A Response to the Discussion Paper circulated by the

Commission on Post-Secondary Education in New Brunswick

Submitted by

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BRIEF TO THE COMMISSION ON POST-SECONDARY EDUCATION IN NEW BRUNSWICK

The Faculty of Engineering at UNB Fredericton would like to thank members of the Commission on Post-Secondary Education in New Brunswick for this opportunity to respond to its Discussion Paper. After offering some background on the Faculty and its programs, this submission offers a short collection of observations and recommendations for consideration by the Commissioners, the Provincial Government, and the people of New Brunswick.

The Commission's Discussion Paper points out that New Brunswickers currently possess a post-secondary education system designed well over forty years ago. By national standards, we are fighting a losing battle in trying to maintain an extensive provincial university and community college infrastructure that largely services a now-shrinking cohort of Maritime high school graduates. New Brunswickers are practical people. They have supported this post-secondary education system with their savings and with their children. However, we cannot assume they will continue to direct more and more resources this way in the future. Nor can we assume that New Brunswick students will be able to afford the significant annual tuition increases required to cover a higher and higher proportion of the full cost of their education. While there are no easy and painless fixes to this dilemma, the underlying problems may be addressed through a combination of restructuring, streamlining, shared services, and targeted financial support.

Make no mistake. We want *and need* to maintain a level of real diversity and choice, and we applaud the efforts of institutions now attempting to grow their markets through targeted niche programs, attracting mature students, and moving into new international markets. We also believe that we must build on strengths, be more focused in our strategies, and use our electronic infrastructure and experience to better advantage within a larger vision. To this end, we encourage the Commissioners and citizens of New Brunswick to consider and reflect on the recommendations made in the more extensive brief submitted by the University of New Brunswick.

In this short submission, we have opted not to discuss the important contributions to the New Brunswick economy made by engineering graduates in the past and present. Nor is there the space to describe the important achievements of our own faculty members in terms of basic and applied research. We won't spend time here describing the significant improvements that dedicated UNB faculty members have made to our undergraduate engineering programs over the past three years – except to say that, with limited resources, we are building better linkages between engineering design, professional studies, mathematics, and science subjects beginning right in first year. We have also brought time to degree completion down into line with comparable programs at other national universities – a major accomplishment.

Rather, we want to focus in this submission on the importance of *partnerships* – past, present and future – to engineering education at UNB.

ENGINEERING @ UNB

University-level engineering education has long been important to the province of New Brunswick. The first lectures in 1854 were instituted at the urgings of community leaders and funded by the Lieutenant Governor Sir Edmund Head himself after Kings College could not find the funds to do so internally. Today, 63% of Professional Engineers or Engineers in Training actively practicing in the province are UNB graduates. The Faculty is by any measure a cornerstone of engineering education and applied research in New Brunswick, and our 250-300 graduates comprise the vast majority of new engineers entering the work force in New Brunswick every year. This pool of graduates is one of the key elements of our industrial and infrastructure. There is no way to build a modern economy – or transform it - without well-trained engineers.

The mission of the Faculty of Engineering is to provide undergraduate and graduate programs of a high standard that meet the needs of society for engineering education and research. The actions of our faculty members are testament to three longer-term objectives:

1. To see UNB recognized as the preferred choice for engineering education in Eastern Canada and in targeted international markets;
2. To see UNB recognized internationally as a key North American centre for inter-disciplinary engineering research; and
3. To see UNB exercise a marked and measurable influence on redefining the role and nature of Engineering in Canada for the 21st Century.

Nine Engineering programs – instructing well over 1100 undergraduate students -- are offered at the University of New Brunswick. Six are offered totally within the UNBF Faculty of Engineering Faculty:

- Chemical Engineering (ChE)
- Civil Engineering (CE)
- Computer Engineering (CMPE)
- Electrical Engineering (EE)
- Geomatics Engineering (GGE)
- Mechanical Engineering (ME)

Three more – Forest Engineering (FE), Geological Engineering (GE) and Software Engineering (SWE) -- are offered in cooperation with other Faculties. With the help of our engineering colleagues at UNBSJ, interested students have the option of taking the first two years of their program on that campus before finishing their degree in Fredericton. We invite interested readers to visit our Web site at *http://www.unbf.ca/eng/index.php3* for more information on each of our programs.

