BREAKING THROUGH

women in engineering are more determined than ever

by Karen Hawthorne

Even in these enlightened times, the picture isn't rosy for women in engineering. Men continue to outpace women in career advancement. The wage gap between men and women hasn't narrowed much in the last decade. Enrolment of women into university engineering programs has levelled off after a boom period in the mid-1980s.

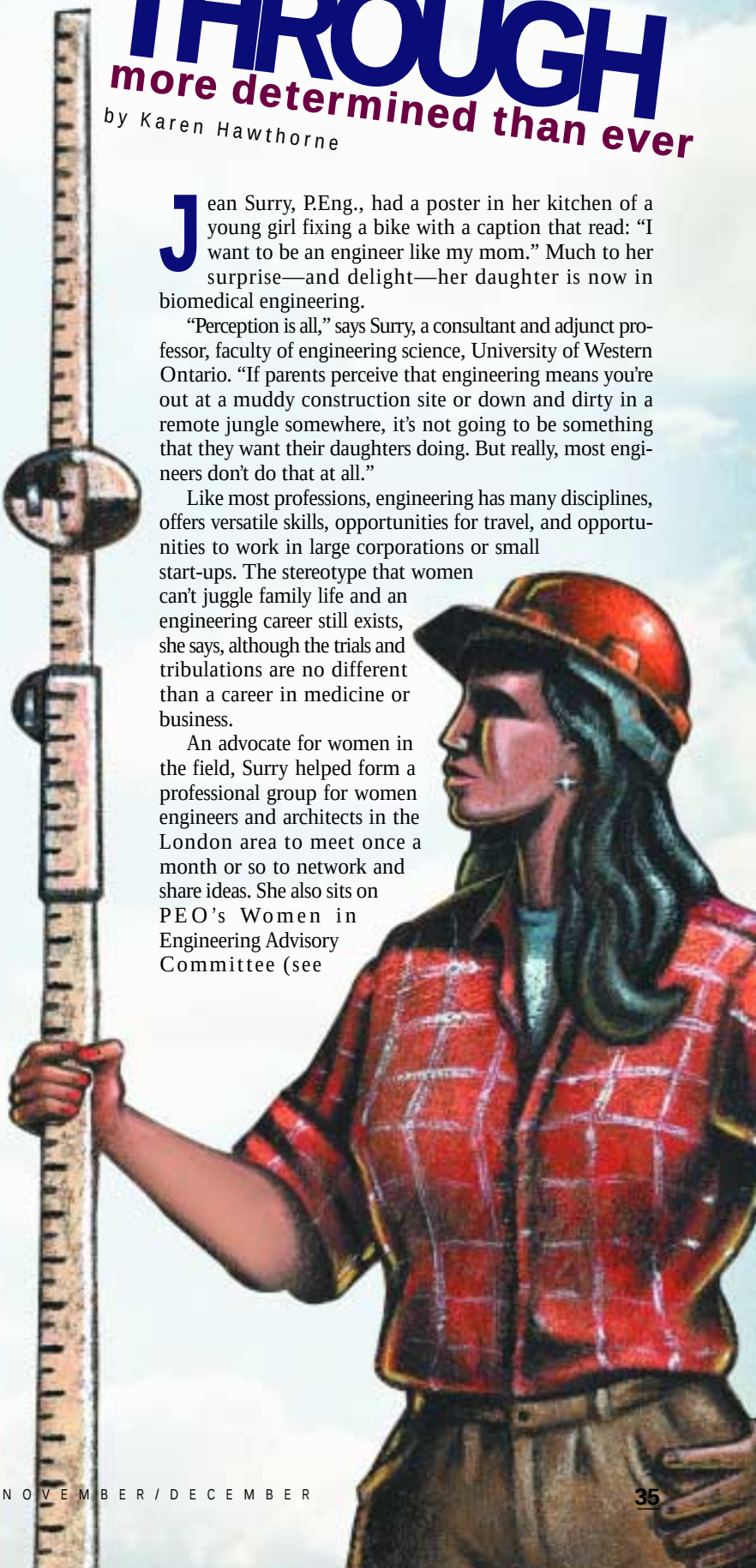
And women still represent only a small percentage of faculty in the engineering and science fields. What's the problem? There aren't easy answers—despite a plethora of studies, surveys and conferences across North America. What's being done about it? Plenty.

