

1998

# Synergy Awards for R&D Partnerships



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The Conference Board of Canada



Canada

## 1998 Award Winners

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### Category A-1 Small- and medium-sized companies

Précitech

Laval University

Certicom

The University of Waterloo

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### Category A-2 Large companies

Chrysler Canada Ltd.

The University of Windsor

Fraser Papers Inc.

The University of New Brunswick

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### Category B Ventures involving at least two or more industry partners

OpTest Equipment Inc., Paprican (The Pulp and Paper Research Institute of Canada)  
The University of British Columbia

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### Category C Innovative and long-standing university-industry interaction

PRECARN  
IRIS

Nortel Networks  
The University of Toronto  
Carleton University  
The University of Calgary

The Natural Sciences and Engineering Research Council of Canada is the national instrument for making strategic investments in Canada's capability in science and technology. NSERC supports both basic university research through research grants and project research through partnerships of universities with industry, as well as the advanced training of highly qualified people in both areas.

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# The Synergy Awards

## for University-Industry R&D Partnerships:

### The beginning of an enduring tradition

**F**our years ago, NSERC (the Natural Sciences and Engineering Research Council) and The Conference Board of Canada launched a new series of initiatives to encourage university-industry partnership in research and development. Their goal? To increase Canada's R&D capabilities to generate jobs and growth.

The Synergy Awards for University-Industry R&D Partnerships recognize examples of university-industry collaboration that stand as a model of effective partnership. The Synergy Awards showcase the benefits of pooling university and industry resources to make the most of Canadian research excellence and industrial know-how.

To be successful, entrants must show effective use of human, technical and financial resources; demonstrate a lasting partnership between university and industry collaborators; provide evidence of tangible commercial results; and document, where applicable, the innovative and long-standing nature of university-industry interaction.

This year, as in previous years, the selection committee had difficult choices to make, but the members did their job admirably. All of the winners met the selection criteria to a remarkable degree, even if differently, proving the benefits of university-industry synergies to the partners themselves, and to the broader community.

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#### The 5th Annual Synergy Awards for University-Industry R&D Partnerships

*Thinking of competing for a Synergy Award next year? An invitation to participate in the 1999 Synergy Awards competition will be issued next spring, and winners will be announced in late June. Selection criteria will remain the same as in previous years. For more information, contact NSERC, by **phone: (613) 996-1898; fax: (613) 992-5337; or e-mail: [srb@nserc.ca](mailto:srb@nserc.ca)**.*

## A shared vision

**R**esearch and development play a critical role in Canada's ability to create sustainable employment and economic growth. They give us the tools to compete in a knowledge-based global economy that is inextricably linked to the fast-paced advances of science and technology.

Ultimate success, however, depends on the collaboration of Canadians in the innovation process. As world economies become more open, gaining a competitive advantage is increasingly a product of our ability to develop, adopt and exploit technology. Partnerships among all players in the economy will help Canada meet the challenges of a global economy.

One such essential partnership is that between universities and industry. Canada's universities supply a steady stream of highly skilled people with new ideas, while industries provide the know-how to exploit that expertise for creating commercial successes. It's a strategy that capitalizes on the strengths and resources that each partner brings to the innovation process.

Collaborative research has become well established in Canada. We have a long history of universities and industry working together, and the impacts of these partnerships can be felt in all sectors of the economy. They have led to productivity improvements and innovations, and have created a worldwide reputation for the excellence of Canadian innovations and Canadian research.

At the same time, these partnerships have supported knowledge-based industries and created jobs that ensure future scientists and engineers will find career opportunities in Canada.

Thanks to successes such as those recognized by the Synergy Award, university-industry collaboration is becoming an important factor in the success of Canada's industry. The winners demonstrate what a shared vision and purpose can accomplish for the social and economic well-being of Canada.

We salute their efforts and celebrate their success. Congratulations!



Courrette

Thomas A. Brzustowski  
President  
NSERC



John Hryniuk Photography

James R. Nininger  
President and Chief Executive Officer  
The Conference Board of Canada

# Promoting best practices in university-industry R&D partnerships: the original partners

## The Conference Board of Canada

The Conference Board of Canada is Canada's leading independent applied research institution, providing objective information and analysis on economic, management and public policy issues to more than 500 member organizations from business, government and other sectors. Thirty-four leading chief executive officers make up the Board of Directors of the Conference Board, representing the interests of member organizations and providing leadership to help the Conference Board focus on critical issues facing Canada.

Since 1954, the Conference Board has been committed to researching innovative practices, designing new strategies, and providing members with up-to-date information, analysis and expertise to help them excel in Canada and around the world. Each year, it publishes reports that analyze and forecast emerging business, management and economic trends; hosts more than 200 conferences, seminars and round-tables; and provides personalized information services that include issues monitoring, surveys and literature searches.

## NSERC (the Natural Sciences and Engineering Research Council)

NSERC is the national organization that makes strategic investments in Canada's capability in science and technology. NSERC supports basic university research, and encourages project research through partnerships between universities and industry. In this way, NSERC contributes to the advanced training of highly qualified people in both areas to build a strong national economy and improve the quality of life of all Canadians.

In 1998-99, NSERC will invest \$498 million in university-based research and training in the natural sciences and engineering. Over 8,700 Canadian researchers and over 9,000 university students and postdoctoral fellows were supported by NSERC in 1997-98. In addition, NSERC programs provided employment to about 12,000 Canadians, of whom 80 per cent were students and postdoctoral fellows. The remainder were skilled technicians and research professionals.

## NSERC's encouragement of university-industry synergy not limited to the awards program

NSERC's efforts to promote partnership between universities and industry stretch far beyond the Synergy Awards. In fact, NSERC sponsors 11 other

programs that foster the discovery and application of knowledge through collaboration. These include:

- Industrial Research Chairs, which support a senior researcher's salary and research program at a university. The program must begin or extend research and development in an area of interest to industry, and an industrial partner must share costs with NSERC.
- Strategic Projects, which support pre-competitive university research in partnership with industry. If successful, these projects will produce a specific economic, social, industrial or environmental benefit for Canadians.
- Research Partnership Agreements, which foster collaborative research between universities, industry and government organizations, including Agriculture and Agri-Food Canada, the Department of National Defence and the National Research Council. These agreements support a range of research from basic to pre-commercial in selected areas.
- Research Networks, which fund large-scale research projects involving collaborations among various sectors on a common research theme. Projects must demonstrate the added advantages of a networking approach.



- Collaborative Research and Development Grants, which support research projects carried out jointly with one or more industrial partners. Participating companies must be willing and able to exploit the research results.
- Technology Partnership Program Grants, which support (with companies) very applied research at the commercialization end of the R&D spectrum. At the end of the project, the participating company must be able to take the technology to the marketplace
- Industrial Research Fellowships, which provide financial support to recent doctoral graduates to help them gain up to two years of postdoctoral research experience in an industrial setting, working on a project defined by the sponsoring company. While adding to their own research qualifications, the Fellows also help the company enhance its R&D capabilities.
- Industrial Postgraduate Scholarships, which provide financial support to master's and doctoral students in the natural sciences and engineering. These scholarships allow students to complete their graduate studies while working on a research project of interest to them, their academic supervisor and their Canadian industry sponsor.
- Undergraduate Student Research Awards in Industry, which provide financial support for undergraduate students who wish to spend time working in an industrial research setting. The award covers summer employment or a co-op work term on an industrial R&D project relevant to the student's program of study.
- New Faculty Support Program, which supports the research activities of a new tenure-track junior faculty member in conjunction with an industry partner. The sponsoring company contributes to the salary of the incumbent and NSERC provides funding in support of the research.
- Networks of Centres of Excellence (NCEs), which link researchers across the country to develop Canada's economy and work on significant problems in areas such as health and biotechnology, information technology, natural resources, infrastructure, and computer-aided learning. NSERC supports 11 NCEs, including two in partnership with the Social Sciences and Humanities Research Council and two in partnership with the Medical Research Council.