Our faculty members are very familiar with demands for accountability in education. Beyond the regular quality assurance reviews conducted for all departments and faculties on campus, all nine programs are formally recognized by the Canadian Council of Professional Engineers through its Canadian Engineering Accreditation Board (CEAB).

The geomatics engineering program is also accredited by the Canadian Council of Land Surveyors (CCLS) and the Royal Institution of Chartered Surveyors (RICS). Regular accreditation ensures that our programs stay at a high calibre and that our students continue to receive an education recognized by provincial engineering associations across Canada and beyond.

A nationally-recognized and diverse Faculty that balances professional programs and research intensity, UNB Engineering contains almost 25% of the graduate students now on the Fredericton campus. Many of them are international students, attracted to New Brunswick by the reputation of UNB's programs and individual faculty members. Most tenured or tenure-track faculty members now hold an NSERC Discovery Grant, conducting a considerable amount of the contract research undertaken on campus and much of the applied research conducted in this province.

The Faculty takes good advantage of its role and place on the campus of a comprehensive university. Just as engineers must work with other professionals as part of their daily routine, we rely on support from other faculties on both campuses to offer our undergraduate programs. As part of ongoing research, Engineering faculty members have collaborated with colleagues in every other Faculty on the Fredericton campus as well as with their counterparts at UNBSJ.

Since 1854, our faculty members and graduates have played leadership roles in the industrial and economic development of Atlantic Canada and beyond. Faculty members and graduates have:

- started and managed successful New Brunswick firms (e.g., ADI, Neill & Gunter, Jacques Whitford, AIL, CARIS, Geoplan/Opus, Terrain Group and many others);
- managed major federal and provincial government infrastructure programs in transportation, telecommunications, energy, mapping and land records management;
- played leadership roles in national firms like Montreal Engineering, Acres International, Suncor, Lavalin, Peter Kiewit, and many other engineering companies right across Canada.

As well, our international engineering graduates have played key roles in infrastructure creation, economic development, governance, and academic leadership. Among our graduates we count business leaders, senior government directors, NGO leaders, and university deans & department chairs in over 50 countries world-wide.

Finally, the Faculty's J. Herbert Smith Centre for Technology Management and Entrepreneurship is testament to the recognition of the link between engineering, innovation and economic development in Atlantic Canada. The Centre has gone from strength to strength and enjoys strong support from the province's business community. A good sense of cooperation has been developed with the UNBF Faculty of Business Administration, our students have won provincial entrepreneurship awards, and many of the TME courses (all electives) are currently over-subscribed.

PARTNERSHIPS ARE CRITICAL

UNB Engineering thrives on partnerships:

- *With other Faculties at UNB:* Our undergraduate students rely on instructors from other faculties to provide them with the basic foundations in maths and sciences, critical thinking skills, and the historical and social contexts so necessary to appreciate the complex problems facing Canada today. Our Masters and PhD students have relied on the expertise, mentorship and, in some cases, the shared financial support of professors in at least seven other faculties on campus.
- *With the Provincial Government:* Since the very first lectures in engineering here were paid for by the Lieutenant Governor, the relationship between UNB Engineering and the Province of New Brunswick has been strong. Especially over the past 75 years, provincial government officials have been instrumental in fostering, sponsoring and using UNB's engineering expertise in the development of New Brunswick's highway, energy, communications, and land information infrastructures.
- *With the Private Sector:* Through the 1950s and 60s, New Brunswick engineering firms partnered with UNB to make extensive use of testing equipment, mainframe computers and lab facilities too expensive for any one company to afford. Over the past forty years, professional consulting firms like ADI and high-technology start-up companies like CARIS have spun out from UNB offices and laboratories to create new opportunities for much-needed employment and economic development here in New Brunswick. Most of our Faculty Advisory Board members come from the private sector in Eastern Canada, and provide valuable input to our programs and longer-term planning.
- *With our Undergraduate Students:* An engineering program costs more per student than other programs, and our students have accepted responsibility for this differential cost. In 2006-07, full-time undergraduate Engineering students at UNB paid a Tuition Differential Fee of $600 per year. It will increase to $800 per year this coming September. At a time when our tuitions are among the highest in the country, why would the students agree to such a serious additional levy? Because, like the faculty and leadership at UNB, they are prepared to invest in UNB facilities and resources in order to keep the quality of their education at or above national levels.

