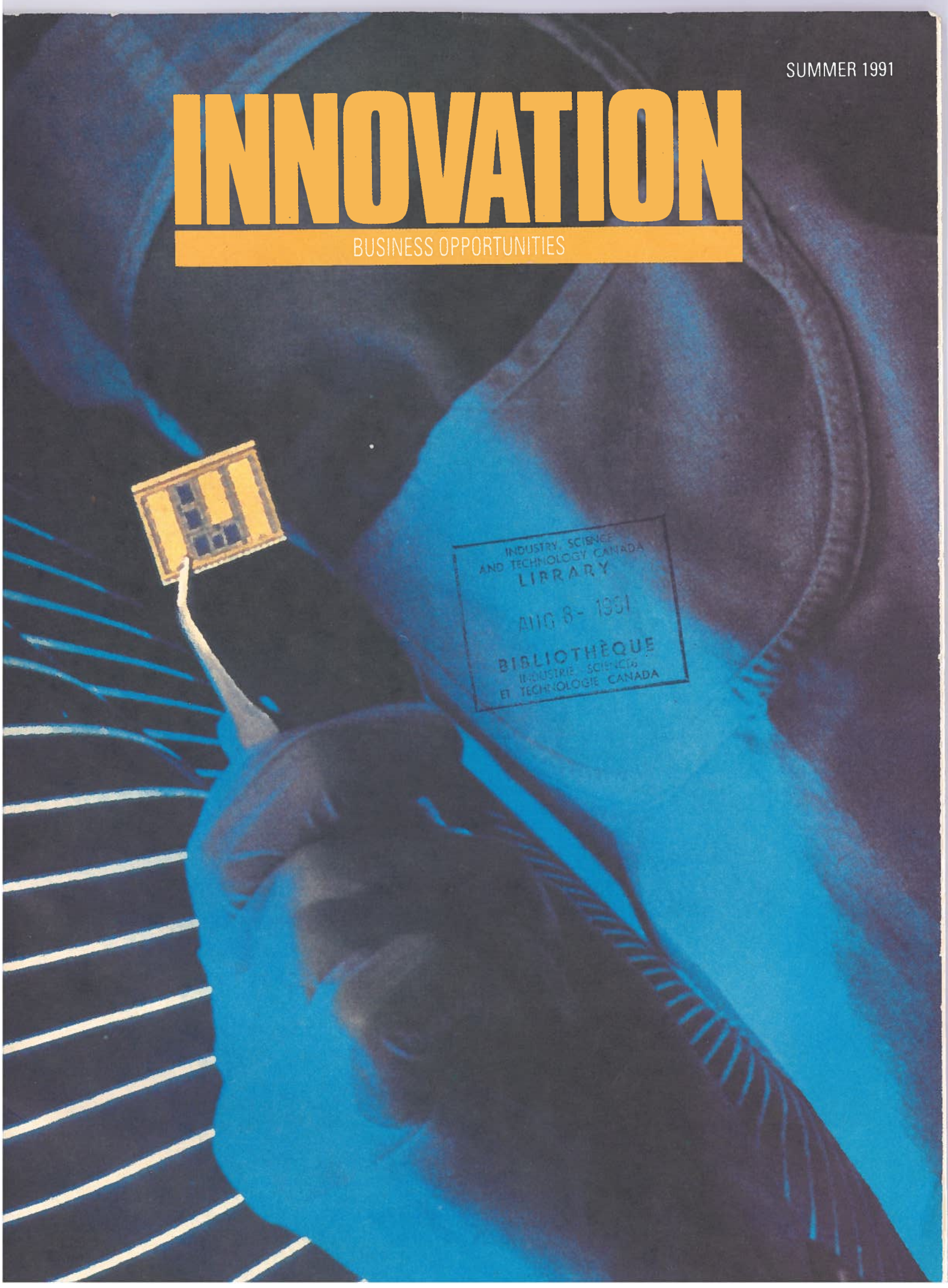
SUMMER 1991

INNOVATION

BUSINESS OPPORTUNITIES



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INNOVATION
This magazine is open to ideas from readers. Business Opportunity items from companies or individuals are welcome. Contact: Innovation; Technology Transfer Service; Technology Liaison Directorate; Industry, Science and Technology Canada; 235 Queen Street; OTTAWA, Ont. K1A 0H5; Tel.: (613) 954-3458.

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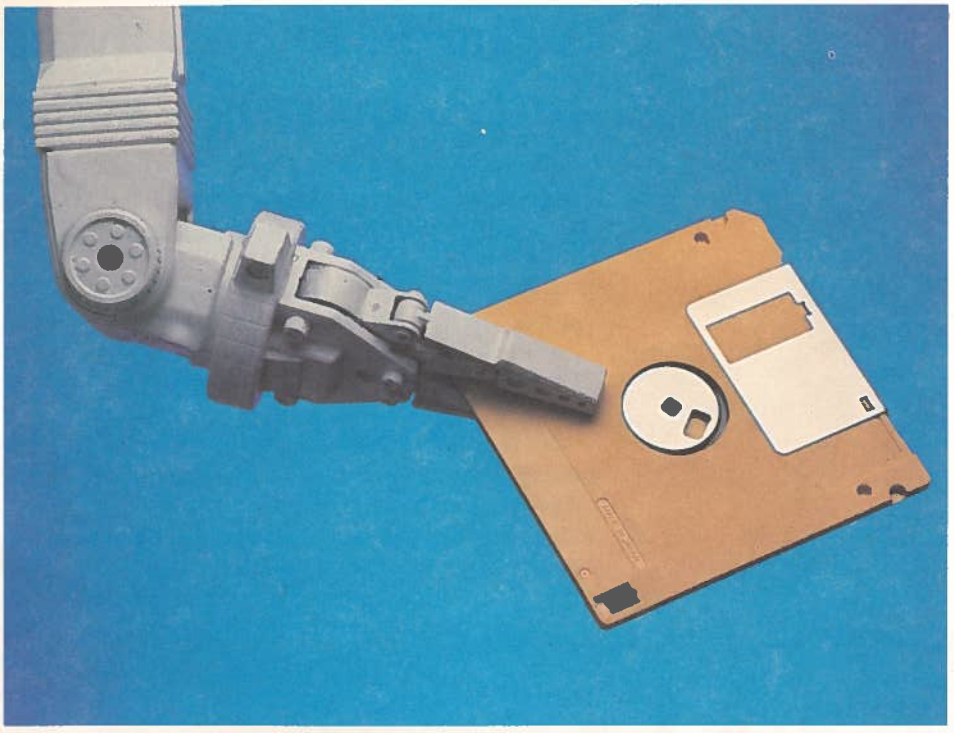
Editorial



In recent years, the federal government has encouraged its research laboratories to increase partnerships with the private sector. One of the ways labs do this is by transferring technologies for commercial application. Two articles in this issue of *Innovation* reflect this phenomenon.

" 'Bridge' over Troubled Airwaves" is the story of Ultimateast Data Communications, a Newfoundland company founded when its owners licensed a technology from the federal government's Communications Research Centre. The technology uses high frequency radio signals to send digital information automatically and reliably to and from remote areas. Clients for the company's mobile communications products include the fishing industry, the Canadian Coast Guard, the trucking industry, and two federal government departments — Communications Canada and the Department of Fisheries and Oceans.

