



Engineers weigh in to the brain drain debate

by Karen Hawthorne

Furious debate has raged for the past few months over whether the brightest Canadians are fleeing south to escape taxes and make more money. There's no doubt engineers are among those crossing the border, with United States-based giants like Microsoft and Sun Microsystems vying with Canadian companies over electrical engineering and computer science graduates before they leave campus. But to what extent are they leaving and why?

Conflicting reports

The Conference Board of Canada has claimed that 52 per cent of Canada's new engineering graduates, or 12,433 people, emigrated to the U.S. from 1995 to 1997, based on analysis showing that the number of non-permanent emigrants from Canada to the U.S. has grown significantly over the past decade.

But a Statistics Canada survey, published by Human Resources Development Canada (HRDC), found that only 5.5 per cent or 448 of the more than 8000 people who graduated from a Canadian engineering or applied science program in 1995 emigrated to the U.S. between 1995 and 1997.

"Clearly, a report stating that more than half of Canada's engineering graduates are leaving the country is of concern," says Dan Levert, P.Eng., president and CEO of the Canadian Council of Professional Engineers (CCPE). "As a nation, we have invested considerable time, effort and money to train our engineers, to say nothing of the individual effort." Levert adds that the discrepancy between the two reports was largely overlooked by the media. He voiced his concerns in a letter to the editor sent to major Ontario daily newspapers last month. Excerpts of the letter were published by *The Ottawa Citizen* and *The Hamilton Spectator*.

Based on interviews with 1995 graduates, the HRDC/Statistics Canada report concludes that the brain drain is very small and the majority of university graduates moved to the U.S. to take advantage of employment or education opportunities, not lower taxes as indicated by the Conference Board.

In light of debate on the brain drain, StatsCan is

revamping its survey of Canadians conducted two and five years after graduation to track more closely the emigration of graduates to the U.S.

CCPE is standing behind the StatsCan finding that the vast majority of engineering graduates stay in Canada to practise, says Karen Martinson, CCPE's manager of engineering resources. "We're confident that StatsCan has very good data," she says, pointing to its reputation for netting a 90-95 per cent survey response rate.

Further research

Martinson says that because there are engineering graduates who do not get licensed—especially in emerging disciplines like software and computer engineering—CCPE cannot track all engineering graduates entering the workforce. However, CCPE, which surveys enrolment in Canada's university engineering programs, has hired management consultants KPMG to do some further research in response to the perceived skills shortage.

Beginning this September, KPMG is conducting interviews with 125 companies across Canada in the IT and biotech industries on attitudes toward the engineering profession, including what employers define as engineering work, what skills they require of engineers and whether their human resources needs are being met by Canadian engineers. A draft report is expected by December.

The Ontario situation

Over 2500 licensed PEO members are currently working in the U.S., out of PEO's 60,000 non-retired members. As for salaries, Ontario engineers earn about 70 per cent of what U.S. engineers earn. The Ontario-U.S. wage gap has increased from 24 per cent in 1992, to 30 per cent in 1998, based on salary surveys done by PEO and the National Society of Professional Engineers (see table on p. 13), says Stephen Jack, P.Eng., PEO's director of programs and events.

"The salary differential is significant enough to be a major factor in engineers moving south," Jack says, adding that it also positions Ontario's engineering services at an advantage internationally. "The export market for our engineering services should be improved," he says. "We should be in a better competitive position because of our lower salaries for engineers."

Some industry and education leaders are adamant

Engineers' Salaries—Comparison between Ontario and the United States

Survey Year	Median Income—Ontario (US\$)	Median Income—U.S. (US\$)	Ontario/U.S. Ratio (%)
1992	\$ 44,280	\$ 58,240	76
1993	44,590	60,800	73
1994	45,730	62,400	73
1995	46,230	64,000	72
1996	46,765	65,800	71
1997	No survey		
1998	48,825	69,550	70

Notes:

1. Data sources: PEO Membership Salary Survey; National Society of Professional Engineers Income and Salary Survey. NSPE survey based on approximately 9000 responses from across U.S.; PEO survey based on approximately 6000 to 7000 responses from Ontario.
2. Canadian to U.S. dollar conversion rate estimated at 0.67 for all survey years, although there are year-to-year fluctuations.

Plugging the drain

The federal and Ontario governments have introduced programs to redress several of the major deficiencies in our research infrastructure and help keep top researchers in Canada. These programs include the Canada Foundation for Innovation, an independent corporation mandated to increase the capabilities of Canadian universities, colleges, hospitals and other not-for-profit institutions to carry out world-class scientific research and technology development.