## 1998 Selection Committee

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### Chairperson

Dr. Paul Guild  
Department of Management  
Sciences  
University of Waterloo  
Waterloo, Ontario

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### Members

Dr. Joseph Paradi  
Department of Chemical Engineering and Applied Chemistry  
University of Toronto  
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Mr. David Edge  
Development and Quality Assurance  
Lever Brothers  
Toronto, Ontario

Dr. Charles Terreault  
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Edmonton, Alberta

Dr. Irwin I.J. Itzkovitch  
Senior Vice-President – Technology  
Noranda Technology Centre  
Montreal, Quebec

Dr. Edward Rhodes  
Past President  
Technical University of Nova Scotia  
Halifax, Nova Scotia

# Certicom's success rooted in university collaboration

The University of Waterloo has earned the reputation as Canada's hotbed for new high-tech talent, culturing computer science successes like Mississauga-based **Certicom** and the University's Data Encryption Group (DEG). Founded in the mid-1980s by Drs. Scott Vanstone, Ron Mullin and Gordon Agnew, **Certicom** has built upon and commercialized a mathematical breakthrough made by the three professors under the auspices of the DEG. Today, their discovery has spawned the basis for a revolutionary technology to secure the world's newest and smallest computing devices.

## Ancient history

Before the 1970s, government agencies – particularly the military – were the main users of encryption systems to encode data mathematically, making it incomprehensible to anyone without a decoder. With the development of increasingly advanced devices for communicating information, such as digital computers, faxes and bank machines, however, it became more than a military or government concern. Suddenly, data security

affected almost everyone, particularly when financial information was involved.

Public-key encryption (which encodes data using a public key but decodes it using a private key) was the most effective system available at the time. Realizing its commercial potential, mathematics and electrical engineering professors at the University of Waterloo began basic research on the technology in the late 1970s. Their work led to the creation of the DEG by Vanstone, Mullin and Agnew in

## The code breakers become the code makers

*In information security, the people who can break the codes can also make the codes, and probably better than the ones they broke in the first place. The University of Waterloo's Data Encryption Group (DEG) is a case in point.*

*Beginning in 1983, the DEG began to make a name for itself in the information security business by breaking a public-key encryption scheme in use by a number of large U.S.*

*companies. Hewlett Packard had built a VLSI (Very Large Scale Integration) device using the scheme, but discontinued it after the code was broken.*

*In 1985, on retainer to the Canadian Banking Association, the DEG reviewed a message authentication coding scheme being proposed as an international banking standard by the International Standards Organization (ISO), again finding a weakness in the scheme that resulted in its abandonment.*

*That same year, the DEG turned its attention in earnest to making rather than breaking codes,*

*discovering some new mathematics and a new architecture that enabled the fabrication of large arithmetic processors to do finite field computations, which are crucial in the design of public-key cryptosystems. Using this new architecture, the DEG built its own VLSI device for public-key cryptography in 1989.*

*In 1990, the DEG demonstrated the first practical implementation of an elliptic curve cryptosystem (ECC), and in 1991, built the first chip specifically to perform elliptic curve computations.*

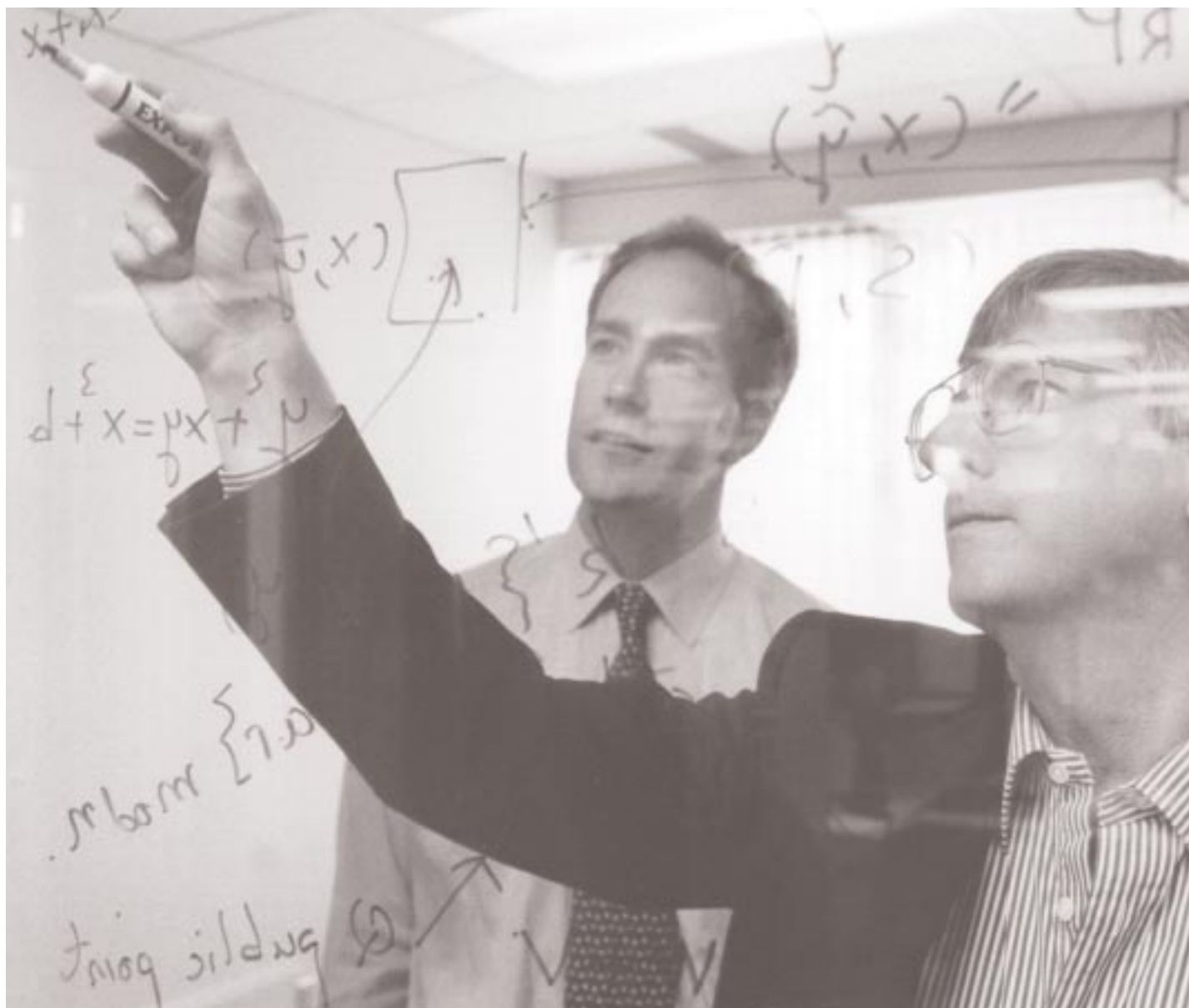
1983 to help industry and academia work together to resolve information security issues.