Transferring technologies from federal laboratories is also at the heart of "Reliable Sources: Spreading the Word on Federal Technologies." The sources are Business Opportunity Documents, a new approach to getting the word out to the private sector on promising federal government technologies. The document broadens the focus beyond technical details of one specific application by getting scientists to explore all possible applications of the technologies.

Universities are another important source of technology that is transferred to the private sector. In the 1970s, several professors in the electrical engineering department at the University of Sherbrooke, in Quebec, saw strong growth potential for hybrid circuits. Today, the company they founded is the largest independent sub-contractor in Canadian microelectronics. CMAC Industries is profiled in "Fast Forward," our cover story.

The academic community also figures in "System Puts Mining Shuttles on Automatic Pilot." The system is the brainchild of Glen Brophey, a former business instructor at North Bay's Canadore College. Vehicle steering, braking, acceleration and maintenance are handled automatically, cutting down on labour by as much as two thirds. Four months of field testing have left Brophey confident as he begins marketing the system.

Another Canadian technology product with impressive market potential is IMPELA, short for Industrial Materials Processing Electron Linear Accelerator. IMPELA is a product of Atomic Energy of Canada Limited, which ran an article on it in the Summer 1990 issue of its *Ascent* magazine. When the technology was chosen for a prestigious R&D award last autumn, the decision was made to adapt the article and include it in *Innovation*. It's called: "AECL Wins with New Power Play."

In today's world, more and more companies want to buy technologies, sell them or manufacture products under technology licensing agreements. Therefore, Industry, Science and Technology Canada has produced a guide to help the Canadian businessperson effectively structure and participate in successful technology transfer. This publication is summarized in "A Guide to Supplying and Acquiring Technology."

Finally, two short articles are included in this issue: "Leading Research State Looks to Canada for Business Partners" and "Business Education Goes Global at Quebec University."

A Guide to Supplying and Acquiring Technology

In today's world, there is some aspect of technology present in almost every business transaction. Even for more traditional industries, such as publishing or food processing, new technological developments are increasingly important.

There are therefore more and more companies that want to buy or sell technologies, or perhaps manufacture a product under a technology licensing agreement with its owner. Each of these transactions involves a transfer of technology. Virtually any technology can be transferred, to varying degrees, for different purposes, and in many fields of activity.

However, the legal aspects of technology transfer are quite complex. Very few legal practitioners have a good grasp of the subject, even those with expertise in other areas of contractual commercial agreements. This is because technology transfer requires a thorough knowledge and familiarity with domestic and international laws, regulations and practices relating to "industrial and intellectual properties" (industrial design, patents, trademarks and copyrights) which are themselves a highly specialized field. Added to this is the difficulty that in Canada and elsewhere, these laws have not kept pace with advances in many fields such as computers, telecommunications and biotechnology.

If the transfer is international, there can be yet another complication. While some governments turn a blind eye to technology transfer activities, others regulate them to a high degree. Put all these issues together with the constantly changing nature of technology itself, and it becomes apparent that no *standard* approach or agreement can be used to structure a successful technology transfer.

Where can one go for help with the complexities of technology transfer?
Industry, Science and Technology Canada has produced a guide to help the Canadian businessperson effectively structure and participate in a successful technology transfer. *Supplying or Acquiring Technology: A Canadian Business Guide* was written by Alec R. Szibbo, a Vancouver barrister and solicitor who is an expert in this field. The first edition of this booklet was published in 1986. Because of significant changes in Canadian law, the guide has been substantially revised.

The 116-page booklet provides some basic information for dealing with the following components of the transfer process:

- Laying the groundwork for selecting the other party to the agreement.
- Choosing the basic structure of the technology transfer agreement.
- Identifying and resolving the major business or legal issues involved in the transfer.

The following questions and answers, based on material in the guide, will give you an idea of the wide scope of practical information it contains.

What is technology transfer?
"Technology" is a very general term that covers knowledge in such diverse areas as computers, industrial processes, consumer goods and natural resource exploitation. In fact, the definition of "technology" can be as encompassing or as narrow as its users or uses require.

"Technology transfer" is therefore the transmission, and sometimes the creation, of such knowledge, with or without the concurrent transfer of goods and services.

What are the possible benefits of a technology transfer for a technology supplier?
As well as obtaining supplementary revenue from R&D investments, the supplier may be able to benefit by using the recipient's facilities and technology for further R&D. The supplier may also subsequently receive the recipient's technology, which could be an improvement on, or complementary to, the original transferred technology.

Other benefits may be derived from the recipient's established market strengths, particularly in local markets. The transfer may also allow the supplier to test the market or to service a market that is too large or not otherwise available due to local government regulation. The technology transfer agreement can also be a key asset in the future sale of a business.

For more possible benefits, refer to Chapter 1 of the guide.

What are the possible benefits of a transfer for a technology recipient?
The recipient may acquire technology that is proven either technically or in the marketplace on a fast timetable and with minimum risk. With this may come the established goodwill the technology has already generated. In addition, the recipient may acquire technology that is not otherwise available due to patent or other legal restrictions.

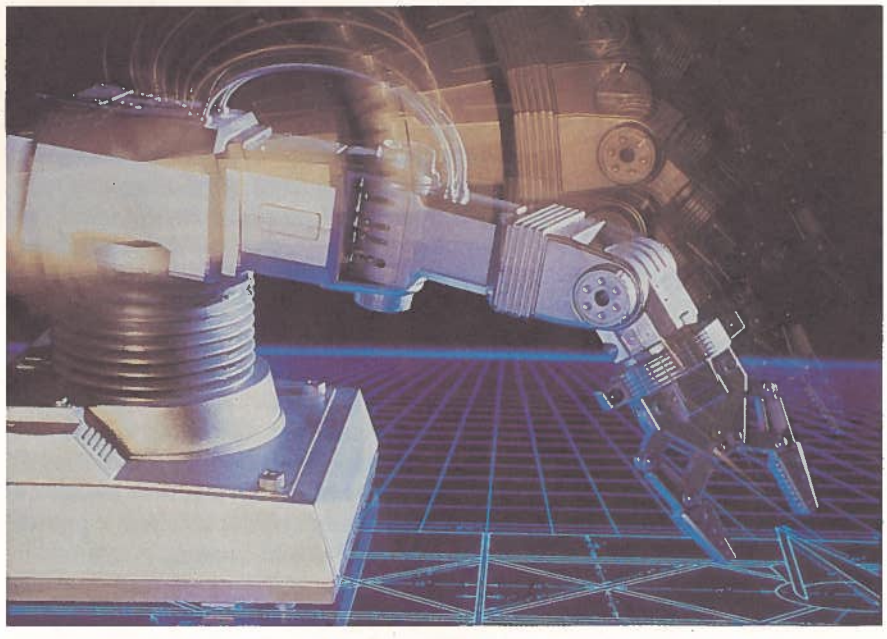
Are there any possible disadvantages of a technology transfer for either the supplier or the recipient?
One possible disadvantage for the supplier is that the recipient could become a competitor and threaten its position in the market.

The supplier could also lose opportunities to expand directly in a market served by the recipient, as well as opportunities to continue developing and improving new generations of technology.