Jean Surry, P.Eng., had a poster in her kitchen of a young girl fixing a bike with a caption that read: "I want to be an engineer like my mom." Much to her surprise—and delight—her daughter is now in biomedical engineering.

"Perception is all," says Surry, a consultant and adjunct professor, faculty of engineering science, University of Western Ontario. "If parents perceive that engineering means you're out at a muddy construction site or down and dirty in a remote jungle somewhere, it's not going to be something that they want their daughters doing. But really, most engineers don't do that at all."

Like most professions, engineering has many disciplines, offers versatile skills, opportunities for travel, and opportunities to work in large corporations or small start-ups. The stereotype that women can't juggle family life and an engineering career still exists, she says, although the trials and tribulations are no different than a career in medicine or business.

An advocate for women in the field, Surry helped form a professional group for women engineers and architects in the London area to meet once a month or so to network and share ideas. She also sits on PEO's Women in Engineering Advisory Committee (see



FACT BOX

Women represent about 51 per cent of the population in North America and 46 per cent of the labour force. That said, only 20 per cent of the continent's engineering profession are female. In Ontario, only 6 per cent of professional engineers are women; across Canada, the number drops to 5.5 per cent. Women enrolling in engineering programs throughout North America make up only roughly 15 per cent of the student body. Despite affirmative action and gender equality legislation, such as the *Pay Equity Act*, effective in Ontario since 1988, the salary gap between male and female engineers in Ontario, for example, stands now at approximately 11.4 per cent.

"Parity" sidebar), which earlier this year partnered with the Ontario Women's Directorate and NSERC/Nortel Ontario Chair for Women in Engineering to launch a comprehensive project called "Ontario Women into Engineering." The partnership aims to encourage and support Ontario's universities in the removal of barriers for women entering and being retained in engineering.

There are no easy solutions, but those involved say educating parents, teachers and society at large is crucial to changing stereotypes and encouraging girls to take an interest in science and engineering from a young age.

Girls need to know that a well-rounded and satisfying life can include math, science and technology, and they need to be taught this from an early age, says Gina Ryan, executive director and CEO, Society of Women Engineers. Headquartered in Chicago, the society has a membership of 15,000 professional engineers and engineering students in 22 countries.

Girls have been stereotypically excluded in math and science in the kinds of toys they play with as kids, says Ryan. She emphasizes the need to change the way girls think about science and engineering at a very young age: "Girl toddlers need to be given the chance to use building blocks and play with trucks and creative toys that don't short-change their range of talents."

Members of the society donate their time to serve as role models at school career days; they sponsor and take part in science fairs, judge "model city"competitions and foster programs like "Introduce a Girl to Engineering Day"during National Engineers Week. They also volunteer as online e-mentors to girls in junior high and high school, and sponsor scholarships to help young women attend engineering schools. Members work with the National Science Teachers Association to promote awareness of engineering and its diverse fields as well as making science activities more appealing to girls. Last year, the society signed a memorandum of agreement with the Girl Scouts of the USA—who have engineering, science and math-related badges similar to the Canadian Girl Guides—to help attract girls to science and math.

Many educators agree that girls learn differently from boys, benefiting from group activities and hands-on learning—qualities that are reflected in changes in engineering education at the university undergraduate level which, in turn, draw more women into the profession.

"We have design teams where the whole class breaks into teams," says Surry, noting the emphasis on developing such "softer skills" as communication and team building as part of the core engineering program.

"You don't have to go in and solve the problem yourself and be *numero uno*,"she emphasizes. Women tend to perform better working in groups, understanding the different processes and facilitating communication among team members.

Generally, universities are looking at internal policies and processes to improve enrolment and retention of female students and faculty members in engineering, says Tom Harris, PhD, P.Eng., dean of engineering, Queen's University, and a member of the Council of Ontario Deans of Engineering. "The issue really is: Do women see this as an interesting career? If not, we just won't get more [female students],"Harris says. "The answers aren't obvious or we would have done it already."

Like many educators and representatives in the profession, Harris points to role models as key to attracting more women to engineering and science. At Queen's, the engineering student society hosts an annual women in engineering conference to discuss issues and highlight successful women in the profession. As part of their class work, engineering students participate in solar car teams and other competitions in the community and on the North American university circuit. Outreach programs at Queen's are similar to those at universities throughout Canada and the U.S., including career days on campus and in local elementary and high schools, community science fairs and future cities' competitions, mentoring programs, and partnering with industry to host engineering conferences.

