentage of graduates who have had an international experience.

Although we did not visit undergraduate laboratories, we learned that some of the teaching equipment is in need of updating and renewal. We also heard that some of the labs are crowded, that lab groups are sometimes large, and that the technical support can be improved. *We recommend that consideration be given to teaching equipment renewal, lab capacity enhancement, and the provision of sufficient technical support for the undergraduate labs.*

The School is doing excellent work in the area of Engineering Education and it has a strong base to build on for future developments in this field. *However, to be recognized as a leader in this area, the School needs to establish metrics by which leadership is demonstrated, and show that it can attain these metrics.*

The School attracts outstanding applicants and admits only about 20% of those applying. Nevertheless, the admissions process has problems: As a result of the algorithm used by the Office of the University Registrar, specifically the incongruous timing of grade release and admissions decisions, serious anomalies and inconsistencies happen in the admission results. These can potentially have negative effects on the School's and the University's reputation. *We strongly recommend that the admissions process be subjected to a detailed study and measures be taken to improve the process as soon as possible. Also, there is a need for closer communication between the Registrar's Office and the School regarding admissions.* Finally, the holistic admission approach proposed by the School should work well as similar approaches are currently in use at other Canadian and U.S. engineering schools.

Another issue related to undergraduate studies was brought to our attention: Very recently a decision has been made to restructure the provision of student advising. While in the past, advising of first-year students was provided centrally, upper year students in the various departments received their program advising from their respective departments. In the new system, the staff advisors have been moved from the departments to a central location (the Student Centre) with the aim of pooling resources and thus achieving efficiencies and providing greater consistency in procedures. However, there are possible negative effects to this move. Specifically, the close connections between program advisors and their departments and the resulting specialized knowledge they gain through these connections

can be lost over time. As well, the faculty in each department used to depend on these staff for a variety of support functions.

We recommend that the effects of the centralization of student advising be carefully monitored, with monitoring to include the perspectives of the students, faculty, staff and administration, and that measures be taken to mitigate negative effects, including, if necessary, reversing the move and going back to the old system.

Graduate Studies:

As already mentioned, the graduate program is of good scope and reasonable size. However, there is considerable room for improvement:

1. There are no plans nor enrolment targets for the graduate programs.
2. Considerable variability exists in implementing the policy of minimum funding of graduate students. These inconsistencies occur between departments and between individual supervisors in some departments. Needless to say, these are a source of frustration and discontent among graduate students who perceive some of the resulting side effects as unfair.
3. There is no formalized process for graduate students to bring their issues to decision makers within the School. Although the School's Committee on Graduate Studies can serve as a forum for receiving and addressing graduate students' issues, it does not appear to be doing this, at least in a formal way. Also, it does not have graduate student representation.
4. There appears to be little communication between the School and graduate students.

5. The School appears to attract good graduate students internationally and we were impressed with the students we met. It appears, however, that the School does little in the way of recruiting graduate students. This is perhaps one of the reasons for the very skewed demographics of graduate students favouring international students.
6. The MEng program is in serious need for reorganization, and restructuring. The School needs to give serious thought to formulating a plan for the MEng program. Here we note that the program is valued by the external community as represented by the Industrial Advisory Board. The program can also become a viable source of revenue for the School. If this revenue is shared with the departments in a transparent manner, the departments would have a strong incentive to participate in the program.
7. The current system of accepting graduate students by individual instructors as opposed to by departments or technical groups within departments is sub optimal.
8. Efforts to provide graduate students with professional development and career preparation should be expanded. The students indicated their appreciation for "My Grad Skills" which is offered by the Faculty of Graduate Studies and noted some of the effort provided by the School in this regard. Also, forums should be provided for exposing graduate student research to the industrial community and in general to enhancing the relationships between graduate students and industry.

To deal with these issues and others and more generally to raise the profile of graduate studies in the Schulich School we strongly recommend the establishment of an Associate Dean, Graduate Students portfolio. This position can have the overall responsibilities of planning for graduate studies across the School and liaising with

the Faculty of Graduate Studies. In this regard, we note that SSE has the largest number of research graduate students of any faculty at the UofC.