In 1985, with a little industrial experience and a few fundamental breakthroughs in mathematics related to cryptography, the three started a company called Cryptech, later renamed Mobius Encryption and finally *Certicom Corp.* in 1995.

"When we started the company, our objective was to commercialize the techniques that resulted from our fundamental research at the University of Waterloo and make our unique expertise available to the industrial community," says Vanstone, now Director of the Centre for Applied Cryptographic Research at Waterloo and *Certicom's* Chief Cryptographer. "Our objective hasn't changed since then."

## The middle years

Since 1985, *Certicom* has concentrated on researching, developing, marketing and selling the new generation of public-key technology based on elliptic curves, developed initially by the DEG. In fact, the DEG built the first chip to implement elliptic curve, public-key cryptography.



Philip Deck (left) and Dr. Scott Vanstone (right) have built a commercial success from *Certicom's* revolutionary mathematical approach to information security. Today, major software and hardware manufacturers are using *Certicom* elliptic curve technology to secure the next generation of handheld computers, electronic commerce applications and wireless devices.

Joël Bérard



## ECC leads the crypto world

Used around the world, Certicom's patented elliptic curve cryptography (ECC) technology has gained widespread acceptance as the most advanced and efficient way to secure communications and electronic commerce, from high-transaction Web servers to

small, power- and memory-constrained consumer appliances.

Based on more than a decade of research, Certicom's ECC enables digital security for every kind of computing device today where high cryptographic strength is needed while minimizing power drain and processing time, and lowering costs per transaction.

Certicom's current list of customers attests to ECC's importance in both the crypto and mainstream computing worlds. The company's partners include Motorola, 3Com/Palm Computing, Pitney Bowes, Sterling Commerce, and VeriFone, the largest supplier in the U.S. of authorization equipment for credit and debit cards.

**Certicom** commercialized the DEG's breakthrough and hired University of Waterloo graduates with expertise in this sophisticated area of mathematics and engineering. The company's patented elliptic curve cryptosystem (ECC) was the result, and **Certicom** is recognized as the world leader in the commercialization of this advanced type of encryption.

## Back to the future

Now a public company with a staff of approximately 96 high-tech specialists, **Certicom's** current goal is to see its Canadian-developed technology in every digital device requiring data security – from handheld computers to personal cellular telephones. Another goal is to continue pursuing fundamental research in public-key techniques with the DEG, reconfigured as the new Centre for Applied Cryptographic Research.

"**Certicom** is deeply committed to supporting the University of Waterloo's efforts to maintain its world reputation in cryptographic research and to foster the development of undergraduate and graduate students in the field," says Vanstone. "We encourage our researchers to visit Waterloo, interact with visiting international

scientists, grad students and faculty, and make themselves an integral and active part of the new Centre, which is a truly world-class organization."

In fact, **Certicom** believes so strongly in the new Centre that it has joined forces with such internationally recognized companies as **Pitney Bowes**, **MasterCard International** and **Mondex International** to provide funding for its creation. NSERC matched industry's funding to create two senior industrial chairs of cryptography at the University of Waterloo, which resulted in the return to Canada of Dr. Douglas Stinson, a world authority on cryptography.

"**Certicom** and the University of Waterloo are extremely pleased to receive this Synergy Award," says Vanstone. "We believe we've built a partnership that will last well into the next millennium."



Philip Deck  
Chief Executive Officer  
Certicom



Dr. Scott Vanstone  
Chief Cryptographer  
Certicom  
and  
Director of the Centre for Applied Cryptographic Research  
University of Waterloo

# Précitech and Laval University partnership forges new Canadian industry

In 1988, when Louis Desrosiers and his Laval University research colleagues began to shop their powder metallurgy expertise, they were looking for a Quebec company that manufactured industrial parts from powder. They couldn't find one, because in an all-too typical Canadian story, the raw materials were simply being exported.

"No one was manufacturing parts from powder in Quebec and only a couple of companies were operating in Ontario. It was all happening in the U.S.," explains Desrosiers.

So they created their own company. The result was Précitech, a parts manufacturer that designs and makes high-end value-added products used in the automotive, lock, and power tool industries, among others. Simultaneously, Précitech launched a long-lasting university-industry partnership and a new Canadian industry. Presently, the spin-off company boasts annual sales of \$4 million, a projected 35 per cent growth rate, and 55 employees and counting.

"We are successful today, but it's taken 10 years to get here," says Desrosiers, now Précitech's Director of Development and

Technology. "And without governments (provincial and federal) and NSERC financing, this project would have never gotten off the ground."

## Equal partners

To launch their fledgling company, the researchers teamed up with entrepreneur Marc Vaugeois and approached Laval's technology transfer office – Bureau de valorisation des applications de la recherche (BVAR) – to see how the university could help.

BVAR was excited by the project, and the partnership blossomed. In 1992, Précitech was officially founded, complete with offices and a research lab in an industrial research park not far from the university. The proximity ensures excellent communication between university researchers and Précitech engineers, maximizing benefits to both partners.

BVAR helped secure financing for 1992 to 1996 from the Quebec government. In 1995 and 1996, the two leading Laval University researchers, professor and powder metallurgy expert Roch Angers and mechanical engineering professor Michel Guillot, applied for and received NSERC funding.

"From the beginning, both Précitech and Laval University worked together on all of the project's components, including the science, methodology, choice of

## R&D game plan: know the science

Précitech's advance marketing research made it clear that to be profitable, a company specializing in powder metallurgy would have to find its niche and differentiate itself from the competition (125 North American powder metallurgy part manufacturers).

"At that time, we identified an opportunity for stainless steel products," says Desrosiers.

"We pursued it in our research program, and today, stainless steel parts account for 65 per cent of sales."

"Our marketing study indicated we needed three key ingredients: a modern, flexible plant; skilled people; and R&D activities. The latter has been our key difference. We know the science, while our competitors

generally do not devote as much effort to understanding it."

"Thanks to our process, we can make parts that would be impossible traditionally. Plus we're cost-effective, because there's no machining, and no material loss," Desrosiers continues. "It means adhering to a long-term vision and performing several years of start-up R&D before you see any results. But Précitech proves that R&D and making a profit are mutual goals."



Louis Desrosiers  
Director of Development and Technology  
Précitech

research equipment, and financial scheme,” explains Pierre Pedneau, BVAR’s director.

## Real-life training

“Grad students have full access to the *Précitech* lab,” says Desrosiers. “Thanks to the partnership, the students receive real-life training, such as seeing a product that they’ve designed get taken to market. That is invaluable experience.”

“We’ve hired 80 per cent of the graduate students who’ve worked for us. That’s pretty good, I think.”

The company and the university also share research papers. Graduate students and faculty members present papers on their research work with *Précitech* to the scientific community, while *Précitech* engineers deliver the same papers to the business community. “For the university community, it is very important to be able to publish,” explains Desrosiers, “and *Précitech* gains the invaluable reputation of being a company with a leading-edge research program.”