One possible disadvantage for the recipient is becoming locked into a particular technology or being obligated to supply supplementary technology to the supplier at no or nominal cost. The recipient can also be forced to accept marketing restrictions and policies relating to the technology's licensed products.

Other possible disadvantages, for both supplier and recipient, are described in Chapter 1 of the guide.

Are there any other factors a recipient in particular should consider before embarking on a technology transfer program?
The recipient should review market-oriented issues and government requirements. These include any changes forecast in the market and the timetable for implementing and initiating the project. Other factors are the local availability of capital, raw materials, product components, and an educated and trained labour force. Among the government requirements are licensing restrictions, restrictions on equity ownership, taxation laws and local product liability laws.



How does one choose the right strategic partner?
The two parties in a technology transfer must be compatible. Both parties should be willing to act in good faith, perceive their relationship positively, and recognize each other's viewpoints and concerns. The parties should have no conflicting interests, and this will usually be reflected by a provision in the agreement eliminating direct competition between them or their affiliated organizations.

Chapter 1 of the guide enumerates the various areas in which the supplier should investigate the recipient, and vice versa. It also suggests likely sources for finding an appropriate partner.

What rights can be obtained?
In Canada the rights that can be obtained fall into five categories. Known collectively as industrial or intellectual property rights, these are patents, trademarks, registered industrial designs (design patents in the U.S.), copyrights and trade secrets.

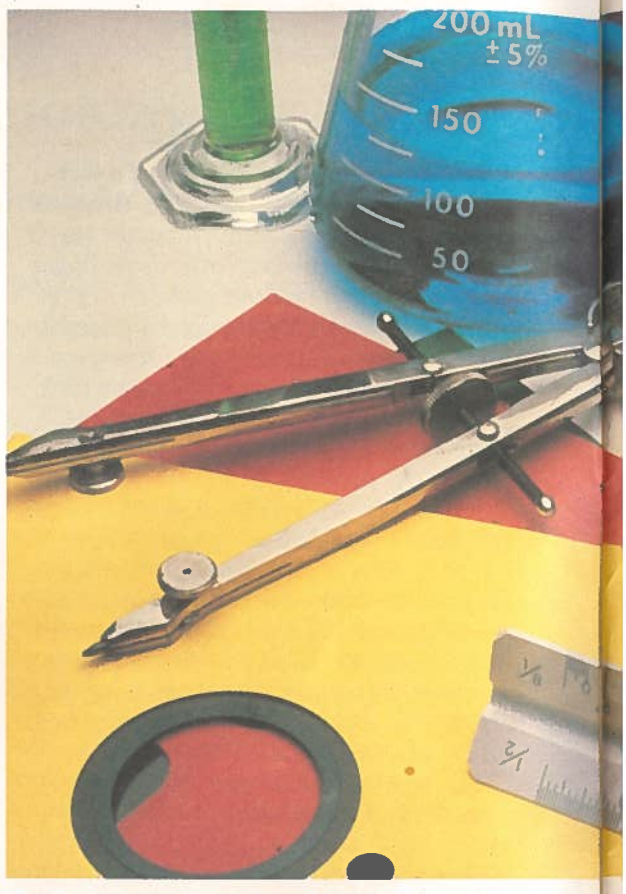
Patents are limited monopoly rights granted under the federal *Patent Act* to an inventor who discloses any new and useful knowledge, process, machine, manufacture or composition of matter, or any new and useful improvement in any of these items. The monopoly right allows the inventor to prevent others, even persons who have developed the same invention independently, from making, using or selling an invention.

Major changes relating to patent legislation and technology transfer came into effect in October 1989. These are explained in Chapter 2 of the guide.

Trademarks are words, symbols or designs (i.e. logos), or a combination of these, used to distinguish the goods or services of one organization from those of others. A trademark may be protected by provincial, civil or commercial law, or by having it registered under the federal *Trade Marks Act.* Registration is advantageous because it allows a trademark owner to claim rights to the mark anywhere in Canada.

Industrial design means features of shape, configuration, pattern or ornament, and any combination of these, that appeal to and are judged solely by the eye. They must also, in most cases, be reproduced more than 50 times. Protection in the form of monopoly rights is available only by registering the industrial design under the federal *Industrial Design Act.*

Copyrights are granted under the federal *Copyright Act.* Copyright generally means that the owner of a copyrighted work is the only person who may copy the work or allow someone else to do so. In June 1988, major revisions to the *Copyright Act* were enacted to protect developments in technology and to align Canada's practices more closely with those of its trading partners. These revisions are described in Chapter 2 of the guide.



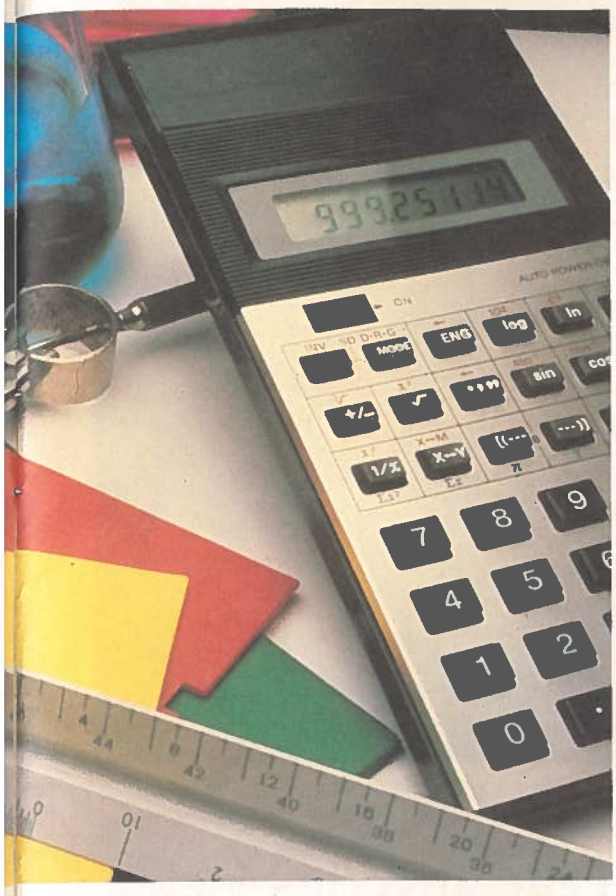
Trade secrets are any secret formula, pattern, device or compilation of information used in business that could help the owner obtain an advantage over competitors who did not know it or use it. In Canada, trade secret law is not fully developed. A person's rights and obligations with respect to trade secrets are usually set out in a written contract.

Chapter 2 of the guide also discusses these five categories of rights in detail and how they can be transferred.

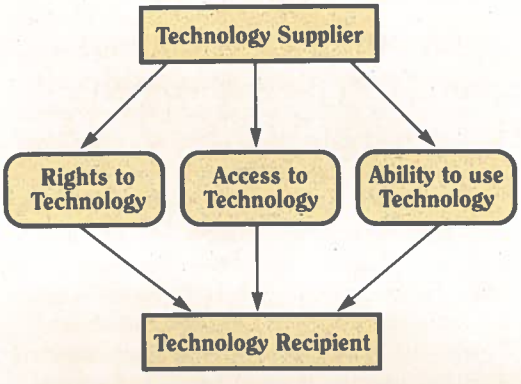
Why is it important to define the technology exactly in structuring the agreement?
The more ways in which the technology in question can be characterized and specified, the smaller the risk of disagreements about the scope of the agreement arising in future. Chapter 3 of the guide, which deals with "Structuring the Agreement," sets out examples of the many ways technology could be conceptualized.