Industry is also on board with the recent creation of, for example, GM of Canada's Canadian Regional Engineering Centre in Oshawa. The centre will add 160 new high tech engineering and skilled trades jobs over the next year, and see \$20 million invested in a new vehicle design facility.

The programs aimed at improving research infrastructure may improve Canada's research environment, but salaries will remain an issue, says Harris. "Ultimately, I believe that our engineering graduates will go where they perceive the best opportunities—this is a combination of interesting jobs, [higher] salaries and [lower] taxes."

that it's not the size of the brain drain that matters, because the talent that's leaking south is important for Canada's growth and prosperity. "The issue of 'brain drain' is very serious for Canada," says Tom Harris, PhD, P.Eng, dean of engineering at Queen's University. "Is it just taxes? No. Should we be concerned? Yes," he adds, pointing to a number of contributing factors, such as the recruitment of students by U.S. companies that offer challenging work, stock options and signing bonuses.

"In several years at Queen's, a number of our very best graduate students have gone to work in the U.S.," Harris says. "A combination of interesting assignments—where they can fully use their education and training, opportunities for advancement and good starting salaries are the prime reasons."

Harris says there are significantly more opportunities at U.S. companies and universities for Canada's PhDs to use their advanced education and training. Top students from Ontario's universities also favour graduate studies at U.S. universities like MIT, Berkeley and Stanford because of name recognition, better facilities and equipment, Harris says.

Faculty mobility is another serious issue. "Particularly in the areas of computer engineering, software engineering and electrical engineering, positions at top U.S. universities might pay between \$140,000

to \$180,000. At most Canadian universities, salaries for outstanding senior professors might be \$90,000 to \$120,000 in Canadian dollars."

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Hot jobs for engineers in IT, manufacturing and construction

by Karen Hawthorne

The high-tech boom has engineers in high demand for most engineering fields, technical recruiters say.

Software design and information technology are hot areas for job growth, as companies try to rope electrical engineering graduates before they walk out of the universities. Jobs posted on PEO's website through the Employment Advisory Service run the gambit from technical sales representatives and soft-

ware systems integrators, to telecommunications designers. But other industries like pharmaceutical development, food processing and new food product development, automotive and other types of manufacturing, and construction are also showing strong employment opportunities.

"Anything related to construction is very big right now, like sign manufacturing and structural engineering," says Paul MacBean, president of Toronto-based Technical Skills Consulting Inc., which links job applicants to clients across Canada. "Particularly in the last few years, business has been booming in the construction industry in Canada." With little activity in construction in the early, recessionary 1990s, students did not opt to study civil engineering, MacBean says of the current skills shortage in construction. Now, mid-to-senior level professionals with four or five years' experience are in demand.

Machinery design and product development also top his list of growth areas to track for new and experienced engineers looking for new opportunities.

Lesley Wieser, a senior consultant with TSC Group in Toronto, recruits technical professionals for a range of industries. "In Canada, the market is getting better for manufacturing and exporting products," she says, highlighting the growth in food and pharmaceutical product development and manufacturing, and continued prosperity in Canada's automotive industry. Electrical, mechanical and chemical engineers are all getting jobs, Wieser adds.

Results of a recent survey by Ontario universities confirm that graduates from the province's university undergraduate programs are doing exceptionally well in today's job market. Although numbers were almost as high for fine arts programs, the employment rate for engineering graduates six months after graduation in 1996 was 91.5 per cent. By 1998, that rate had jumped to 97.5 per cent.

For the survey, 1996 graduates of undergraduate degree programs were asked 12 questions regarding their employment situation six months and two years after graduation. Over 25,000 graduates completed surveys, representing 54 per cent of the class of 1996.

Technical recruiters also say today's employers are looking for engineers with a cross-section of skills, including communication, interpersonal and marketing skills. "There's a high demand for strong management and supervision of teams," Wieser says, adding that some recent graduates just don't have the communication and presentation skills to make a short-list. Because civil engineers work with contractors, millwrights, electricians and production staff, for example, engineers have to relay information and communicate problems effectively, she says.

"There's always a high demand for engineers in senior manufacturing positions because of the small percentage of engineers who have sales, marketing and business management skills," says MacBean, whose company recruits for entry-level and mid-to-senior positions. "At all levels, clients will request a broad range of skills."

Engineering programs are changing to respond to the call for a broader skill set in today's knowledge-based economy. For example, concurrent degree programs now allow engineering students to acquire two degrees, such as engineering and computer science, business or psychology.

Keeping tabs on growth industries

Mohan Mathur, PhD, P.Eng., dean of engineering at the University of Western Ontario, predicts that engineers with a strong background in information technology will be in demand in the biotechnology industry, perhaps creating new engineering disciplines.

