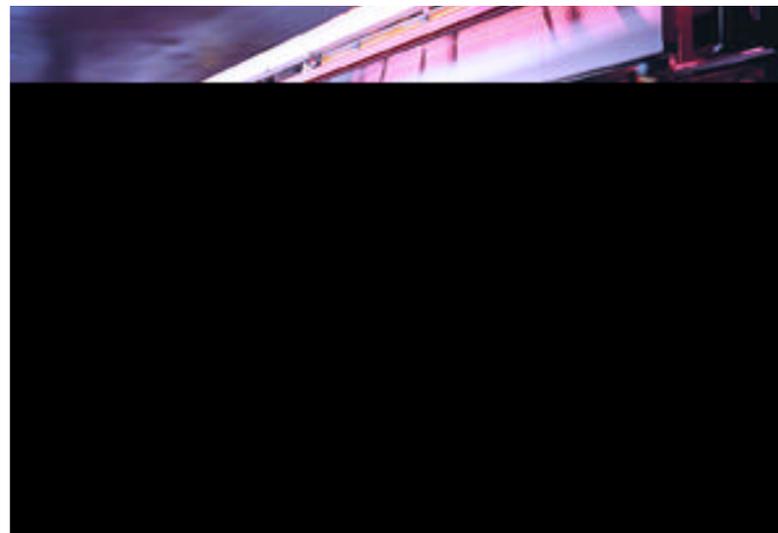


# TROUBLE

## ON THE SHOP FLOOR

### the auto industry's human resources crisis



**t**he automotive industry worldwide is undergoing fundamental changes in the way that vehicles are designed and built. For example, automakers are outsourcing to parts suppliers more of the responsibility for the design and manufacturing of vehicles. To create components and systems for original equipment makers (OEMs), suppliers must employ increasing numbers of highly qualified personnel (HQP), who are able to do more advanced design work and meet the safety and quality requirements of the OEMs.

The sector is also under intense pressure to produce new products more quickly and at higher quality. The typical design cycle for a new vehicle has dropped from five to six years, to just over two years, and manufacturers are striving to make the process even faster in the future. Industry-wide quality standards, such as QS-9000 (and the related ISO-9000 series), along with statistical quality methods, increased safety requirements and design for the environment, have made the industry more complex than ever before—requiring much more sophisticated

Canada's automotive industry is experiencing a shortage of skilled workers just when it needs them most to compete. Education and training programs are needed to provide engineers and other workers with the right stuff.

ed skills at all levels in the workforce.

On top of the operational and workforce changes caused by outsourcing, the world's auto industry is now in a period of consolidation and rationalization, as the number of independent automakers decreases. Within companies, the number of different car designs is also decreasing, as the industry strives to achieve economies of scale.

As a result, there is a great deal of excess capacity in the industry (about 17 vehicle

assembly plants worldwide). This is creating intense competition not only among companies, but also within companies among assembly plants and divisions, who are vying to produce the highest possible quality products at the lowest cost in order to be assigned contracts to build successful product lines and protect jobs.

#### How big is the skills shortage?

As is the case with most people-related problems, the HQP supply problem in the auto industry has many facets, some of which initially appear to be contradictory. Canadian graduates are not generally perceived to possess the skills and knowledge needed within the sector. The fact that no Canadian university offered an automotive engineering program until this year indicates that this perception has at least some validity.

On the other hand, some mainly U.S.-based companies are willing to hire new Canadian graduates and train them with the necessary skills. In fact, over one-third of those who graduated from the University of Windsor's mechanical engineering program in 1998 are earning up to \$75,000 U.S. (about \$110,000 Canadian) working in Detroit in the production engineering

departments of the Big-3 automakers (Ford, General Motors and DaimlerChrysler).

Meanwhile in Canada, automakers and their suppliers still regularly recruit automotive design engineers in Europe, because Canadian engineering graduates lack automotive design skills, or even highly developed, general mechanical design knowledge. Recently, however, the supply of well educated European engineers appears to have dried up, meaning that even this may no longer be an option.

The most worrisome trend is that several major Canadian-owned supplier companies have opened engineering offices in the United States during the past few years, because they have been unable to recruit sufficient numbers of engineers with automotive engineering knowledge in Canada. These companies have also found that recruiting U.S. engineers to work in Canada is not feasible.

All of these factors have led to inflated salaries and poaching of HQP from one company to another, to the detriment of everyone in the sector.

In the next few years, a large number of retirements are expected in Canada's skilled labour force in auto assembly plants. This is a big concern for all companies in the sector. Eventually, they may be unable to fulfill their contracts due to a shortage of people who have sufficient experience.