What are the most commonly used methods for obtaining technology rights?
The two most commonly used methods are acquiring rights by purchase or licence.

By purchasing the proprietary rights to a technology on a complete or a limited basis, one acquires a legal interest in it. Licensing provides limited rights to the technology, usually for a fixed time period.



Three Essential Components of Technology Transfer



The key difference is that the technology supplier can sell the proprietary rights only once. With the licensing approach, on the other hand, many licensees can operate simultaneously unless an exclusive licence has been granted.

The implications of proprietary rights and licences are discussed in detail in the guide.

How can the recipient ensure that they have acquired the ability to use the technology?
For the recipient to make the most effective use of the technology, the supplier should provide "show-how" in at least one form (preferably more than one). The recipient can receive "show-how" through training programs, formal education, staff exchanges, consulting services, continuing maintenance, etc.

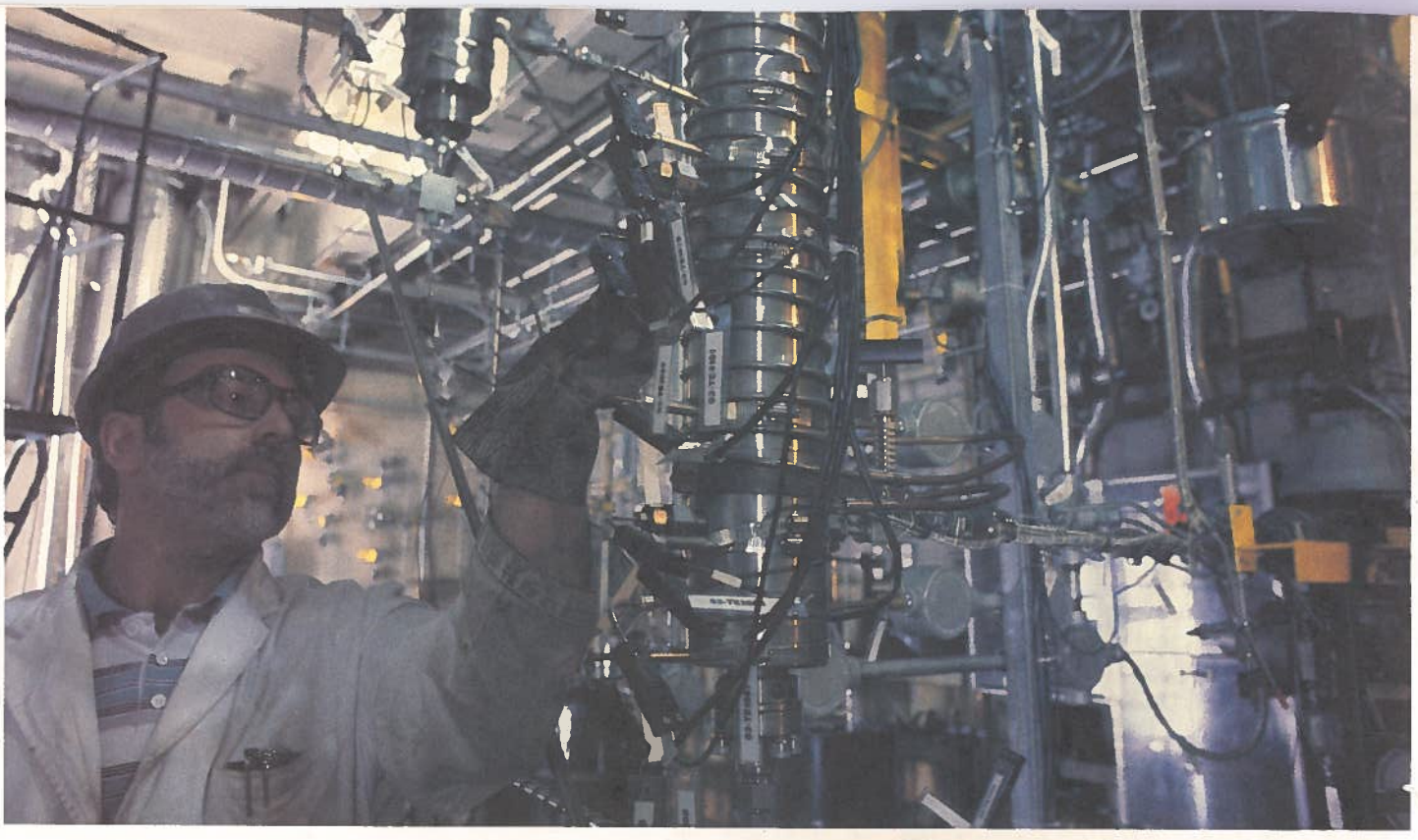
What information or advice can a legal counsellor give regarding the preparation of a technology transfer?
A lawyer familiar with technology transfer issues can help in the following areas: preparation of a "Request for a Proposal" to acquire or supply technology, and the proposal itself; preparation of a letter of intent establishing the technology agreement's scope; advice on domestic and foreign laws that could affect the agreement; and structuring the formal agreement and helping negotiate it.

What are the most important stages in preparing an agreement?
These are determining the technology requirements and identifying a suitable partner; the preparation and presentation of the offer; and the drafting of a non-disclosure agreement protecting both the technology and any other business information from being disclosed by either party. The final step, the actual negotiation of all the terms and conditions of a complex technology transfer agreement, may take several months to conclude.

Does the Goods and Services Tax (GST) affect technology transfer?
The GST is structured to apply to technology transactions. The paying recipient of the technology must pay the tax to the supplier (as remitting agent for the federal government) at a rate of seven percent of any consideration paid or payable for supply of technology in Canada. The GST is not applicable to technology transferred from Canada for use exclusively outside Canada. The tax does not apply to the Canadian recipient of foreign technology if the recipient is in the business of making tax-exempt supplies.

Contact

To obtain a copy of *Supplying and Acquiring Technology: A Canadian Business Guide*, please contact one of the Business Service Centres listed on the inside of this magazine's back cover.



The CANMET hydrocracking process has been demonstrated in a 5 000-barrel-per-day plant at Petro-Canada's Montreal refinery.

Reliable Sources: Spreading the Word on Federal Technologies

The latest approach to commercializing technologies developed in federal government laboratories is to get scientists more involved in marketing. The Business Opportunity Document, currently being put to the test by several federal government bodies, is intended to capture the imagination of these experts.

Dr. Keith Belinko, Director of the Technology Marketing Division at the Canada Centre for Mineral and Energy Technology (CANMET)*, describes the document as "a vehicle for communication between the scientists and the industrial partner."

The Business Opportunity Document, which has been adopted at CANMET, identifies possible products, services or processes that might be created from a given technology.

It supersedes the business plan or business case typically used to describe the financial risks and benefits to a potential investor, and goes one step further by exploring all the possible applications to the technology in question. Many conventional business plans focus on technical data related only to the primary application seen for the technology.