"I am convinced that engineering graduates will be contributing to tissue engineering and molecular engineering to custom-produce biological products with the required physical properties—with assured quality and in bulk," he says.

Nuala Beck, Canadian economist and author, says the high-tech revolution "has now broadened out and given a whole lot of other industries a new lease on life," such as new hand tools and medical instruments.

She says that engineers looking for career opportunities should "make a beeline" for the following growth industries:

- ◆ communications equipment;
- ◆ instrumentation process control equipment;
- ◆ manufactured housing;
- ◆ household furniture manufacturing;
- ◆ cutlery and hand tools;
- ◆ metal-making machinery;
- ◆ electronics;
- ◆ computer equipment; and
- ◆ medical instruments.

Building PEO's industry profile

As part of ongoing efforts to raise awareness of PEO's regulatory role at key industry events, PEO will be hosting a booth at Construct Canada '99, to be held December 1-3, 1999, at the Metro Toronto Convention Centre. Aimed at architects, builders, contractors, developers, engineers and property managers, the show covers the design, construction, retrofitting and renovation of buildings, housing and infrastructure. It will feature 850 exhibits and over 150 seminars. Be sure to visit PEO at booth #539. For more information and free passes, fax a business card to (416) 512-1993, call (416) 512-1215 or visit www.constructcanada.com/.

PEO takes first steps toward professional regulation in software

by Alison Piper

PEO recently embarked on a media campaign to spread the word about its new criteria for assessing the qualifications of software practitioners who wish to become licensed as professional engineers.

A news release announcing PEO's desire to license software practitioners and outlining requirements has been distributed to IT, high-tech and university media, organizations representing IT and high-tech practitioners, engineering associations and engineering educators. It affirms PEO's support for the development of software engineering programs that meet national accreditation standards set by the Canadian Engineering Accreditation Board, and PEO's licensing criteria for software practitioners.

Individuals whose work experience is mainly in software design and development, but whose academic background is in something other than an accredited computer engineering or other information technology-related engineering program are now eligible for licensure, provided they meet other licensing requirements. Previously, the experience of such applicants was assessed on an individual basis.

Approved by PEO Council in May, the new licensing criteria define the core knowledge that software practitioners require for P.Eng. licensing, providing a basis for consistently assessing the qualifications of software practitioners (see "P.Eng. licensing simplified for software practitioners," *The Link*, August/September 1999, p. 3).

"This is an important change and a first step in introducing professional regulation to the software industry," says PEO President Patrick Quinn, P.Eng. In today's

marketplace, software practitioners may come from various backgrounds, he notes. Some are professional engineers educated in traditional engineering disciplines, who have acquired expertise in the software field. Others come from a computer science background. Still others have limited formal training. "It's very difficult to know who is properly qualified," Quinn says.

PEO's requirements for a P.Eng. licence for software practitioners include:

- ◆ graduation from an engineering program approved by the Canadian Engineering Accreditation Board or equivalent education;
- ◆ four years of suitable employment experience—applications without an appropriate degree may demonstrate more extensive work experience in place of education, or may be required to write exams;
- ◆ knowledge of control theory, mathematical foundations, digital systems and computer architecture, software design and programming fundamentals;
- ◆ knowledge of three of communications, optimization, data management, real time and control systems, performance analysis, parallel/distributed systems, and human interfaces and ergonomics; and
- ◆ successful completion of PEO's Professional Practice Exam.

PEO is now identifying those aspects of software design for which professional engineers should take responsibility—expected to include software integral to engineered products, processes and systems, and software tools used to design such products, processes and systems.

Recently, the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) announced a similar step. Qualified individuals practising engineering in the software engineering field are now eligible to be licensed as P.Engs by APEGBC. Requirements for licensing include a bachelor level degree or higher in electrical or computer engineering, engineering science, physics or the computer/software field and a minimum of four years of experience in software engineering. President Paul Blanchard, P.Eng., says the move is aimed at promoting the value of software engineers and supporting high standards of professionalism in the field.

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Enrolments up for engineering students, national survey finds

by Karen Hawthorne

Enrolments in Canadian undergraduate engineering programs are up for a second straight year, a national survey conducted by the Canadian Council of Professional Engineers (CCPE) has found.

Enrolments rose 2 per cent from 1996 to 1997, following a similar increase from 1995 to 1996, according to annual survey results published in CCPE's *Canadian Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded, 1993 to 1996*. A total of 42,920 students were enrolled in university engineering programs in Canada in 1997.

Survey findings point to significant decreases in the numbers of students entering some of the profession's traditional disciplines, such as civil engineering, which are being offset by increased enrolments in newer disciplines, like computer engineering.