Universities are not alone in trying to understand why more women aren't choosing engineering and science-related careers. Along with professional engineering societies, research institutions are now putting the issue on the priority list. Why?

"We can't afford to waste that much talent," says Alice Hogan, program director for the National Science Foundation's Advance program. "Women make up half of our workforce—half of our talent resources. We need them in science and technology."

New this year, the Advance program aims to increase the participation of women in the scientific and engineering workforce through the increased representation and advancement of women in academic science and engineering careers. Advance offers financial awards to individuals and organizations.

"People are realizing now that there are enough women in the pipeline and we should have seen more movement upward in the ranks [in academia and industry] by now," says Hogan. "So maybe we have to look at the institutions and the examples they're setting."

WEAC seeks parity for this and future generations

Harassment is professional misconduct if you're a professional engineer in Ontario, and PEO now has a *Guideline on Human Rights in Professional Practice*. The change of the wording of Regulation 941 of the *Professional Engineers Act* and publication of the guideline were major accomplishments for WEAC this past year. The regulation change became effective December 15, 2000 when a regulation to amend the definition of professional misconduct was filed.

These accomplishments have inspired others. In October, the Division for the Advancement of Women in Engineering and Geoscience (DAWEG) of the Association of Professional Engineers and Geoscientists of British Columbia invited PEO to talk about its efforts to include harassment in the definition of professional misconduct. Nancy Hill, P.Eng., LLB, a PEO appointed Councillor and former WEAC chair, made the presentation.

More than 10 years ago, PEO established WEAC to encourage the full participation of women in the engineering profession. Since its inception, WEAC has developed several programs to that end. The Future Engineers Initiative (see news, page 11) works to promote and explain engineering to girls and women in order to increase the percentage of women who enroll in accredited university engineering programs. Women into Engineering is a partnership project of PEO/WEAC, the NSERC/Nortel Networks Joint Chair for Women in Science and Engineering in Ontario, and the Ontario Women's Directorate, part of the Ministry of Citizenship. The partnership recently held a forum, outlining accomplishments and discussing future initiatives (see *The Link*, page 2). The project's next steps include: creating a gender issues training kit; researching and developing women in engineering associate positions reporting to deans of engineering in at least three faculties; and improving engineering pedagogy by researching and making recommendations to improve the pedagogical and social relevance of engineering curricula. The phase I project report for Women into Engineering is available on the PEO website at **www.peo.on.ca.**

The Georgia Institute of Technology (GIT) received one of four Advance Institutional Transformation Awards (AITW) this past October. "The issue of the participation and performance of women in science and engineering has been at the heart of my work for 25 years," says Mary Frank Fox, PhD, co-principal investigator for the project, which has received more than $3 million from the National Science Foundation for its five-year implementation.

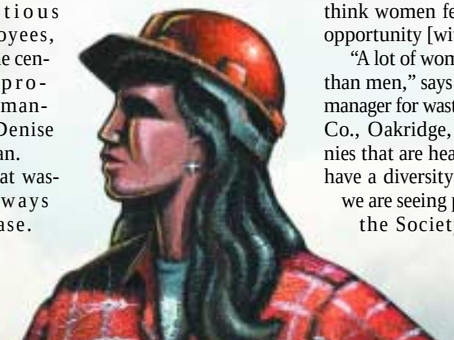
Frank Fox, co-founder of the school's Center for the Study of Women, Science & Technology, says that women faculty serve as teachers, advisors and role models for students. "This is where the students are trained and much of the research and development for the country takes place," she says. According to Frank Fox, the low representation of women in science and engineering faculties is directly proportional to low numbers of women climbing corporate ladders or continuing in graduate studies. "The destiny of faculty and students are connected," she says.

Proposed AITW activities at GIT include: making the advancement of women an organizational priority through leadership and action; creating the means for equitable allocation of such resources as lab space and equipment; establishing evaluation criteria for professors that are clear and unbiased; and enhancing family-friendly practices like parental leave and childcare facilities.

Research conducted by the Conference Board of Canada's Centre of Excellence for Women's Advancement in 2000 found a significant gap between the perceptions of senior women managers and chief executive officers concerning the progress and advancement of women in Canadian organizations.