The idea is the brainchild of Dr. Belinko and high-tech entrepreneur Denzil Doyle, a self-proclaimed "innovation consultant who makes his living and gets his jollies out of the transfer of technology."

Mr. Doyle's credentials are impressive. He is an electrical engineer, former president of Digital Equipment Corporation, and author of a book on technology transfer entitled *Making Technology Happen.* He and his son Michael run Doyletech Corporation, a consulting firm that specializes in the planning of new business ventures and in the creation of management tools for the orderly growth of technology-intensive firms.

As if that were not enough, he owns Instantel, a high-tech firm with 25 employees that sells its products in more than 25 countries worldwide. Instantel makes seismographs that can provide a printed record of the details of an explosion within minutes, which has proven to be a great boon for mining and construction companies.

* *CANMET is part of Energy, Mines and Resources Canada.*

Instantel also manufactures a wandering resident system, currently in use at 130 hospitals and old age homes. The monitoring device looks like a wristwatch and is worn by patients with some form of dementia who tend to wander. Exit doors have receivers wired in, alerting staff that someone is leaving. The system has proven to be a welcome alternative to either physical restraints or chemical intervention.

The seed for the Business Opportunity Document was planted three years ago in Mr. Doyle's column on technology transfer in *Ottawa Business News*. The article was read by an assistant deputy minister with Energy, Mines and Resources Canada who invited him to conduct a workshop for scientists. This led to a contract with CANMET to develop and implement the concept.

Mr. Doyle is a firm believer in scientists' potential for innovation: "There are an awful lot of ideas in their heads that are outside their field of activity." His article argued that they "probably possess more product and market knowledge related to technology than the [technology] broker will ever have. To extract this knowledge, a whole new dialogue will have to be developed."

He believes he has set the stage for this dialogue with the Business Opportunity Document.

"So far as the products are concerned.... you're just as likely to get an environmental product out of National Defence as you are out of the Department of the Environment."

Mr. Doyle points out that this kind of unexpected discovery occurred at Atomic Energy of Canada Limited in Chalk River when scientists developed a technique for detecting toxins in feed grain. "Who would have ever thought that Atomic Energy of Canada would come up with an agricultural product?"

In Packaging Technology Transfer Opportunities, a report written by Dr. Belinko and Mr. Doyle, the Business Opportunity Document format is described as being "flexible enough to accommodate an opportunity that is at a very early or advanced stage of development. . . . Irrespective of the stage of development, the intent of preparing a Business Opportunity Document is to place emphasis on the business opportunities of the technology." Copies of the report are available from CANMET.

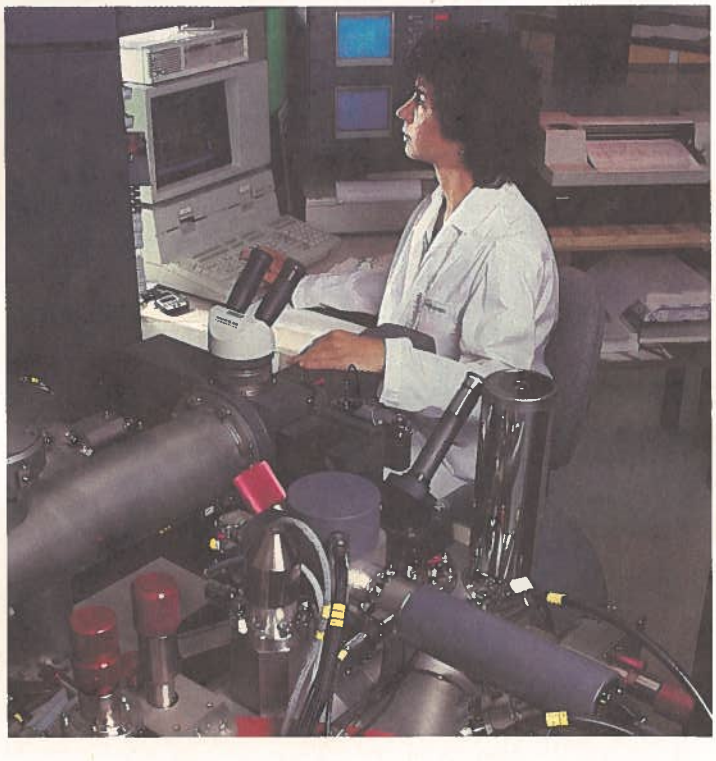
The document is divided into six sections:

- The Business Opportunity: a simple statement of how an investor will make money from a product, service or process generated by the technology.
- The Technology: a brief description of the technology so that potential investors can determine quickly if it fits with their own missions.
- The Products/Services and Processes: a brief description of each, along with possible migration (product evolution) strategies.
- The Markets: who will purchase the products, services and processes and in approximately what quantities over some period of time (usually five years).
- The Investment and Payback: an indication of how capital-intensive the exploitation process is likely to be, along with the timing and magnitude of the payback.
- Technology Transfer Possibilities: how investors might work with the owner of the technology (licensing, sale of technology, consulting arrangements, etc.).

Arrangements can be made for distribution of Business Opportunity Documents by the laboratory/institution or by Doyletech. Mr. Doyle suggests that his clients' in-house marketing people develop their own specific mailing list, but will compile one himself if requested to do so.

Denzil Doyle
Doyletech Corporation

CANMET's metal technology laboratories have extensive facilities for microstructural characterization.



In the following case, a highly focused mailing list might include all microwave product manufacturers in North America. Environment Canada has developed a way to dry out beaches contaminated with oil. By heating up the sand using microwaves, the oil flows out and is captured.

Doyletech will also develop a generic mailing list of large companies interested in diversifying. "We're going to build up our own inventory of mailing lists. . . ." says Mr. Doyle.

Dr. Belinko welcomes the introduction of the Business Opportunity Document at CANMET laboratories, where a staff of about 1 000 carry out research in oil and gas, coal, mining, mineral sciences, metals technology, alternative energy, and energy efficiency.

A scientist by training, Dr. Belinko is enthusiastic about forging links between the scientists in CANMET's research laboratories —"our main strength"— and industry.

"If you look at the global situation right now, countries are placing a lot of importance on technology for economic, social and cultural tools. CANMET has recognized this link and has placed a great deal of emphasis on helping Canadian companies become more competitive through technology exploitation."

"In order for Canada to remain competitive, it is important that we capitalize on exploiting our technologies fully," he says. "Government labs, being major players in science and technology, obviously have a role to play in terms of making sure the technologies that are being developed will find their way into the marketplace and put Canada in a position where it can compete globally and internationally."

CANMET's mandate includes working in partnership with industry and transferring technology to it. "That's a very strong mandate," emphasizes Dr. Belinko. The centre has licensed a number of technologies, including software, equipment and processes.