Research:

As mentioned above, the School has established its research priorities and they fit nicely within three of the strategic research areas of the University. The review team was pleased to see considerable effort for promoting interdisciplinary and cross disciplinary research. However, although the School is performing at a robust level, the good performance is not uniform across departments. *We recommend that some departments be encouraged to increase research intensity.*

Also, the external research funding of about \$200K per faculty member, though respectable, can be increased. *We recommend that targets for the external funding of research should be set and progress toward meeting these targets should be monitored.*

From a research strategy standpoint, there is concern that some departments are trying to meet the University and School directives in an artificial manner. As an example, the Biomedical faculty who have been placed in the Department of Civil Engineering do not appear to us to be a good fit with that Department. We fear that this will result in them not attaining their full potential. Further, they would not be of help in Civil Engineering meeting its standard teaching obligations. This gives additional concern because in our view, given the geographic context of the UofC, its Department of Civil Engineering should strive toward greater strength and prominence.

We recommend that despite the emphasis on multidisciplinary research, the fit of new faculty appointees with their home departments should be carefully considered.

We were impressed with a number of initiatives the UofC has put in place to support its research priorities including the provision of large

sums of internal funding. Also, to promote multidisciplinary team work, SSE is establishing multi-user labs.

In our meeting with the Associate Dean, Research and some of the faculty who hold research chairs, some worthwhile ideas were proposed. These include the establishment of a system for faculty to obtain teaching reduction or no teaching for a term to develop a brand new research idea or direction. Of course, such buyouts of teaching can have deleterious effects on the ability of the Department to meet their teaching obligations. Indeed, striking the right balance between the support of research and teaching is always a challenge for academic administrators.

We also heard that despite the expansion of buildings and facilities, there remains a shortage of appropriate research space. Another issue that is not unique to SSE relates to securing sufficient funds for the ongoing operation and maintenance of major research facilities.

In conclusion, we recommend that the Associate Dean, Research, continue to be proactive in supporting both teams and individual researchers in securing funding from a variety of sources, and in helping create mechanisms for the support of research and researchers.

Governance and Administrative Structures:

The Governance structure of the School, with an Engineering Faculty Council and its various committees, is fairly typical of engineering faculties at other Canadian Universities. Also, although the administrative structure of the School is generally similar to those of other faculties of engineering, we have some specific comments to make here:

1. The Associate Deans. We do not feel that the current structure is effective in serving the School across all areas of its activities. As already mentioned, the School is in dire need of an Associate Dean, Graduate Studies and an associated governance structure that

supports the planning and operation of graduate studies at the School level. *Indeed, to attain its full potential, the graduate program needs a more organized, systematic, consistent, strategic approach to admissions, funding, mentoring and placement of graduate students.*

Although we were impressed with the Associate Deans and with their passion and commitment to their tasks, it was clear that their portfolios overlap in somewhat confusing ways. Also, large portions of their portfolios can perhaps be better performed by dedicated staff working under the oversight of the Associate Deans. We believe that the number of associate deans can be reduced, even with the addition of an Associate Dean, Graduate Studies. *We recommend that the Dean consider restructuring the Associate Deans portfolios along the lines mentioned above.*

2. The centralized reporting structure where the departmental staff managers report to the Dean's Office, bypassing the department heads, although it can lead to some efficiencies, it can also have negative effects on both the functioning of the departments and on the empowering of Department Heads to deploy their staff resources to best effect.

We recommend that the effectiveness of the system of centralized staff reporting be carefully monitored from the perspective of all involved, over a reasonable period and, if necessary, appropriate changes implemented including going back to the old system of reporting.

Budget:

A cursory look at the operating budget of the School indicates that after accounting for size differences it is consistent with budgets of other Canadian engineering faculties. Nevertheless, there is a perception among faculty members that successive budget reductions have made

it difficult for them to do their job in the best possible way. From that perspective, they see the University budgeting process (that is, the process of allocating budgets to individual faculties and in particular to the SSE) as opaque. In this regard the faculty of the Schulich School are not different from those at many other universities in Canada or the U.S. A number of other Universities have solved this perception problem by adopting a system of responsibility – centered budgeting. We understand that the UofC is considering such a system. In the meantime, *we recommend that the Provost should enhance her communications on budget matters.*