## “Sintering:” the science behind the success

The Laval University-*Précitech* research team are experts in powder metallurgy, a leading-edge technology that produces industrial parts, often with complex shapes, from metal powders.

### Production process

To produce a part, the metal powder is compacted into the shape of the final product by pouring it into a die in a mold at room temperature.

At this point, the part has no mechanical properties. That’s where metallic powder expert and Laval University professor

Roch Angers comes in. He’s an expert in “sintering,” a process of oven-firing the parts at high temperatures so that they form metallurgical bonds.

During sintering, a reaction occurs at the surface of the compacted metal particles. When heated almost to the melting point of the metal itself, the particles “agglutinate,” or bond together, giving the part almost the same strengths and properties as if liquid metal were

poured into the mold in the traditional manner.

### The model advantage

Laval mechanical engineering professor Michel Guillot works with the *Précitech* research team to model stages of manufacturing the metal powders. Thanks to this advanced finite-element analysis-based technology and in-depth knowledge, *Précitech* is able to model and test parts brought in by customers, removing any flaws and resulting in a better, stronger product.

Of further benefit to the university, the intellectual property of the Laval researchers stays with them. “If production and sales meet expectations, royalty income is expected to flow back to the university,” says Pedneau.

## Rapid technology transfer

The close ties were also key in facilitating a rapid transfer of scientific expertise from the university to the company.

“Thanks to this project, the university has contributed to building a new company, creating new jobs and strengthening the local economy,” says Pedneau. “The project also generated substantial research funds.”

For *Précitech*, the advantages are also numerous. “Because we work side by side, our engineers could regularly consult with university researchers on a problem, both for troubleshooting and for long-term planning,” says Desrosiers.



Pierre Pedneau  
Directeur, Bureau de valorisation des applications de la recherche  
Université Laval

Louise LeBlanc

# Partnership fuels Automotive R & D Centre

**W**hen *Chrysler Canada* and the University of Windsor partnered on a new automotive research centre, they faced a tall order: their new centre had to achieve economic, technological and social benefits for the two founding partners and for Canada as a whole.

Since its May 1996 opening, the \$50-million Automotive Research & Development Centre has easily filled that order, acting as proof-positive of the benefits of university-industry synergy. Jobs have been created, automotive research has intensified, the environment is getting a break, and much more.

"Our work with *Chrysler Canada* is a classic example of a 'win-win' partnership between university and industry," says University of Windsor President Dr. Ross Paul. John Mann, Director of Engineering, *Chrysler Canada Ltd.*, agrees: "The Centre is a shining example of how people from different organizations can work together to significantly enhance research and educational opportunities in Canada."

## Bucking the trend

When the centre opened, it employed 100 full-time highly qualified personnel. Since that time, staff has doubled to 200. "Needless to say, we are very proud of this rapid growth in a field where the trend has been to downsize," says Mann.

The benefits don't stop there. The centre has created three prestigious NSERC/*Chrysler* professorships; 50 work-term opportunities for co-op engineering students; a graduate internship program; and thesis projects for 20 graduate students. In addition, a number of Windsor engineering graduates have gone on to find full-time employment in the automotive industry.

"The University of Windsor students are terrific!" enthuses Mann. "We work very closely with the university to ensure a good fit and a good co-op learning experience for each student. As a result, the students enjoy their assignments at the centre, and *Chrysler* benefits as well."

## Research saves time

Since the centre opened, *Chrysler* has doubled the amount of research it conducts in Canada. The centre's primary R&D activities include alternative fuels, automotive materials, vehicle durability, mechanical engineering design, vehicle safety, and fuel economy and emissions.

## Student research powers new engine

Windsor mechanical engineering student Egidio Mosca spent all winter in his basement – creating a greener way to mow lawns.

As part of a co-op work term at *Chrysler Canada*, Mosca was assigned the challenge of converting an engine to

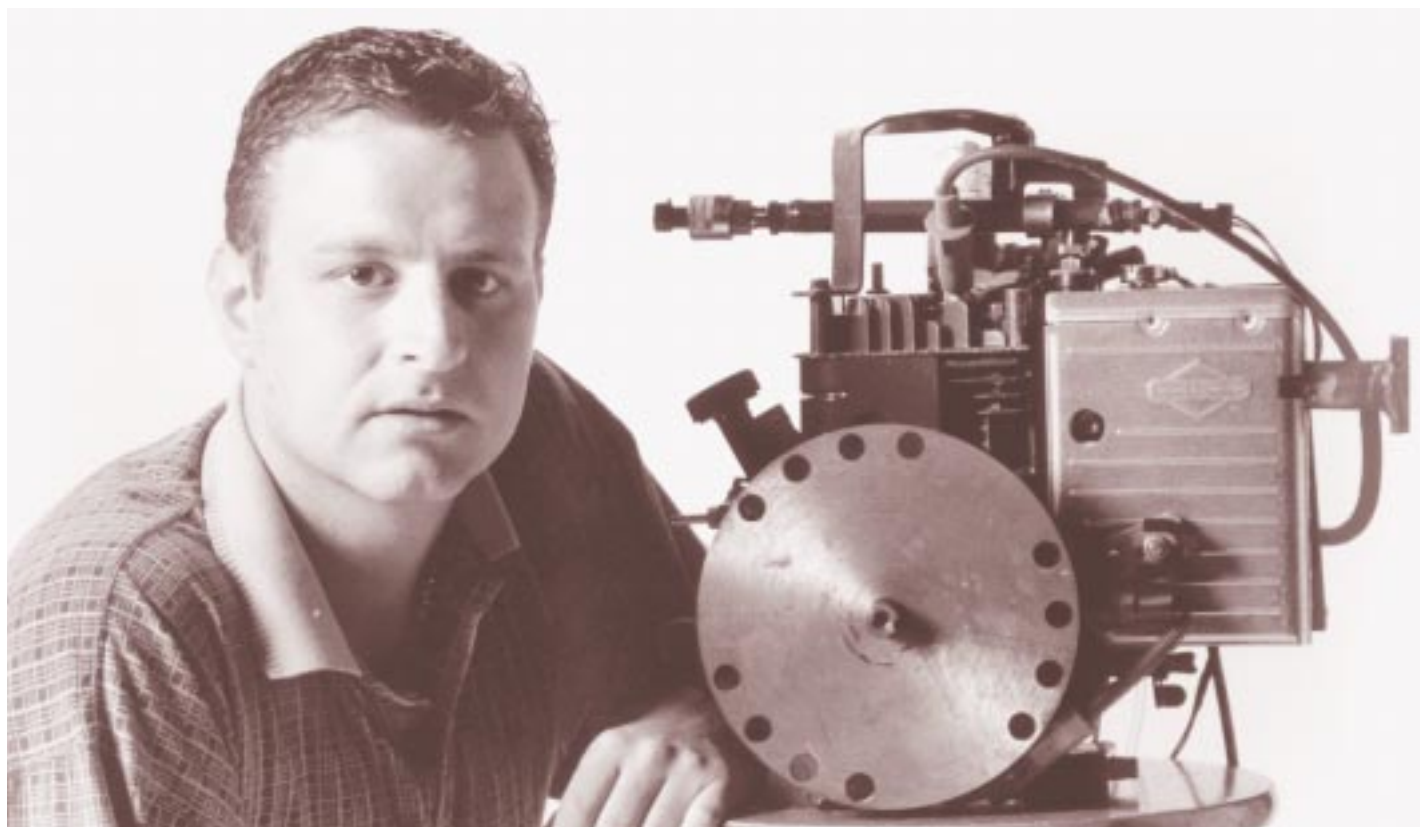
propane for his fourth-year project. With a little help from his friends, electrical engineer Marc Drouillard and mechanic Mario Miceli, Mosca converted a single-cylinder gasoline engine to propane, and replaced the carburetor with fuel injection equipment. *Chrysler* supplied all the parts, resources and technical support he needed, and Briggs and Stratton Corporation supplied the engines. The

project ran from May 1997 to March 1998, and was based in his parents' basement.