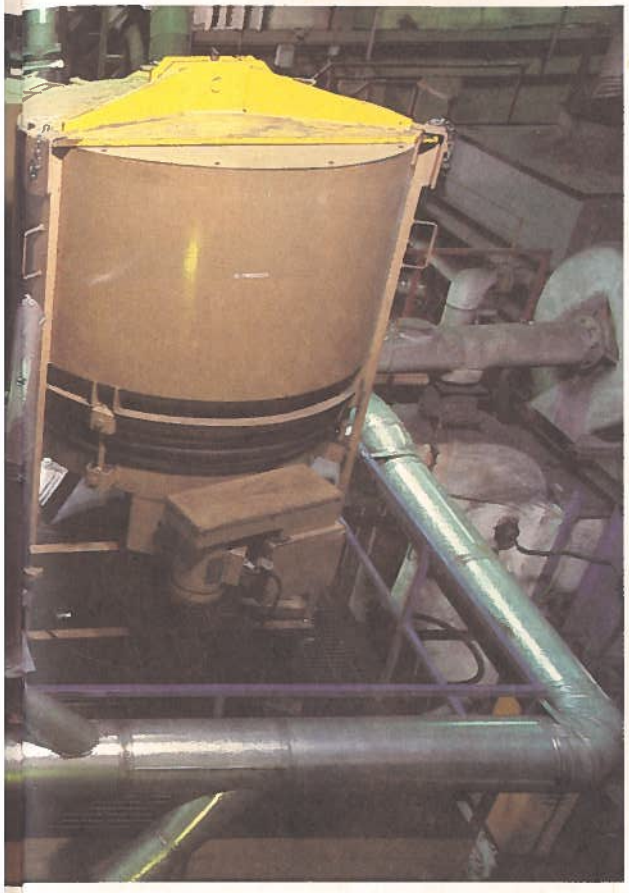
"We've been doing this now for the past three years in a very focused and concerted effort. During that period, we have looked for different vehicles for achieving this partnership, and we saw the Business Opportunity Document as one way of achieving it," he says.

The document essentially starts a chain of events that have to occur in order to allow the technology to be fully exploited commercially. The main vehicle for transferring that technology is through licensing.

Any royalties accruing as a result of technology transfer will go into the federal government's Consolidated Revenue Fund. As a technology centre, CANMET gets 20 percent of the revenue it generates. Within the organization, the money tends to go where the work was done to encourage further technology development, says Dr. Belinko.

Mr. Doyle stresses that in recent years, methods of protecting new technologies have changed. It used to be that federal government technology was transferred through Canadian Patents and Development Limited, a Crown corporation. He considers the process involved expensive and time-consuming, adding that the patents do not catch all the ideas that could be spun out from a given technology.

Legislation has been drafted to phase out Canadian Patents and Development Limited, leaving federal organizations interested in protecting and transferring technology to make their own arrangements.



"While patents had some use 40 or 50 years ago when Canadian Patents and Development Limited was set up," says Mr. Doyle, "the fact is that many new businesses get started today without any patents.... People found other ways of protecting their technology.

"Before you go about divulging too much of your technology to a potential exploiter, you would make them sign a non-competition agreement or an acknowledgement of ownership agreement—that kind of thing."

In many respects, these instruments are far more powerful than patents because the people most likely to steal your idea are the people who know it well, says Mr. Doyle, speaking from personal experience.

He emphasizes that the Business Opportunity Documents "are not going to give away the farm in terms of detailed technical knowledge. They're really only meant to catch the attention of a potential exploiter."

CANMET is not the only federal government body using the Business Opportunity Document. It has been introduced at Environment Canada and Atomic Energy of Canada Limited. Mr. Doyle believes it would prove valuable to Fisheries and Oceans, Agriculture Canada, National Defence Canada, the National Research Council and other science- or technology-based organizations.

Although they have been given a different name at Atomic Energy of Canada Limited, Mr. Doyle says Business Opportunity Documents proved their worth "in the sense that we've spun out some business units from AECL that they're continuing to fund themselves. We've also spun out a couple of companies based on these documents."

While the contribution of scientists to Business Opportunity Documents is their greatest asset, there are many reasons why the concept has been received enthusiastically.

The document will ensure consistency in the way information is made available, making it easier for industry to assess whether there is something of interest to them, says Dr. Belinko. It will also allow the scientific community the opportunity to focus more on the potential of a technology and whether it's worth further pursuit.

Mr. Doyle sees the document as a useful tool for organizations out trying to sell their research and development capability. "If you really want a company to throw R&D money at your feet, your best bet is to show that company a menu of products or services that might come out as a result."

Dr. Belinko is enthusiastic about the potential of the Business Opportunity Document. "I am very excited that there is a process now whereby I can help scientists think of the business side of the technology," he says. "I think scientists and industry will benefit mutually from this ability to communicate. Personally, I am very committed to this exercise."

CANMET has developed technology to burn low grade fuels in an environmentally acceptable manner using fluidized beds.

Contact

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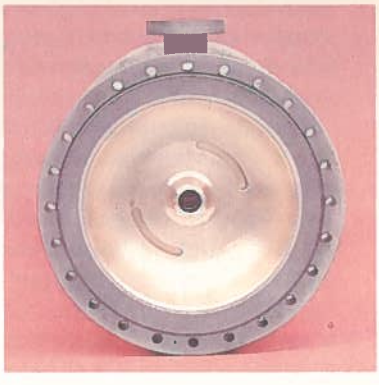
Under a CANMET-sponsored program, buses fuelled with methanol are being operated in Winnipeg and Medicine Hat.

AECL

Wins with New Power Play

An award-winning new electron accelerator developed by Atomic Energy of Canada Limited (AECL) has excellent potential to increase industrial applications of irradiation and reduce costs. The machine is known as IMPELA, which is short for Industrial Materials Processing Electron Linear Accelerator. It is being developed and marketed by AECL's Accelerator Business Unit in Kanata, Ontario, just outside of Ottawa. Last year, IMPELA earned one of 100 prestigious awards offered by *R&D Magazine.* This American publication recognizes the development of outstanding technical products introduced to the market. Other recipients for 1990 include Mitsubishi Electric, Toshiba, Eastman Kodak, Ciba-Geigy and NASA's Lewis Research Center.



The IMPELA high power on-axis-coupled accelerator cavity.

Like other electron accelerators, IMPELA is an electrically powered machine that produces directed beams of high-energy electrons. These beams collide with molecules in the target material to modify and enhance its properties.

Industrial applications of accelerators currently in use are limited to enhancing the properties of surface coatings and the processing of sheets of material typically not more than a few millimetres thick. The following are typical applications of accelerators:

- Accelerators make it more feasible for manufacturers to print directly on cans instead of gluing labels to them. By reducing drying time, they increase production speed.