#### What skills are needed?

Although the major focus of the auto industry's HQP shortage is in mechanical and manufacturing engineering, there are several other disciplines in which Ontario universities provide education

#### Skills Checklist

Skills needed in the auto industry include:

- ✓ Design
- ✓ Team work
- ✓ Analysis and testing
- ✓ Manufacturing
- ✓ Human kinetics/ergonomics
- ✓ Environmental engineering
- ✓ Personnel management
- ✓ Communications
- ✓ Budgeting
- ✓ Project accounting and management
- ✓ Time management

that is needed in the sector. They include: human kinetics and workplace ergonomics, public health nursing, environmental engineering and science, labour relations, personnel management and business.

There are also a host of "essential skills" that are important in the development of a fully qualified engineer. These include: proficiency with business and technical writing and other forms of communication; the ability to make effective presentations; an understanding of business economics, including budgeting, project accounting and management; and the ability to manage time and priorities in a busy professional environment.

#### Researching the problem

The problem of the lack of relevance of Canadian engineering education has been recognized for decades, to the point where industry is generally dissatisfied with the skill sets of new engineering graduates—especially mechanical engineers. Typical comments include that new graduates "don't have any practical know-how," "can't read or make engineering drawings," "don't have any hands-on experience with machinery, so how can they design it?" and "don't understand mechanical tolerances or the cost consequences of a design decision." These comments ring especially true in the auto industry, where the speed and efficiency of the design process and the eventual cost of the product have serious consequences for competitiveness.

In 1995, the American Society of Mechanical Engineers (ASME) commissioned a major survey and report to learn about the skills industry requires of graduate mechanical engineers. Known as the Product Realization Process study, it defined the body of knowledge

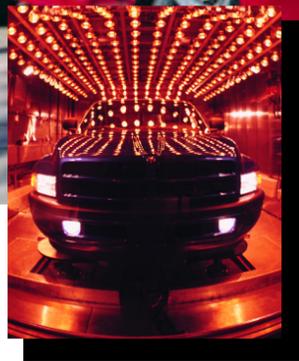
### Canada's auto industry: How do we compare?

The automotive sector is Canada's largest industry, with total economic activity of about \$75 billion, representing approximately 13-15 per cent of the gross domestic product annually. It is also Canada's largest employer. About one in seven Canadians and one in six Ontarians earn their living in the industry. Comparing Canada's auto industry to those in other countries, we find that:

- Canada is about the fifth largest producer of motor vehicles. It manufactures about 2.5 million vehicles annually, representing about 16 per cent of North American production.
- On a per capita basis, Canada has about three times as much vehicle assembly capacity as the United States.
- Canadian parts suppliers and assembly plants are widely regarded as efficient, high-quality producers of motor vehicles. They enjoy a 25-30 per cent advantage in terms of hourly labour costs, which comprise 10-15 per cent of the cost of building a vehicle.
- Investment in production capacity for Canada's auto industry is the highest of any sector in the Canadian economy. But investment in research and development is only 25 per cent of the industrial average. Further, only one automaker does any product development and design in Canada, and only two conduct a significant amount of research.
- The automotive sector employs over 150,000 people directly, who earn about 25 per cent more than the average industrial wage. In short, these are good jobs that need to be protected.
- Suppliers to the auto industry employ large number of engineers in design and manufacturing engineering positions. These companies are beginning to see the need for more research and development in order to maintain their future business capacity.

Photo on this page: Ford of Canada

by Peter R. Frise, PhD, P.Eng.



The University of Windsor has become a hot spot for automotive research sponsored by industry and the Natural Sciences and Engineering Research Council (NSERC). From left to right are: Dr. Jerry Sokolowski, P.Eng., Ford/NSERC Industrial Research Chair in Light Metals Casting Technology; Dr. Peter Frise, P.Eng., DaimlerChrysler Canada/NSERC Industrial Research Chair in Mechanical Design; and Dr. Andrzej Sobiesiak, P.Eng., DaimlerChrysler Canada/NSERC Industrial Research Chair in Alternate Fuels.

The University of Windsor/DaimlerChrysler Canada Automotive Research and Development Centre provides high-tech facilities for research in alternative fuels and mechanical design.

The ASME report also listed 56 "best practices" and related the industry perspective of these to that of university faculty members. It found that although faculty members basically agreed with industry about what knowledge is important for young engineers, they were not generally delivering this knowledge to students. This is

that could form the basis of a set of learning objectives for an undergraduate mechanical engineering program. This body of knowledge comprises several broad skill areas, including design, team work, analysis and testing, and manufacturing.

often because faculty do not have this knowledge themselves because few of them have industry experience.

The issue of why engineers educated in Europe have more highly developed automotive design skills than those educated in Canada was the subject of a 1995-96 study called the Windsor Experiment. The study was conducted by senior officials of Chrysler Canada Ltd. and the University of Windsor, as well as representatives of several government departments and other educational institutions. It involved a series of visits to leading European institutions to benchmark their practices. The study found that, in European university-industry partnerships, the line or barrier between industry and universities is not well defined, enabling people and resources to pass back and forth quite freely. It also found that, although uni-

versity and industry partners maintain their distinct identities, they have a genuine recognition of, and concern for, each other's needs and goals.