Although there were no complaints about budgeting within the School, there is the issue of making new budget allocations sensitive to new activities. For instance, increasing graduate enrollment in a department should result in an additional budget allocation. This is particularly needed in the case of the MEng Program. *Therefore, we recommend that even in the absence of a responsibility-centered budgeting system at the University level, the School should utilize an activity-based funding model to create appropriate incentives for meeting targets and realizing goals.*

Future Growth:

The School has recently been given a base budget allocation of \$4.5M including the funding for hiring 25-30 new faculty. This is part of the advanced hiring initiative recently announced by the Provost and which we applaud. This presents the School with an important opportunity which can be utilized for faculty renewal. In this regard we point out that the faculty demographics indicate that the School is top heavy and in need of an injection of faculty at the assistant professor level.

We recommend that the new advanced-hiring positions be allocated to departments on the basis of a sound academic plan.

The Schulich School is a medium-size Engineering Faculty located in a major "Engineering City". In our meeting with the School's Industrial Advisory Board, we solicited their views on the question of the size of the SSE. They indicated support for increasing the size of the School so as to increase the number of graduating engineers. Also, the Dean and a number of faculty members are supportive of growth. However, there is a pervasive concern among some faculty that growth will not be accompanied by appropriate resources (see discussion on this issue in the section on Budget above).

We recommend that the School develop a plan for growth with a number of options for the ultimate size. Developing a growth plan will require a formalized process related to the setting of School goals and Departmental goals. Such a plan should be carefully costed and should be developed with broad consultations within and outside the School. The first step in the growth plan is obviously the 25-30 new hires as a result of the advanced hiring program.

Facilities and Space Planning:

As mentioned earlier, SSE has some fine space and facilities. It is also awaiting the completion of a major new building. Nevertheless, we heard some comments to the effect that space for graduate students and research is inadequate. We also learned that the School will be hiring a consultant to do a study of its space holdings and its space needs. *We recommend that a study of the SSE space requirements versus its space holdings be undertaken at the earliest possible date and that such a study should take into account future plans for the School's growth. The results of this study should be shared widely within the School and should inform future space planning.*

We also recommend that the School continue with its plans to update and renovate its old facilities.

We were given a detailed presentation on the University's approach to planning for new space. Nevertheless, we heard comments to the effect that in many cases the overriding criterion is architectural beauty as opposed to educational functionality from the users' perspective. *We recommend that the University modify its process for the planning of new buildings to include a users' committee that participates in the planning process from the beginning of the project conception and remains engaged until the building is ready for occupancy.*

Like many other universities, the UofC utilizes a central room booking system. Although this is entirely reasonable and results in the efficient use of the physical plant, some consideration should be given in room bookings to ensure convenience for both students and faculty. *We recommend that the algorithm used for the booking of classrooms should ensure that SSE students receive their lectures as much as possible in SSE buildings, thus minimizing travel time between classes for both students and faculty.*

Diversity and Outreach:

The review team was impressed with the activities underway to promote diversity. We commend the Dean for his leadership and commitment to diversity. Here we note that the SSE is among a small number of Engineering faculties in Canada with a relatively high female student enrolment (in the 25-30% range).

Community Relations and Development:

The Schulich School of Engineering enjoys strong support from its local community. This was evident in the meeting we had with members of the Industrial Advisory Board. We also learned about some of the activities that the school undertakes on a regular basis to enhance its relations with the community. Towards that end we make the following recommendations:

We recommend that the School add to its Industrial Advisory Board two or three members who represent the research arms of some companies from a range of industries. This will bring expertise that can enhance the connection to the research and graduate studies operations of the School. We also recommend that the School hold events that showcase the work of its graduate students to the industrial community.

On the development front, except for a few sporadic remarks in the written material provided to us, we did not have the opportunity to meet with relevant staff. Thus we are unable to comment on this important function.

Academic Planning:

The School has an academic plan. However, it appears that the plan has not yet been operationalized. That is, the plan lacks specific goals, strategies, targets and benchmarks.

We recommend that the School take steps to operationalize its plan by setting specific goals, strategies for achieving goals, targets and performance measures as well as benchmarking the School's performance relative to its peers. This is a major activity that must be undertaken with broad consultations with all stakeholders. Such a formalized and rigorous process can have the added benefit of increasing transparency within the School.