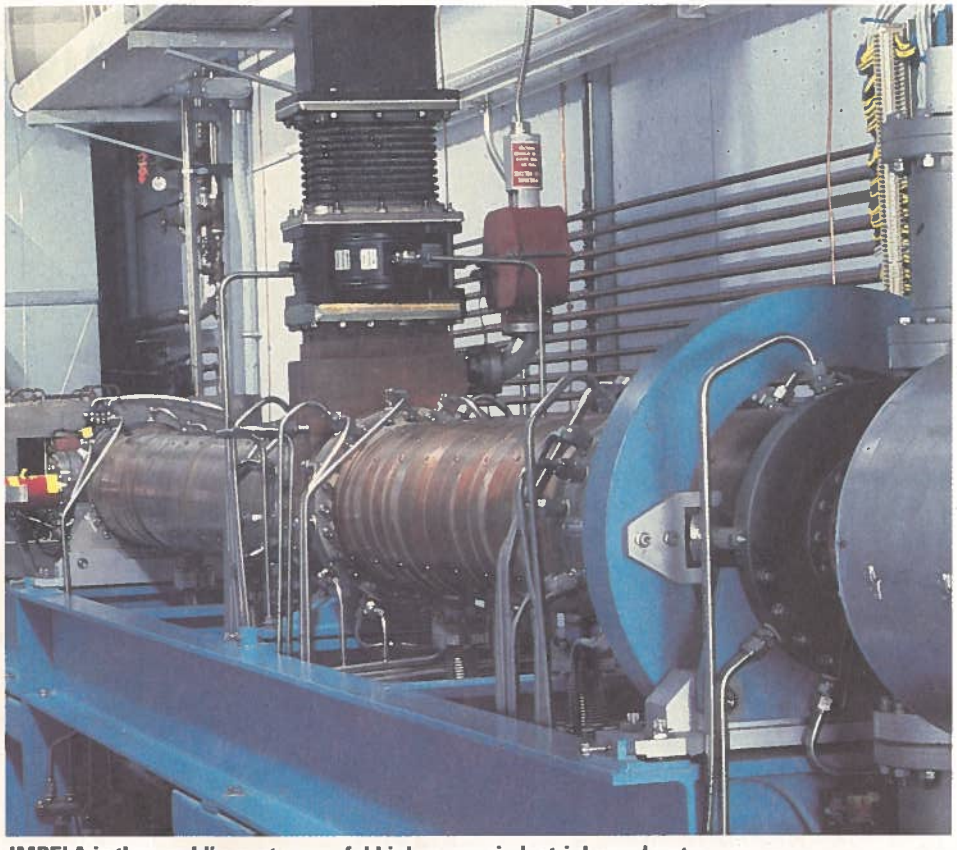
- Plastic wrapping treated with electron beams from accelerators shrinks when heat is applied to fit snugly over products of any shape on a display card. The same principle is used to manufacture pipes or cables that are highly impermeable.

- Products as diverse as magnetic computer diskettes and flooring are processed by electron beams to cure adhesives and coatings.

IMPELA is in the vanguard of a new generation of higher-energy, higher-power electron accelerators that penetrate the target material far more deeply. For example, an IMPELA accelerator can penetrate up to 8 cm of plastic or rubber or 60-cm thick boxes of medical supplies.

The IMPELA family of accelerators is capable of handling electron beam powers of 20 to 250 kW at energies of 5 to 18 MeV (million electron volts). By contrast, accelerators used in traditional applications usually operate at less than 100 kW and 3 MeV.

AECL has built a 10-MeV prototype IMPELA that operates at 50 kW — 2 1/2 times the power of any comparable machine in the 10-MeV range. Located at AECL's Chalk River Laboratories, the prototype has been operated successfully at full power and is in the final stages of testing.



IMPELA is the world's most powerful high energy industrial accelerator.

Although there are many potential applications for the IMPELA family of accelerators, Andrew Stirling, general manager of the Accelerator Business Unit, sees two main areas of near-term opportunity — the sterilization of medical supplies and the processing of plastics.

The sterilization of medical supplies is currently dominated by artificially produced radioactive isotopes, mainly Cobalt 60, that are generated in reactors. Gamma radiation from Cobalt 60 is characterized by its ability to penetrate great thicknesses of material and to irradiate large volumes at a slow rate.

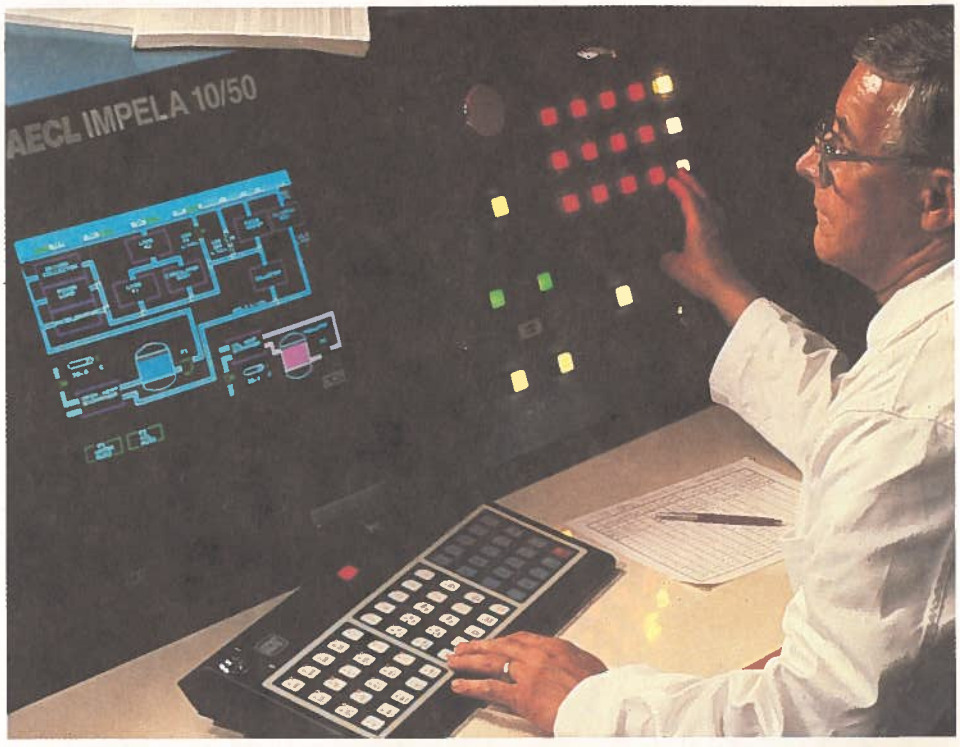
High-power, high-energy electron beams, on the other hand, are less penetrating but can process large volumes of material more rapidly. Electron accelerators, therefore, are better suited for the sterilization of certain medical products that can suffer unacceptable material damage if subjected to the slower processing inherent in gamma radiation.

"Although the accelerator share of the medical sterilization sector will in itself not be big enough to ensure commercial success," suggests Gerry Hare, product manager of the Accelerator Business Unit, "it's a good starting point for building the market for IMPELA."

Hare believes the largest market potential exists in industrial radiation processing — the cross-linking, grafting and curing of polymer materials.

IMPELA's ability to deliver deeper-penetrating ionizing radiation cost-effectively offers opportunities to extend radiation processing to bulk materials, larger components and thicker or more dense materials. For example, the accelerator could be used to help produce lightweight plastic structural components with improved strength, heat, or pressure resistance for civil, automotive, or aerospace applications.

Another major opportunity identified by Hare is in the processing of natural fibres, in particular for the pulp and paper and the wood products industries. Irradiation from electron beams can alter the size of molecular chains to modify the chemical make-up of wood products. Wood fibre, for example, can be modified to produce cellulose-reinforced plastics. Electron beams can also be applied in pulp and paper processing to improve efficiency and reduce the use of chemicals.



IMPELA's standard industrial programmable logic controller provides automatic start-up and performance monitoring.

"These applications are more speculative than medical sterilization," admits Hare. "The growth of this market depends on how fast these industries move, but potentially the market is much larger."

Other possible applications for the IMPELA technology include the sterilization of toxic substances, waste water, and sewage; the preservation of food; and the disinfestation of feed supplies.