This year, the centre developed a Gender Diversity Tool Kit to inform executives and front-line managers about effective practices that address barriers to the development, retention and advancement of Canadian women. The tool kit is a series of reports that address key issues identified by women executives as hallmarks of a women-friendly organization. With the majority of employers reporting skill shortages at all levels, organizations are pushing to attract and retain talented and ambitious employees, says the centre's program manager Denise McLean.

That wasn't always the case.



When Vera Straka, P.Eng., graduated from civil engineering at London University in the UK over 30 years ago, she started working as a consultant with smaller firms where she was often mistaken for the secretary when she answered the phone. Now a professor in the faculty of engineering and applied science, Ryerson University, Straka is dedicated to changing perceptions and breaking down barriers.

"I feel very strongly that something needs to be done,"she says. "It's disturbing. Women are still paid less—all the surveys show that. There are barriers to overcome in industry and academe. I think we need to get the message out about what's going on."

In today's marketplace, "a diverse workforce is a more productive workforce," says McLean. Women are perceived as better than men at interpersonal relations and at balancing the needs of the company's stakeholders, looking at the overall financial applications of projects, and more-inclusive in their decision-making.

"Women are looking for a culture that is welcoming to women," she says, pointing out that the percentage of women in senior executive positions overall is about 13 per cent. "They want their contributions to be welcomed and valued. If they sense that there's a glass ceiling, in many cases, they'll jump ship to another organization." Women are looking for networking and mentoring opportunities, gender inclusive performance criteria linked to salary compensation, and work-life balance initiatives, including paid leaves and flexibility options.

The trend for larger companies is to incorporate exactly those women-friendly initiatives. IBM Canada's technology campus in Markham has just funded the construction of a day-care facility nearby. The company has mobile work stations fitted with laptop computers, flexible work options, regular part-time and internal mentoring programs—all geared to meet the needs of its employees, says Susan Turner, IBM Canada's director of diversity and workplace programs.

"We established the first women's council at IBM in 1993, with the mandate to advance women in business," says Turner. "I think women feel that they do have equal opportunity [within IBM]."

"A lot of women out there do make more than men," says Gail Mattson, P.E., deputy manager for waste deposition, Bechtel Jacobs Co., Oakridge, Tenn. "There are companies that are heavily recruiting women and have a diversity program in place. I think we are seeing progress." Former CEO for the Society of Women Engineers, Mattson is now helping to form an international group of women engineers to link major women's groups around the world to keep the momentum going for change, because "in a lot of countries there is still no opportunity for women [in science and engineering] at all."

Still in the preliminary stages, the group plans to have a website for women to network and access information about engineering and science organizations, scholarships, teaching and business opportunities, and conferences around the globe.

Another trend in the marketplace is entrepreneurship for engineers and other professionals as companies consolidate, lay off employees and outsource contracts. While engineering education in many schools has added entrepreneurship and business management to its course calendar, women engineers at all levels are working for smaller companies or starting their own, says the Society of Women Engineers' Gina Ryan. "About 10 per cent of our members are starting their own business so they can have control and make their own choices,"she says. "Engineering is now seen as a more intellectual, creative profession with more options."

"More education has to be done," adds Mattson. "But I do think things are changing out there—slowly." ◆

Karen Hawthorne is a freelance writer based in Toronto.

A link to other resources

Here are some useful resources about women in engineering and science:

- *The Woman's Guide to Navigating the PhD in Engineering & Science* by Barbara B. Lazarus et al, US$29.95, ISBN 0-7803-6037-0, IEEE order no. PP5883, 144 pp., IEEE Press and John Wiley & Sons.
- *Nobel Prize Women in Science: Their Lives, Struggles, and Momentous Discoveries*, second edition, by Sharon Bertsch McGrayne, US$19.95 paperback, ISBN 0309072700, 450 pp., Joseph Henry Press.
- *Journeys of Women in Science and Engineering: No Universal Constants*, Susan Ambrose, Kristen Dunkle, Barbar Lazarus, Indira Nair, Deborah Harkus, editors. US$27.95 paperback, ISBN 1-56639-528-3, 461 pp., Temple University Press.
- **http://www.peo.on.ca**, click on the Links button, click on Women in Engineering and from there select: "Women and Success in Engineering,"as well as other sites of interest.
- "Fairness and Equity in Engineering"pp. 307-343, *Canadian Professional Engineering Practice*, Second Edition, Gordon C. Andrews and John D. Kemper. Saunders College, Canada: Harcourt Brace and Co., Toronto.