Concluding Remarks:

The Schulich School has an excellent foundation upon which to build its future. We believe that the recommendations made in this report, and summarized below, can help the School achieve the goal of moving up to the next level.

Finally, we wish to thank all those who met and shared their views with us in a frank and open manner. As well, we are grateful to all who helped organize the site visit.

Summary of Recommendations:

1. If scaling the Energy program is contemplated, the appropriate resources that will be needed and the funding model for this program should be addressed.
2. Increase international exchange program offerings, and simplify and streamline the process for the students who seek to participate in such programs.
3. That consideration be given to teaching equipment renewal, lab capacity enhancement, and the provision of sufficient technical support for the undergraduate labs.
4. That the admissions process be subjected to a detailed study and measures be taken to improve the process as soon as possible. Also, there is a need for closer communication between the Registrar's Office and the School regarding admissions.
5. That the effects of the centralization of student advising be carefully monitored, with monitoring to include the perspectives of the students, faculty, staff and administration, and that measures be taken to mitigate negative effects, including, if necessary, reversing the move and going back to the old system.
6. To deal with the graduate program issues outlined in the report, and more generally to raise the profile of graduate studies in the Schulich School, we strongly recommend the establishment of an Associate Dean, Graduate Students portfolio. This position can have the overall responsibilities of planning for graduate studies across the School and liaising with the Faculty of Graduate Studies. In this regard, we note that SSE has the largest number of research graduate students of any faculty at the UofC.

7. That some departments be encouraged to increase research intensity.
8. That targets for the external funding of research should be set and progress toward meeting these targets should be monitored.
9. That despite the emphasis on multi-disciplinary research, the fit of new faculty appointees with their home departments should be carefully considered.
10. That the Associate Dean, Research, continue to be proactive in supporting both teams and individual researchers in securing funding from a variety of sources, and in helping create mechanisms for the support of research and researchers.
11. To attain its full potential, the graduate program needs a more organized, systematic, consistent, strategic approach to admissions, funding, mentoring and placement of graduate students.
12. That the Dean consider restructuring the Associate Deans portfolios along the lines mentioned in the report.
13. That the effectiveness of the system of centralized staff reporting be carefully monitored from the perspective of all involved, over a reasonable period and, if necessary, appropriate changes implemented including going back to the old system of reporting.
14. That the Provost enhance her communications on budget matters.
15. That even in the absence of a responsibility-centered budgeting system at the University level, the School should utilize an activity-

based funding model to create appropriate incentives for meeting targets and realizing goals.

16. That the new advanced-hiring positions be allocated to departments on the basis of a sound academic plan.
17. That the School develop a plan for growth with a number of options for the ultimate size. Developing a growth plan will require a formalized process related to the setting of School goals and Departmental goals. Such a plan should be carefully costed and should be developed with broad consultations within and outside the School. The first step in the growth plan is obviously the 25-30 new hires as a result of the advanced hiring program.
18. That a study of the SSE space requirements versus its space holdings be undertaken at the earliest possible date and that such a study should take into account future plans for the School's growth. The results of this study should be shared widely within the School and should inform future space planning.
19. That the School continue with its plans to update and renovate its old facilities.
20. That the University modify its process for the planning of new buildings to include a users' committee that participates in the planning process from the beginning of the project conception and remains engaged until the building is ready for occupancy.
21. That the algorithm used for the booking of classrooms should ensure that SSE students receive their lectures as much as possible in SSE buildings, thus minimizing travel time between classes for both students and faculty.

22. That the School add to its Industrial Advisory Board two or three members who represent the research arms of some companies from a range of industries. This will bring expertise that can enhance the connection to the research and graduate studies operations of the School.
23. That the School hold events that showcase the work of its graduate students to the industrial community.
24. That the School take steps to operationalize its plan by setting specific goals, strategies for achieving goals, targets and performance measures as well as benchmarking the School's performance relative to its peers. This is a major activity that must be undertaken with broad consultations with all stakeholders. Such a formalized and rigorous process can have the added benefit of increasing transparency within the School.

Appendix A:

Agenda of the Site Visit