Mosca's product has applications for lawnmowers, rototillers and other small machinery.

The best news? The propane-powered engine produces as much power as the old gasoline version, but with 75 per cent less hydrocarbons, and much lower greenhouse gases.





Egidio Mosca, mechanical engineering student  
University of Windsor

R&D that simply cannot be done on the road is also possible. A major portion of *Chrysler's* investment was directed toward



Dr. Ross Paul, President  
University of Windsor

establishing a New Vehicle Durability Laboratory, which has helped shave months off *Chrysler's* development process for new vehicles.

"We can evaluate concepts and prototypes in just a few weeks' time – which is equivalent to a vehicle's lifetime in consumer hands," explains Mann. "This compares very favourably to the more conventional 'proving grounds' evaluations that can take a year or more to complete."

### Partnership builds on strengths

From the beginning, each partner defined its role according to strengths. The University of Windsor owns the facilities, including a \$7.4-million building purchased with federal, provincial and municipal grants. *Chrysler Canada* funds all operating costs. The university is also the source of

research talent and resources, including faculty, co-op programs, and undergraduate, graduate and postdoctoral students.

*Chrysler's* \$24-million initial financial contribution helped renovate the building and buy state-of-the-art research equipment, with the subsequent \$25 million directed toward continuing and strengthening the research programs.

The company also plays a consulting role – the university is able to tap into *Chrysler* and seek advice on developing a course curriculum

"Our work with *Chrysler Canada* is a classic example of a 'win-win' partnership between university and industry."

Dr. Ross Paul,  
President, University of Windsor



"The Centre is a shining example of how people from different organizations can work together to significantly enhance research and educational opportunities in Canada."

John Mann,  
Director of Engineering,  
*Chrysler Canada Ltd.*

that is applicable to the modern automotive world. In addition, *Chrysler* engineers serve as guest lecturers at the university, teaching a credit course that emphasizes teamwork and project-oriented engineering.

## Research positions automotive giant

While a current leader in alternative fuels technology, *Chrysler* understands it can only keep that position by generating significant new fundamental knowledge. That's where not only the centre, but the three new professorships, funded by NSERC, the University of Windsor and *Chrysler*, come into play.

"For *Chrysler*, there's no better way to generate such future knowledge than in partnership with NSERC and the University of Windsor," says Mann. "The location allows for the university to take advantage of industrial expertise and resources that are not within the reach of the usual academic environment."

"It's a perfect fit for *Chrysler*, because our research goals are clearly aligned with those of academia, and we want to be part of the solution."



Bringing the test track into the lab.

It's a research emphasis that also spells good news for Canadians and the environment. The University of Windsor and *Chrysler* are helping to support the Propane Vehicle Challenge, a student competition among universities across North America that challenges students to develop effective, alternative ways of fueling automobiles.

## Well-deserved recognition

The success of their partnership has garnered the partners much recognition, including the NSERC award. "I am delighted with this award, which further underscores the growing reputation of the University of Windsor for its partnership ventures," says Paul.

Mann is equally pleased. "The University of Windsor and *Chrysler Canada* are very proud of this award," he says, "and of our innovative partnership."



John Mann  
Director of Engineering  
*Chrysler Canada Ltd.*

Vern Harvey Commercial Photography

# Fraser Papers and the University of New Brunswick build a sustaining partnership

**F**orestry isn't just about jobs and wood supply anymore. Increasingly, biodiversity is becoming a concern for forward-looking companies that recognize the environment is fundamental to the forest industry's existence.

Based on a shared interest in improving local knowledge of the relationship between wildlife communities and their habitats, a partnership between *Fraser Papers Inc.* and the University of New Brunswick (UNB) is looking at how forest management practices can be used to maintain biodiversity.

The roots of the collaboration go back to 1993, when the Edmundston, N.B.-based Wood Products Group of *Fraser Papers* became concerned with a significant decline in the white-tailed deer herd in northern New Brunswick. *Fraser Papers* started talking with UNB, which eventually led to a three-year collaborative project with the university's Cooperative Fish and Wildlife Research Unit to study the causes and extent of deer mortality. The results of this study are now being used by the provincial government for game management.

"The most important aspect of this research is that it's building a knowledge base so that the forest



Assessing quality of wildlife habitat on Fraser Papers Inc. property.

industry will have a better understanding of the impact it's having on the region's biodiversity," says Dr. Graham Forbes, Director of UNB's Cooperative Fish and Wildlife Research Unit. "Prior to these studies, there was a lack of localized information on the relationship between industry cutting practices and wildlife."

Other ongoing research includes studies on the specific winter habitat preferences of deer – information essential to combining forest management with wildlife management; the responses of small mammals and birds (as indicators of biodiversity) to forest harvest activities; and watershed management.

## Biodiversity

*In a nutshell, biodiversity is the variability among all living things, including diversity within species,*

*between species and of ecosystems. It's important because:*

- *all life on earth depends on it;*

- *many plant and animal species may hold benefits as yet undiscovered; and*
- *diversity makes ecosystems better able to adapt to change.*



Dr. Graham Forbes  
Director of Cooperative Fish and Wildlife Research Unit  
University of New Brunswick

## Opening doors, changing perceptions, sharing resources

In the last four years, 15 graduate and undergraduate students and six technical staff have benefited from the valuable training, exposure and funds provided by *Fraser Papers*.



Steven Young  
Wildlife Biologist  
Fraser Papers Inc.

"Sharing costs for conducting research and using each other's resources makes for an efficient and productive partnership," says Steven Young, Wildlife Biologist for *Fraser Papers*. "The UNB Cooperative Fish and Wildlife Research Unit offers excellent direction and resources that includes a pool of great graduate students to supervise research efforts."

Young also credits the collaboration with demonstrating to stakeholders the seriousness of the company's commitment to sustainable forest management. "The cooperative research projects seem to have changed perceptions of us by government so that we are now seen as part of the team looking for solutions. Common backgrounds

and our demonstrated commitment to the environment have boosted our credibility and opened up new areas of communication on research and management issues."

*Fraser Papers'* commitment extends to the development of best management practices for its forest management planning and operations. "This is where the rubber meets the road," says Young. "The research will provide scientific documentation that will be used as we continue to fine-tune our current management practices."