  Rather than treat this as just another fee imposed to help cover overall university costs, the leadership of UNB has agreed to direct 100% of the proceeds of this Engineering Program Fund right back into resources that enhance undergraduate engineering education. Since it is their money being spent, a student-led Advisory Committee accepts proposals from the Departments and then decides how the proceeds from the Fund will be allocated every year. Proposals funded in 2006-07 supported much-needed upgrades to classrooms and laboratories, new state-of-the-art equipment, computer hardware & software, "Help-Centre" staffing in selected engineering and science courses with high attrition rates, renovations to the Library, and teaching stipends to ensure key courses were offered.

Today, as the Commission has pointed out, New Brunswick faces serious challenges in terms of capacity and demographics, and must address a post-secondary education system that was designed for a different time and different goals. In order to meet new quality and retention goals, we must think and act differently than we have in the past. The *status quo* is not an option.

To that end, enriching existing partnerships and building new ones will be even more important in future. For example:

(1) Between New Brunswick's Public School System and Universities: We must address the "disconnect" between the performance of provincial high school graduates with the expectations of university math and science instructors – a disconnect that works to the detriment of our students. Standardized national test scores of New Brunswick K-12 students fall among the lowest in both Canada and the United States. We see that many of our own incoming students -- accepted into Engineering with solid high school marks and a genuine interest in math and science -- still have serious academic challenges in passing their first year subjects. Too many wind up disappointed and either take longer to complete or move out of the program altogether. Fixing this will require:

- Accelerating and intensifying the dialogue between High School and University-level educators to build a shared understanding of appropriate curricula and standards for math and sciences -- one that ultimately results in better student preparation and a smoother transition to first-year courses in university.
- Placing more highly qualified new mathematics and science teachers in New Brunswick schools. A 2004 US National Academy of Science Study[1] offers one example of a longer-term plan to meet this goal:

  > *Annually recruit 10,000 science and mathematics teachers by awarding 4-year scholarships and thereby educating 10 million minds. Attract 10,000 of America's brightest students to the teaching profession every year, each of whom can have an impact on 1,000 students over the course of their careers. The program would award competitive 4-year scholarships for students to obtain bachelor's degrees in the physical or life sciences, engineering, or mathematics with concurrent certification as K–12 science and mathematics teachers. The merit-based scholarships would provide up to $20,000 a year for 4 years for qualified educational expenses, including tuition and fees, and require a commitment to 5 years of service in public K–12 schools.*

In New Brunswick, even a target of funding the university education of ten groups of ten new math and sciences teachers a year for each of the next ten years would have an impact on tens of thousands of school students across the province.

[1] NAS [2004] *Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. National Academy of Sciences, Washington, D.C., USA. http://books.nap.edu/catalog/11463.html

(2) Between Community Colleges and the Universities: Many UNB engineering students begin their technical education at community colleges. Others move from engineering into community college programs. In future, we believe more students will move in both directions. Recommended actions that will support this include:

- Better and more formalized articulation arrangements – ones that meet increasingly stringent accreditation requirements of professional engineers, technicians and technologists;
- Introduction of more effective "bridging terms" for people who want to move into university after finishing their community college diplomas, as well as better means recognizing the combination of technical education and work experiences of mature students returning for more formal education after being out in the labour force;
- (As recommended in UNB Fredericton's main brief to the Commission) Co-location of community colleges and university facilities where appropriate and as opportunities arise, in order to share libraries, student services, recreation facilities, physical plant, and security.

We feel strongly about UNB Engineering taking a leading role on this issue as it moves forward.

(3) Between Universities: Providing full-time faculty members with limited course release time and short-term funding for technical support will not move us along fast enough to make real change. Early successes in sharing delivery of courses among partner universities through Web-based learning and other models of distance education must be given greater financial support. Also -- using as an example the arrangement that now exists between Carleton University and University of Ottawa – we recommend investigating the feasibility of creating a stronger partnership between UNBF, UNBSJ and UdeM in order to offer combined graduate studies in engineering in New Brunswick.