The study concluded that these positive relationships provide excellent educational opportunities for students—one of the reasons why European engineering students are so much better prepared for careers in the automotive and other design-related sectors. To make our education system more effective, the study report recommended that Canadian universities and colleges work together to ensure that students can move between institutions with as little duplication or repetition of material as possible.

I am currently supervising a master's student at the University of Windsor, who is conducting a study aimed at identifying the skills Canadian industry requires of mechanical engineers. Although similar to the ASME study, it will consider the impact of such factors as Canada's largely branch-plant economy and two official languages, and the influence of NAFTA. The study will also consider the effects of globalization, the explosion of the Internet, the development of company intranets (internal corporate communications and information networks) and the dropping of trade barriers, which has fostered much faster time-to-market targets in today's manufacturing sector.

### Call to action

Since Canada's automotive sector and its universities are currently facing major challenges, it makes sense to see what common

Table 1. Needs and goals of industry and universities

	INDUSTRY	UNIVERSITIES
NEEDS	Skilled personnel	Funding to develop curricula to develop appropriately skilled personnel
GOALS	Access to leading edge research	Consultation to help guide curriculum development
	Profitability	Development of curricula relevant to students and their career aspirations
	Competitiveness Return on investment	Educational and research excellence

and complementary needs, goals and capabilities exist to determine what we can do for our mutual benefit and, particularly, for the benefit of young people. Table 1 summarizes the complementary needs and goals of universities and industry. What's needed is cooperation between universities and the auto industry to develop the curricula and workforce training initiatives that will address the skills shortage and ensure that educational resources are used wisely. ♦

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## Ontario's new automotive curricula

Until January 1999, no Canadian university offered a named course of instruction in automotive engineering and only one community college offered a program in automotive parts design technology. Since then, however, several new initiatives have been developed, which will help address the skills shortage in Canada's automotive sector. Some of them are described below.

### Training tomorrow's automotive engineers

In winter 1999, the University of Windsor began offering an option in automotive engineering, which the first group of students completed this summer. The option comprises four courses offered in the final year of study of the mechanical engineering program. They have been designed according to the findings of the

ASME study, which call on universities to emphasize practical applications, a solid foundation of theory and soft skills, such as team work, management and a knowledge of how engineers fit into business.

The core courses in the option are automotive systems design, internal combustion engines and elements of mechanical design. In addition to the core courses, students choose an elective from a wide range of courses in mechanical, materials, industrial and manufacturing systems engineering.

### Nurturing automotive research

Automotive research at Windsor is partially centred at the University of Windsor/DaimlerChrysler Canada Automotive Research and Development Centre

(ARDC), which opened in May 1996. Since then, total capital investment at the ARDC has grown to over \$75 million, plus operating costs. Employment of researchers, students, engineers and support personnel has grown to over 200 people. Over 60 co-op students have had work-term placements. About 18 graduate students and post-doctoral fellows are currently working on their research projects at the facility.

The ARDC provides a base of operations for the two DaimlerChrysler Canada Inc./Natural Sciences and Engineering Research Council (NSERC) Industrial Research Chairs and their research activities and personnel. One chair is specializing in alternative fuels, the other in mechanical design. The Ford Motor Company has also sponsored an NSERC Industrial Research

Chair, who is specializing in light metals casting technology to complement Ford's large metal casting operations in the Windsor-Detroit area.

The Centre for Automotive Materials and Manufacturing (CAMM) opened recently at Queen's University, with support from Alcan and the Ontario Research and Development Challenge Fund. It operates under the guidance of an advisory committee comprising representatives from industry, including Alcan, Dofasco, Dupont and Magna International, as well as researchers at the University of Toronto and McMaster University.

The centre intends to develop novel joining techniques for dissimilar materials, alternative materials, rapid

prototyping and manufacturing processes, and metal forming technology. CAMM will provide facilities for 12 principal investigators, 12 post-doctoral fellows, 24 PhD and master's-level students, up to 12 undergraduate students and several support staff.

### Getting technologists up to speed

St. Clair College's Windsor campus has created a new automotive product design stream in its mechanical engineering technology program. Developed in consultation with DaimlerChrysler Canada Inc. and the University of Windsor, the program is intended to give technologists special insight into the auto industry and prepare them for jobs in mechanical

design offices by providing training in industry standard software and other areas. The program also incorporates enhanced math and basic science curricula, to enable graduates to transfer to a university engineering program with maximum credit for their college-level work.

Georgian College in Barrie is developing a new automotive parts design program in conjunction with several leading auto parts manufacturers and the Industrial Research and Development Institute in Midland. Similarly to St. Clair College, Georgian College wants to develop pathways for their graduates to complete full university degrees in engineering. It is designing the new program to permit easy transfer to university for high-standing graduates.