### A winning partnership

*Tackling real-world problems, exposing students to the latest techniques and industry needs, developing world-class scientists essential to Canada's productivity and economic growth. Sounds like a win-win all around – and these are just a few of the benefits Fraser Papers Inc. and the University of New Brunswick (UNB) have realized from their partnership.*

*For the past five years, UNB's Cooperative Fish and Wildlife Research Unit has been working with Fraser Papers to improve our understanding of effects of forest management on forest wildlife and biodiversity.*

*By all accounts, everyone involved in the project is happy with the arrangement.*

- Dr. Graham Forbes, Director of the UNB Research Unit, sees the experience as a valuable investment in the future: "From a career point of view, the partnership offers a great chance for students to work toward real-world solutions, which can only improve their employment prospects down the road."
- And Steven Young, Fraser Papers' Wildlife Biologist, appreciates the value that Fraser Papers gets for the quality of research conducted: "The results we get from our collaboration with UNB, utilizing the tremendous UNB student resource, far exceeds what we could accomplish in house at anywhere near the financial investment. It's just a great arrangement for everyone involved."



# Innovation the fundamental building block in important new pulp and paper tool

**W**ho ever said that Lego™ models were child's play?

Not the researchers at the University of British Columbia (UBC) Pulp and Paper Centre, the *Pulp and Paper Research Institute of Canada (Paprican)* or *OpTest Equipment Inc.* Working together in a long-term partnership, the three groups have developed a revolutionary pulp and paper tool that saves pulp mills time, money and effort – the on-line, real-time Fibre Quality Analyzer (FQA). And it all grew from a set of Lego™ building blocks.

Intrigued? Here's the story.

## Beginning at UBC

Almost 10 years ago, Dr. Richard Kerekes, the Director of UBC's Pulp and Paper Centre, began looking for ways to measure wood pulp fibres quickly and on-line. The technology to image fibres for on-line analysis was there, but a critical problem was to develop a method to align and position fibres in a flowing stream so that they could be imaged. This problem was tackled at UBC with funding from the Mechanical Wood-Pulps Network of Centres of Excellence.

That's where the Lego™ comes in. Kerekes explains, "When we were looking for ways to test flow cells and optics configurations quickly, we needed a flexible method to

## New instrument marries medical science with pulp and paper engineering

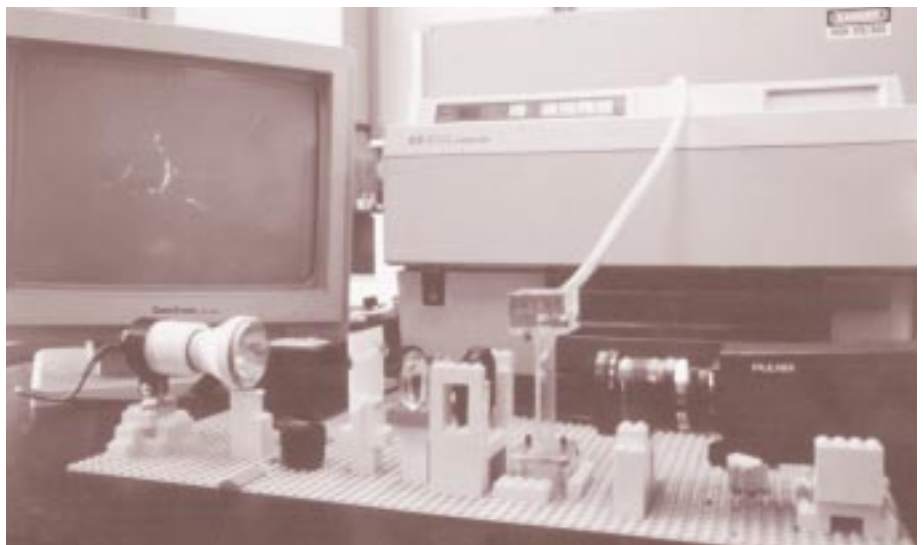
*Typically used in medicine for blood analysis, flow cytometry measures the properties of cells as they move, or flow, in a liquid suspension. The liquid creates a fluid sheath that aligns the cells into a single stream. Light then passes through the stream, and the scatter and fluorescence emitted from the cell are*

*collected and analyzed by computer software.*

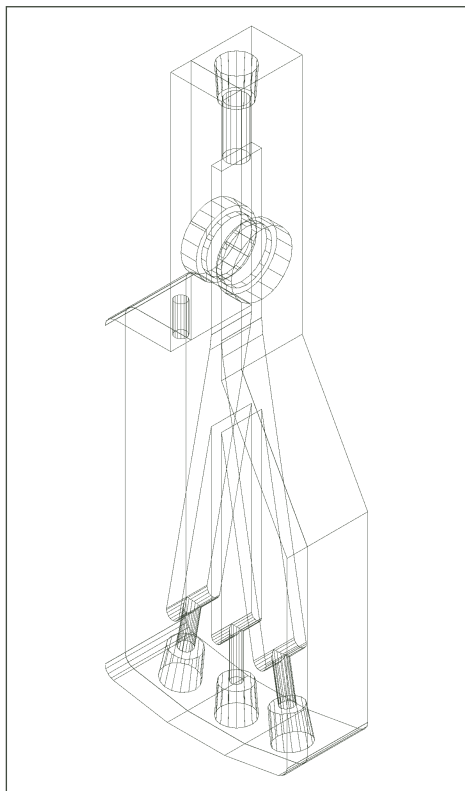
*Researchers at the UBC Pulp and Paper Centre, the Pulp and Paper Research Institute of Canada (Paprican) and OpTest Equipment Inc. adapted this technique in their Fibre Quality Analyzer (FQA) to measure fibre quality in wood pulp. Using a liquid sheath created by the instrument's patented flow cell, the FQA aligns the pulp fibres, passes them through a light source, images them by a video camera, and uses computer software to*

*analyze their shape, length and other properties that will affect paper quality.*

*"One of the good things about working with UBC and the Mechanical Wood-Pulps Network of Centres of Excellence on this project was their ability to adapt techniques from the medical field to fibre measurement," says Roland Trepanier, OpTest president. "We developed an innovative approach to measuring pulp quality by building upon concepts from another discipline entirely."*



Early apparatus in the development of the FQA used Lego™ to position the flow cell, optics and camera in demonstrating the image analysis algorithms on fibres in flowing suspensions.



The UBC Pulp and Paper Centre work focussed on the development of a flow cell to align and position fibres in a flowing stream so that the fibres could be imaged by a video camera. This had to be accomplished without contact between the fibres and cell walls in order to avoid fouling and plugging.

The objective was met by developing a flow cell based upon hydrodynamic focussing principles. This flow cell was patented by UBC and Paprican – Canada Patent 2,145,275 and US Patent 5,311,290.



Dr. Andrew Garner  
Director, Vancouver Laboratory  
Pulp and Paper Research Institute of Canada



Dr. Richard J. Kerekes  
Director, Pulp and Paper Centre  
University of British Columbia

assemble the components.” James Olson, a student at the time, and a Paprican research engineer, used Lego™ for this. “It was perfect, enabling us to test options quickly,” says Kerekes.

The researchers from UBC worked with researchers from the Vancouver Laboratory of Paprican, led by Gordon Robertson. They successfully developed a narrow channel that would direct wood pulp in a thin stream through the measurement device in such a manner that pulp fibres were aligned and positioned in a plane without touching walls. This last requirement was critical, because pulp fibres and other debris could easily clog the instrument. To meet these objectives, the UBC and Paprican researchers adapted a concept from biomedical flow cytometry to pulp fibres.

