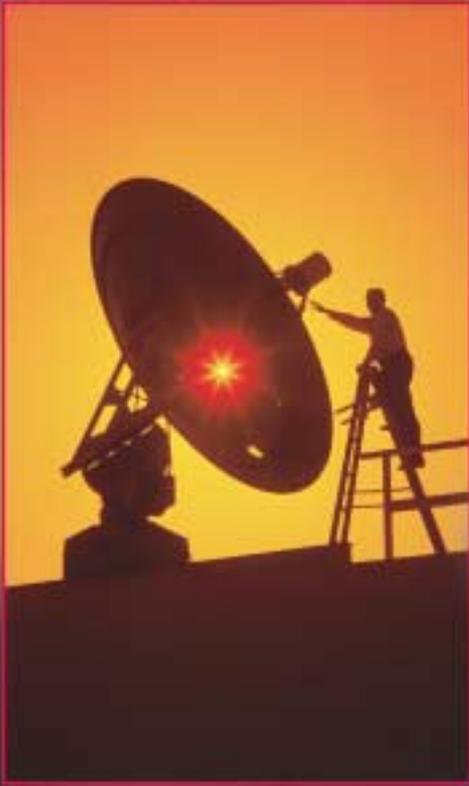


Communication



ENGINEER

Engineering specialists have long been in demand, but there's a growing need for professionals with diverse expertise to meet the challenges of today's global marketplace. The University of Western Ontario (UWO) is at the forefront of merging disciplines of study for future engineers.

Medicine



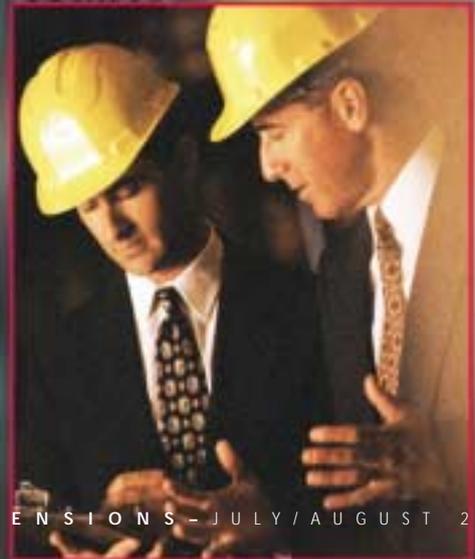
Research



Innovation



Business



Robotics



ERRING THE Future

A multidisciplinary approach to engineering education

The future of engineering education will require more resources, strong teaching faculty engaged in relevant research, and skilled managers, administrators and technicians to support it all.

UWO's engineering faculty is focused on the twin missions of research intensiveness and teaching excellence. But what sets the faculty apart from other schools is its commitment to a multidisciplinary approach, which permeates every element of the way we carry out the teaching of engineering at UWO. This multidisciplinary philosophy encompasses our approach to programs, research, the hiring of faculty and staff and, most importantly, our plans for the future of engineering education.

When undergraduate students begin their engineering education at UWO, they are welcomed into a common first-year program that encourages them to discover the breadth of activity related to the profession.

Beginning in second year, students with a strong academic standing are encouraged to enter our Concurrent Degree Program, which couples engineering with business, law, medicine, computer science, or any number of other combinations in the social sciences and humanities. This program was formalized in 1998, capping a long tradition of helping students to pursue multiple degrees, with 105 students registered. By September 2002, the number of students had grown to 247. Because UWO is a comprehensive university, it is able to offer an extensive variety of program options.

Combining engineering with business is a popular option. Our first student, Joel Adams, graduated in 2000 from the concurrent engineering/HBA (honours business administration) program. This year,

40 students were registered in the same program. Adams says he often credits the flexibility of the curriculum for enabling him to forge his own path, including the encouragement he received "to pursue leadership opportunities in and out of the classroom." Adams has experienced the advantages of graduating with broad skills in business and engineering. Now he provides business services to start-ups and other companies, and recently developed and taught a course in entrepreneurship in the UWO Faculty of Engineering.

A head for business

Western sees entrepreneurship as a key benefit of the multidisciplinary approach. While we encourage undergraduate students to build coalitions with business, entrepreneurship is also evident among faculty, graduate students and staff, who are all encouraged to work directly with industry.

The results of such industry partnerships are the high numbers of successful grant applications, research activities in conjunction with industry, and spin-off companies.

An outcome of this approach is that faculty positions are often set up as multidisciplinary ventures in research; for example, James Johnson, PhD, P.Eng., has a cross-disciplinary appointment between mechanical engineering and the department of surgery in the faculty of medicine and dentistry, as well as the Hand and Upper Limb Centre at St. Joseph's Health Centre, to do research in computer-assisted joint replacement surgery. Similarly, James Lacefield, PhD, has a cross-appointment between electrical engineering and the department of medical biophysics in

the faculty of medicine and dentistry to research micro-imaging technology, while Cynthia Dunning, PhD, a member of the mechanical engineering department, has also recently accepted a cross-appointment with the department of surgery.

Other multidisciplinary appointments in UWO engineering involve research into advanced robotics, instrumentation controls and fluid mechanics, as well as into areas of social impact in the Boundary Layer Wind Tunnel Laboratory and the Institute for Catastrophic Loss Reduction. The benefits of cross-disciplinary appointments are many, but most important are the immediate and practical applications of science and engineering to human lives.