Undergraduate enrolments in civil engineering declined approximately 26 per cent from 1993 to 1997, from 6652 students in 1993, to 4031 students in 1997. Enrolments in computer engineering increased by 106 per cent over the same period, from 2157 students in 1993, to 4436 students in 1997.

The other two areas that experienced significant percentage gains are biosystems, with a 13 per cent increase, and industrial/manufacturing, with an enrolment increase of 9 per cent.

"Students are considering their future job prospects, and are entering the disciplines that appear to offer the most opportunities for employment," says Dan Levert, P.Eng., CCPE's president and CEO.

The increase in enrolment in emerging engineering disciplines is a targeted initiative by industry, government and educators with, for example, the Ontario government's Access to Opportunities Program (ATOP). "Fortunately, the government of Ontario has responded positively to the industry demand to double the size of the pipeline graduating electrical, computer, software and communications engineers, and also computer scientists," says Mohan Mathur, PhD, P.Eng., dean of engineering at the University of Western Ontario.

Started in 1998 and supported by industry partners like Nortel Networks, ATOP channels funds to universities for the development of new programs and facilities.

"In order to meet the market demand, in my opinion, the government's response has been speedy and praiseworthy," Mathur says. Other engineering deans agree that the demand for computer, software and communications engineers will continue to be strong.

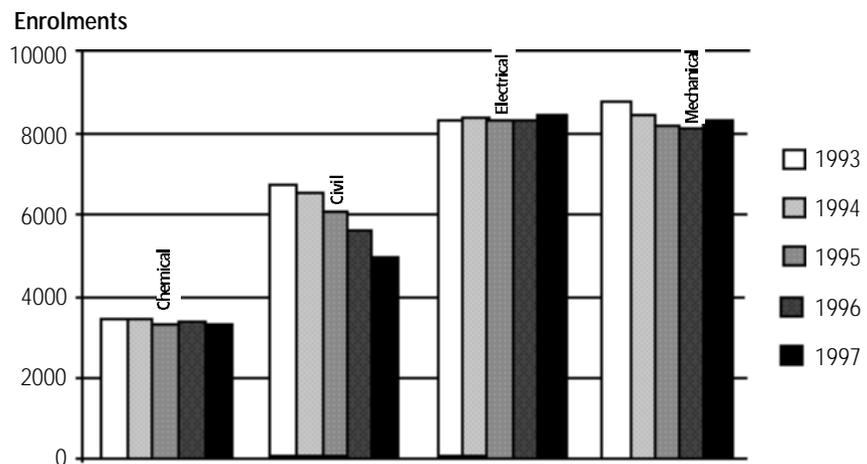
Conducted by the Canadian Engineering Resources Board, a standing board of the CCPE, the survey also identifies recent trends in Canadian undergraduate and graduate engineering enrol-

ment and the number of engineering degrees awarded.

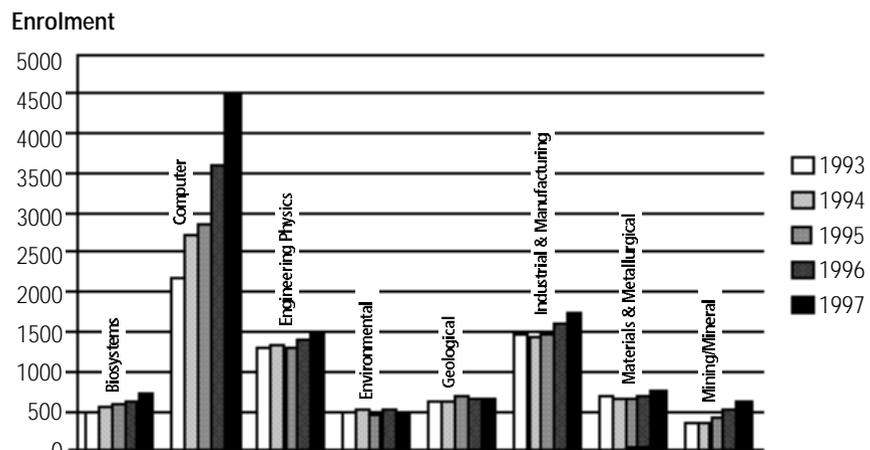
Noteworthy is the ten-fold increase in the number of women entering the profession since 1975. In 1997, 8252—just over 19 per cent—of Canada's undergraduate engineering students were women, up from 849 students—3.6 per cent—in 1975.

Given the increase in the number of students entering the profession over the past five years, the decline of 3.3 per cent in the number of undergraduate engineering degrees awarded in 1997, relative to 1996, should be a short-lived trend, says Levert.

Engineering Undergraduate Enrolments in Traditional Disciplines



Engineering Undergraduate Enrolments in Other Disciplines



Source: Canadian Engineers for Tomorrow, 1993 to 1997