The transition from a Lego™ model to reality took about two years, during which time the channel – now called a flow cell – progressed from a desktop apparatus to the prototype flow cell used in the commercial FQA. The cell was

patented by its inventors – James Olson, Gordon Robertson and Tim Finnegan – for UBC and Paprican.

In addition to the flow cell development, considerable further research was undertaken by Paprican to develop suitable illumination of the fibres using circularly polarized light, and image processing software to capture images and determine fibre length and shape.

## Over to OpTest

With the basic elements of the system in place, the technology was licensed to OpTest Equipment Inc. of Hawkesbury, Ontario for commercialization. “We turned the technology over to OpTest in 1993 because they had a good reputation for developing quality instruments for the pulp and paper industry,” says Dr. Andrew Garner, Director of Paprican’s Vancouver Laboratory. “We felt they had the expertise and knowledge to make the FQA a success.”



### The On-Line Fibre Quality Analyzer model

Designed for in-mill use for the rapid, accurate and automatic determination of pulp properties and pulp quality. Representative samples are captured from the centre of the process line and sent to the on-line FQA. The on-line model has the same flow cell and optics as the laboratory unit and provides the same results.





As the pulp passes through the flow cell, laminar sheath flow ensures that the fibres retain their natural shape and proper orientation.



Roland Trepanier  
President  
OpTest Equipment Inc.

*OpTest*, in turn, “felt the FQA had great market potential,” says company president Roland Trepanier. “We worked extremely cooperatively with the UBC and Paprican team, and invested \$300,000 to complete the engineering phase and develop the commercial prototype.”

They also made significant improvements in the FQA’s performance, speeding up image analysis from 1 to 100 fibres per second. This required the development of yet another version of the flow cell, an improved optical system, and a new video camera system. At the same time, they also improved their methods of analysis. In addition, in a far-sighted move,

*OpTest* based the FQA operating controls on the coloured touch-screen technology used for the company’s other products.

The first FQA units were working prototypes sent to three beta test sites in Canadian mills – at *Domtar*, *Irving Pulp and Paper*, and *Weyerhaeuser* – and to *Paprican*. “The original instruments were large floor-mounted units,” says Trepanier. “With the experience we gained in testing and using them, we redesigned the system as a compact bench-top instrument with a modular design, which reduces both manufacturing and delivery time.”

## Commercial success in the pulp and paper industry

Word spread about the FQA from the beta sites, and 70 units have been sold to date, accounting for about 35 per cent of *OpTest's* business. As an added testament to the instrument, *Weyerhaeuser* has even standardized its operations using this technology.

"We're thrilled with our success on the FQA, both commercially and with the Synergy Award" says Trepanier. "A positive project with positive results – it really shows that these kinds of collaborations work."

UBC's Dean of Applied Science Dr. Michael Issacson couldn't agree more: "The success of this project is extremely gratifying," he says. "Seeing a product developed and sold, knowing that people are employed as a result of our research – it's what we all work toward."



### The FQA commercial instrument

This instrument rapidly and accurately measures fibre length, curl, % fines, kink and coarseness in dilute pulp samples. The patented flow cell resists plugging or fouling and orients fibres for correct image analysis. The FQA meets or exceeds the specification of TAPPI Test Method T271.

# PRECARN – promoting and proving the doctrine of collaboration

**F**ar-fetched as these breakthroughs may sound, they are just a few of the futuristic technologies that have resulted from the university-industry collaboration led by *PRECARN*.

A member-owned consortium of Canadian companies and government research organizations, *PRECARN* conducts research and development in intelligent systems – sensors, software and computers embedded in machines and devices. The focus is on solving industrial problems.

The *PRECARN* network covers an extensive range of research disciplines, from computer vision and other sensing technologies to knowledge-based and reasoning software; robotics; automation and control; and human-machine interface technologies. With applications in the largest sectors of the economy, such as manufacturing, mining, forestry and leading-edge information technologies, the network's research work has tangible benefits for Canadian industry.

## Filling a gap in expertise

A recognized pioneer in collaborative research, *PRECARN* was established over 10 years ago to bridge the gap between university research and industry, thereby creating an industrial capability

- A microscope that can discriminate between malignant and healthy tissue for earlier detection of cancer.
- A virtual excavator that can train heavy equipment operators.
- Software that can recognize individual voices and identify each speaker.
- Robotic tools that can help doctors perform coronary bypass surgery without stopping the patient's heart.

in intelligent systems. *PRECARN*'s uniqueness stems from its highly participatory, needs-driven approach to R&D. By concentrating on marketable technologies with direct relevance to its members, *PRECARN* has had a tremendous impact on the development and growth of the intelligent systems industry sector.

A benchmark in *PRECARN*'s early history was the creation of its university-based research program – the Institute for Robotics and Intelligent Systems (IRIS). Managed

by *PRECARN* and reporting to its board of directors through a management committee, IRIS is one of 11 federally funded Networks of Centres of Excellence.

## A pipeline to industrial solutions

"Our two research networks interact continuously," says Harry Rogers, President and CEO of *PRECARN*. "*PRECARN* is our industry-based network, while IRIS is university-based. All members of the consortium play an essential role in creating a knowledge and information pipeline that spans the full spectrum from the research lab to industrial application." Collectively, members select, finance and perform research and development projects that are relevant to business and industry.

"Our projects are made up of a customer who is going to use the technology, technology providers who are going to develop and supply it, and university researchers who are bringing their knowledge and expertise to the work," says Rogers. Although all

## A window to advanced technology

For Canpolar East Inc., a small Newfoundland-based company that specializes in machine vision technology, membership in *PRECARN* has meant a

window to Canada's advanced technology community and access to state-of-the-art research it could not afford to carry out in house. "Our company has benefited enormously," says Dr. Ernest Reimer, President of Canpolar East and a past Chair of the

*PRECARN* Board of Directors. "The technical and business contacts we have made through *PRECARN* have taken Canpolar from being a relatively small engineering company with a limited future to one with a global-market reach."



The Photo Company

Harry Rogers  
President and CEO  
PRECARN Associates Inc.

are necessary to the mix, the end users, who understand the need for the technology, and how it will be used, are perhaps the most important element in ensuring the technology is successfully created and exploited.

A clear indication that industry is buying into the collaboration fostered by PRECARN is the steadily increasing ratio of its funding between the early and late 1990s. For its part, PRECARN and IRIS have made total R&D



studio van dulong

Dr. Ernest Reimer  
President, Canpolar East Inc.



#### Virtual digging for gold

Training people to operate heavy equipment can be time consuming and costly. Now with intelligent system technology, workers can have the real experience – virtually.

With the Virtual Excavation Simulator, people can have the “feel” of being in and operating a real excavator. Using special computers, and adding of couple of joysticks, people can “see” an image on the computer screen and have the feel of what a real excavator would be doing. An operator can see the scoop digging a virtual hole and dumping the virtual soil, all while directing the process from the comfort of the lab.

investments of \$105 million from 1990 to 1997.

To Harry Rogers, the value of the collaborative process is not limited to the intelligent systems and robotics industry. “With a few exceptions, Canada is made up of small- and medium-sized companies. For Canada to be competitive in global markets, we need to collaborate to accomplish as a

group what, in other countries, individual large companies can do on their own.”