Teamwork makes the grade

Students are equally adept at recognizing the value of exposure to non-engineering disciplines. Self-directed multidisciplinary teams tackle such "mega-projects" as the Sunstang solar car, the Flying Mustang aero design, the Formula SAE car and the Beowulf Initiative in super computing. Teams comprise students from different years, different engineering programs and such non-engineering programs as business, science, information and media studies. Secondary school students and alumni are also welcomed onto these teams. These projects are voluntary and give exposure to business planning, and sponsorship and fundraising solicitation, in addition to design, problem solving, computer modelling, fabrication, and rapid prototyping. Such large-scale projects promote student recruitment, outreach to the community and better industrial and corporate relationships. Additional benefits include

by Jan Shepherd McKee and Franco Berruti, PhD, P.Eng.

mentorship and leadership experiences for the team members.

Industry has also shown a clear commitment to a multidisciplinary approach in engineering. When the faculty opened its doors at UWO in 1957, a “focused and specialized” approach was needed in engineering education. Today, however, in a world full of specialists, someone must coordinate their efforts. We believe this is the future role for which our graduates are prepared.

Integrated engineering

The Integrated Engineering Program was created at UWO in 1998 to address the need for engineers with a range of expertise. Ralph Buchal, P.Eng., PhD, the coordinator of this program, says there is in industry “a large and unmet need for engineering generalists with a broad knowledge of the fundamentals of several disciplines, and the ability to interact with specialists and develop further specialization through continuing education and workplace apprenticeship. Engineers of this type are well suited to working in small companies, to becoming entrepreneurs, to working in interdisciplinary design teams, and to becoming involved in management.”

Integrated Engineering emphasizes design in every year of the program. With careful selection of students and restricted enrolment, we are developing more courses for integrated students, which will lead to a deliberately managed expansion of the program itself.

Real world experience

Another response to the needs of industry is the creation of the Industry Internship Program (IIP), UWO’s answer to cooperative education programs. The IIP helps students gain important experience through employment in the engineering industry for 12 or 16 months. The success of this long running program has spawned the Summer Engineering Co-op Program (SECOP), created to assist students in finding valuable summer job experience.

Rethinking education

Along with an emphasis on integration, the multidisciplinary approach has influenced our thinking about the very fundamentals of engineering education. In

the past, engineering education focused on engineering science and analysis. Combined with the weighty academic influence of the university environment, this focus produced curricula that failed to address the practical aspects of good engineering design. While many engineering schools address these practicalities during the final year of the curriculum, UWO has made a particular effort to pose “real world” problems to senior-level design teams. These projects are sponsored by industry and have immediate applications. Industrial partnerships are strengthened through low risk research and development and recruitment of students into good jobs.

At Western, we believe design itself is key and must be taught to all engineering students, and our programs do not wait until the final undergraduate years to begin teaching the design process. Indeed, we are ready to roll out our first-year design program this September, in conjunction with the new Engineering Design and Innovation Studio. This new initiative, formed under the guidance of Brian Thompson, PhD, P.Eng., the Natural Sciences and Engineering Research Council-GM Canada Chair of Engineering Design and Innovation, was developed in cooperation with the Materials and Manufacturing Ontario Connections program.

As Thompson says, “Studio pedagogy, a cognitive schema developed to utilize intuition and initiative, is being applied to teaching engineering design with a process in which the principles of engineering science are rigorously applied.”

The studio will introduce students in the common first-year program to the multidisciplinary team approach in a working studio environment starting on day one. Teams will work on open-ended, real world problems aimed at generating a wide range of solutions. Thompson believes the innovation studio will create a healthy and creative engineering-innovation community that is collaborative and open. “Individuals do research, but teams design and innovate,” he says. “Design is a community endeavour in which complementary experts collaborate to find design harmony.”

To foster a multidisciplinary approach to teams even earlier than first year, UWO engineering has created strong relationships with local secondary schools through a high school student cooperative education program. Under this program, selected secondary school students are encouraged to team up with members of the engineering faculty to work in labs in the faculties of engineering, science, medicine and in local hospitals and research facilities. Their participation on multidisciplinary teams provides “hands on” experience in the engineering profession. Students are actively recruited through these practical means to look closely at a future in the profession.

Communication is key

The final key to a strong multidisciplinary approach to engineering education is communication. Although engineering at UWO has a sound technical communications program in report writing, collaborative team communication and oral presentation, we are seizing the opportunity to build upon that strength. We plan to expand and integrate the communications program with the new design initiative to include such areas as team building, conflict resolution, project management, organizational communication, leadership and the communication of new ideas.

Today’s engineer must be flexible and adaptable to thrive in a fast-paced technological society. Professional engineers must also commit to lifelong learning. At UWO, we believe that the multidisciplinary approach is vital to engineering education. The university’s new, four-storey Thompson Advanced Technology Centre (www.engga.uwo.ca/atc/Default.htm to view time-lapse video of construction), which is nearing completion, will become home to some of Canada’s finest researchers and multidisciplinary teams. It also symbolizes the next step in the development of a multidisciplinary education. ✦

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