(4) Among Universities and Community Colleges: Students in all provincial post-secondary institutions rely far more on the Internet today for their information. Our provincial universities and community college campuses are each at different stages in their transition from hardcopy to the most effective mix of hardcopy and electronic library resources. Taken collectively, provincial educational institutions spend millions of dollars annually in library acquisitions and electronic journal site licenses. Implementing a single virtual provincial library accessible from all post-secondary institutions has the potential of providing New Brunswick students with the same range of electronic resources found at any of the top institutions across the country – with less duplication of costs and overlap of resources.

(5) Among Universities, Government and the Private Sector: In order to give students the best possible education – and to encourage them to stay here when they graduate – requires more extensive and intimate partnerships between universities and potential employers. New Brunswick employers can no longer afford to be trumped by outside competitors making earlier and more attractive offers to our most employable students and graduates.

- Undergraduate Co-Op and Professional Experience programs offered in Engineering, Science, Computer Science, and Business Administration provide our students with valuable professional experience in advance of graduation. Due to budgetary challenges, all these programs at UNB must recover 100% of their operating costs through additional Co-Op fees paid by the students. The high fees involved make it difficult for many students to participate fully. With proper financial support and if used strategically, these programs could be excellent vehicles for encouraging students to stay with New Brunswick organizations at competitive rates of pay.
- We need more programs like Business New Brunswick's *Community Economic Development Fund*, which supports the collaboration of UNB Chemical Engineering students with industrial and community clients to solve real-world problems in their senior design projects.
- Government, industry and universities must seize opportunities to collaborate on the acquisition and shared use of expensive high-technology equipment and facilities. Moving forward, this could include shared establishment of new laboratories, purchase of new equipment, and even attraction of specialized new personnel – valuable new resources that may only be viable to consider if shared and accessible by multiple partners. We encourage the Province of New Brunswick to look to the Province of Québec for examples of provincially-funded programs encouraging cooperation between industry and academia in leading-edge research of strategic importance to the province's economic development.

TO THE FUTURE

Perhaps prophetically, the first UNB engineering graduate, Henry Ketchum, left New Brunswick almost 150 years ago – not for Ontario or Alberta, but to work on a major railway construction project in South America. UNB is still in the business of preparing our graduates to work anywhere – that's part of the role and the expectation of a national university. Today, New Brunswickers can be duly proud that UNB engineering graduates work everywhere -- from Fredericton and Saint John to Shanghai, from Miramichi to Mozambique, and from Campbellton to Canberra.

One of the objectives of the faculty is "to see UNB exercise a marked and measurable influence on redefining the role and nature of Engineering in Canada for the 21st Century." A strong UNB Faculty of Engineering must continue to play a critical and essential role in this regard here in New Brunswick and beyond. Through our research, we will help define the engineering systems and practices of the future. Through properly resourced education and partnerships, we can accelerate the introduction of leading-edge methods of engineering practice to our industry and government.

Figures from the Association of Professional Engineers and Geoscientists of New Brunswick indicate that well over 20% of its members practicing in this province are aged 55 or over. A vibrant university engineering capability within a healthy post-secondary education system is absolutely essential to the economic success of New Brunswick's industries and communities. Given the departures from the engineering profession that will take place here over the next decade, there will be a tremendous need for new graduates to maintain *and* transform the infrastructure needed to make New Brunswick self-sufficient. It is unlikely we could attract enough engineers from outside the province to meet our future needs, and we could definitely not import the loyalty our graduates have to this province.

Henry Ketchum eventually returned and made his mark professionally here in New Brunswick. Our challenge today is to keep home as many of those who want to stay and attract back home others who may be needed to help reinvent the New Brunswick of the 21st century. Healthy and sustainable partnerships will be key to attracting solid students into our program in future, keeping a critical mass of graduates here in New Brunswick, and making sure that graduates from all our programs continue to be recognized nationally and internationally.

In closing, the principal author would like to acknowledge the important contribution of our Faculty's Department Chairs and other interested individuals in providing valuable suggestions and feedback during the preparation of this document. On behalf of the UNBF Faculty of Engineering, we all thank the members of the Post-Secondary Education Commission for provoking the important discussions now taking place.