“While we certainly can’t claim to have created the intelligent systems sector, I think we can modestly claim to have had an important role in its growth,” says Harry Rogers, President and CEO of PRECARN.

And how.

#### The intelligent systems industry – then and now

*In 1987, when PRECARN was just getting its legs, there were only a handful of Canadian producers of intelligent systems technologies. In fact, of the original 22 PRECARN members, only 5 were producers of intelligent systems. A recent PRECARN survey of 600 firms paints a much brighter picture of the current state of the industry:*

- There are now approximately 250 firms whose primary business is designing, producing and selling intelligent systems.
- 70 per cent were founded since 1980; 40 per cent were founded in the last seven years.
- Total revenues from these firms is roughly \$3.8 billion, with over 50 per cent of the total coming from exports.
- These companies provide over 23,000 jobs.
- Technical staff make up more than 50 per cent of the employment in 70 per cent of the firms.
- In each of the last three years, 60 per cent of the firms reported annual growth rates of over 10 per cent.



# Nortel Networks' university partnerships a model for the high-tech world

**R**esearch, education and resourcing are the three pillars of *Nortel Networks'* model for successful university-industry collaboration. By partnering with universities, *Nortel Networks* capitalizes on their unique capabilities while sharing its own strengths with them.

The benefits? World-class research capabilities and education programs, advancement of fundamental knowledge, building blocks for future products and services, and economic and social spin-offs for Canada.

## The shape of things to come – research

"*Nortel Networks* relies on advanced research and development to maintain its position as a world leader in communications

technology and product innovation, and to help build Canada's reputation as a centre of global expertise in information technology," says Dr. Claudine Simson, Vice-President, Global External Research and Intellectual Property.

While *Nortel Networks* offers universities research funding and modern equipment, universities contribute knowledge and innovative research methodologies. Faculty, research staff and students work together with *Nortel Networks'* researchers to develop new research directions.

## A whole greater than the sum of its parts

*Nortel-university partnerships have taken many forms over the years: guest lectures by Nortel Networks employees, research funding and scholarships, intern and co-op placements, donated equipment, endowed chairs, and joint research projects. In several cases, these partnerships have been solidified into concrete arrangements that maximize the effectiveness of these elements and facilitate continued collaboration. Some examples:*

- With the University of Toronto, the Nortel Institute for Telecommunications, which represents an investment of more than \$8 million. It includes the establishment of two endowed chairs, and three junior faculty positions, a new Master's of Engineering Program in Telecommunications, equipment for two new laboratories, endowed scholarships for undergraduate and graduate students, and an Advisory Council to provide long-term planning and leadership.
- With the University of Calgary (and other stakeholders), the Software Engineering Research Network (SERN). SERN is a virtual institution that manages joint industry-university projects for industry personnel and students and is open to new partners and new technologies from elsewhere.
- With the University of Toronto, the Nortel Institute for Telecommunications, which represents an investment of more than \$8 million. It includes the establishment of two endowed chairs, and three junior faculty positions, a new Master's of Engineering Program in Telecommunications, equipment for two new laboratories, endowed scholarships for undergraduate and graduate students, and an Advisory Council to provide long-term planning and leadership.



Dr. Claudine Simson  
Vice President, Global External Research and Intellectual Property  
*Nortel Networks*





The Bulletin, Homa Favian

Peter Munsche  
Assistant Vice-President, Technology Transfer  
University of Toronto

For *Nortel Networks*, this means early access to new ideas, concepts and methodologies to help shape the future of technology and product design directions. For universities, it means access to up-to-date research capabilities and an understanding of industry's needs.



Dr. Mildred Shaw  
Industrial Research Chair in Software Engineering  
University of Calgary

## Nortel Networks' numbers tell the partnership story

- More than 2,000 interns and co-op students work at Nortel Networks each year.

- Nortel Networks hires one out of every three of Canada's master's and Ph.D. graduates in electrical engineering and computer science.
- Over 800 new graduates were hired by Nortel

Networks in 1997, and 40 per cent had worked for Nortel Networks previously.

- One in every four Nortel Networks' employees is engaged in research and product development.

## Education

*Nortel Networks* also supports numerous university chairs, new faculty positions, and cooperative education programs across Canada. This helps universities attract top-notch faculty and offer up-to-date undergraduate and graduate curricula. For example, under the auspices of the Nortel Institute, the University of Toronto has created a new Master's of Engineering Degree in Telecommunications (MET), as well as established a comprehensive Summer School programme focussing on advanced telecommunications topics. As well, Calgary and Carleton offer specialized master's degree programs in software engineering and systems engineering and technology management, respectively.

"It's part of our corporate philosophy to contribute to the development of first-rate education systems wherever we operate," says Simson.

Learning opportunities aren't for the universities alone: *Nortel Networks* employees also benefit from university educational opportunities.

"One of the things worth noting about the evolution of our partnership with *Nortel Networks* is the role that continuing education played in it," says Peter Munsche, the University of Toronto's Assistant Vice-President, Technology Transfer. "For many years, *Nortel*

*Networks* employees have spent part of their summers at the university learning about the latest developments in telecommunications technology."

In addition, *Nortel Networks* also opens its doors for professors on sabbatical to continue their collaborative research in an industry setting, and to co-op students and interns to complement their academic education with hands-on, practical training.

"You can't do software engineering totally in a university and you can't do the kind of research we're doing totally in industry," says Dr. Mildred Shaw, the University of Calgary's Industrial Research Chair in Software Engineering, Department of Computer Science and Department of Electrical and Computer Engineering. "It needs to be collaborative. It needs complementary skills and resources."

## Familiarity breeds content – and employment

*Nortel Networks*' research and educational collaborations allow it to meet and recruit some of the best students in Canada. By fostering a close relationship with students early on, *Nortel Networks* has a leg up in the competitive job market and can count on highly qualified individuals who are already familiar with its needs.



Mike Pinder Photography

Dr. John ApSimon  
Vice-President, Research and External  
Carleton University

"One of the advantages of Carleton's partnership with *Nortel Networks*, "says Dr. John ApSimon, Carleton's Vice-President, Research and External, "is that we sit very close geographically to *Nortel Networks*' major R&D operations here in Ottawa. We've been collaborating with *Nortel Networks* for over 20 years, and as the relationship continues to grow, we're seeing *Nortel Networks* contribute extensively to enhancing Carleton's research capabilities, and hire more and more Carleton graduates. The synergy of these partnerships is really paying off," says ApSimon.

And these partnerships will continue to pay off – for *Nortel Networks*, for the universities and for Canada – as new ones are formed and old ones are solidified.

*Nortel Networks*' collaborative relationship with the University of Toronto, Carleton University, and

the University of Calgary represents just the tip of the iceberg with respect to the company's support to universities and institutes around the world.

"*Nortel Networks* has many more such success stories, stemming from its long-standing support and advocacy of university research and education activities – many of them in Canada," said Simson.

"With more than \$20 million each year committed globally to supporting research and education, we see ourselves as being ideally positioned to lead the way in demonstrating the windfall that can be realized for all parties through supporting this kind of relationship," she said.

At the same time, graduates are confident about finding jobs, often carrying on with their own research projects.



Inside the construction of Skylab, the newest of *Nortel Networks*' R&D facilities.