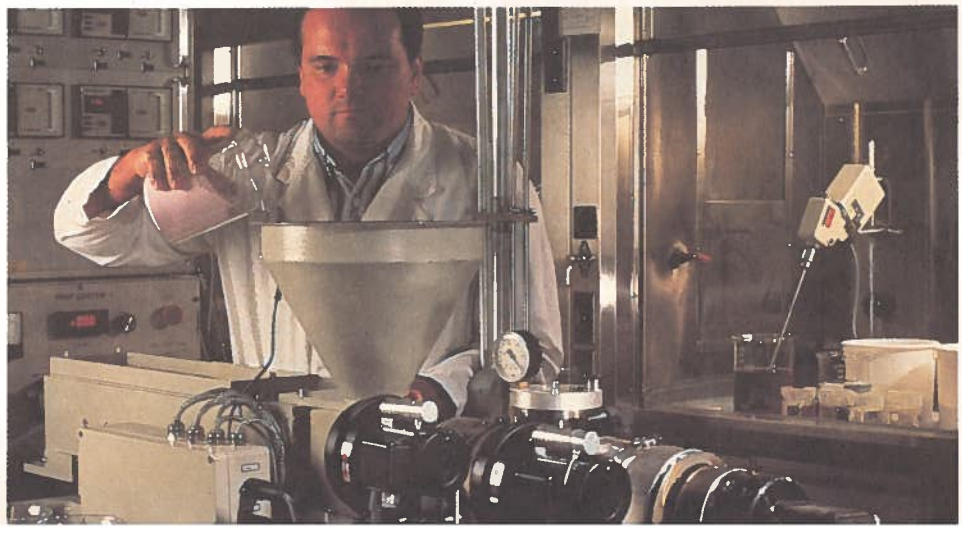
The cost of current applications of the technology may be reduced by IMPELA accelerators. With greater power, each IMPELA unit could replace several smaller lower-power accelerators to provide for more economic handling of bulk materials. Because of the high capital cost per kilowatt of beam power, higher energy electron accelerators today aren't used for processing large volumes of material.

"IMPELA will reduce the cost per kilowatt, making its use feasible where a large throughput of material is required," explains Hare. "Using an IMPELA is like having one big industrial diesel engine to do all the work, instead of a lot of smaller four-stroke engines — it makes the operation much more economical."

"Our goal over the next three years is to place an IMPELA in each of three or four strategically important industries," explains Hare. "We want to establish our credibility in each of these targeted industries and plant the seeds for future market growth."

AECL's entry into the electron accelerator market is designed to capitalize on its vast experience in particle beam R&D. "Most electron beam equipment is manufactured by electrical companies that have little to do with the nuclear industry," says Dr. Jim Ungrin, project manager for the IMPELA prototype at AECL's Chalk River Laboratories. "However, the next-generation machines demand a different level of technology. We have an opportunity to move into it because we have an expertise in high-power accelerators that few others can command."

That expertise grew out of an AECL program in particle beam R&D aimed at breeding new sources of nuclear fuel. "The machines required for breeding nuclear fuel would have been very large and expensive proton accelerators," explains Ungrin. "However, we were able to reduce the physical size of the experiments by employing smaller, less complex machines that used electrons to model the behaviour at high power of high-energy proton beams. As a result of this research, we built up the knowledge base necessary for the design of high-power electron machines such as IMPELA."



The Applications Research Branch at AECL's Whiteshell Laboratory is developing new processing applications for industrial accelerators.

The early experiments were performed on AECL's Electron Test Accelerator, with a 4-MeV, 80-kW beam produced from a standing wave structure. Dr. Joe McKeown, now the director of science and technology with the Accelerator Business Unit, was involved in this pioneering work and saw the opportunity to develop a range of industrial equipment from it. One of the high-power accelerator structures investigated in these experiments was chosen for the IMPELA family.

IMPELA is a single-structure accelerator that is compact and reliable, but still able to deliver high energy and high power. IMPELA uses a long-pulse mode of operation, accelerating 200-microsecond-long pulses of electrons about 250 times a second. By comparison, most linear electron accelerators generate pulses of only a few microseconds. The relatively long pulse allows the accelerating gradient to be more precisely controlled during each pulse, thereby ensuring constant beam quality. Although long-pulse operation can be more stressful on equipment, these stresses fall well within the capacity of the IMPELA design.

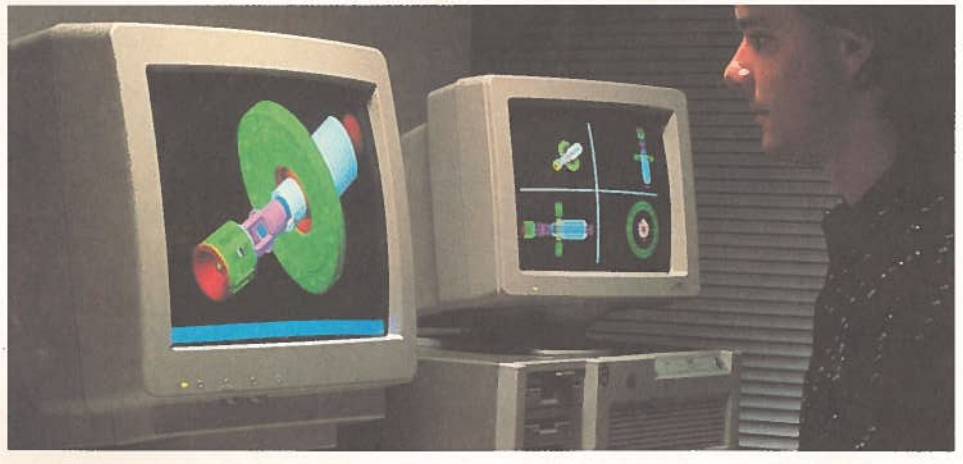
A prime design criteria for the IMPELA accelerators was to incorporate controls that could be operated by ordinary factory workers in typical industrial settings. A standard industrial programmable controller is used to automate the start-up, monitor performance and perform some control functions. The controller also provides an extensive data retrieval system for quality assurance and maintenance.

The engineering and marketing team also recognized that it was not enough to develop the technology for IMPELA. To expand the market for these machines, new applications for ionizing radiation had to be found and nurtured. To undertake this work, AECL established the Radiation Applications Research Branch at its Whiteshell Laboratories in Manitoba, and built a 10-MeV, 1-kW accelerator for its use. This low-power accelerator operates as a source of electrons, principally for laboratory and pilot-scale applications. The branch works with industrial clients to refine existing irradiation procedures, develop new uses of the technology, and create new products.

"The Whiteshell accelerator and Applications Research Branch have been very successful as a marketing tool, bringing a large number of customers in contact with us and generating interest in the accelerator program," acknowledges Hare.

The IMPELA units will be manufactured mainly through subcontracts, and suppliers for all the major components have been identified. The Accelerator Business Unit will oversee final assembly and testing of the machines.

Beyond the sale of IMPELA machines, McKeown sees a sizable engineering consulting business developing for the Accelerator Business Unit. In fact, the group received a consulting contract in 1990 for the conceptual design of a high-power electronic accelerator from Japan's Power Reactor and Nuclear Fuel Development Corporation.



Advanced computer-aided design techniques are used in the development of IMPELA components.

"IMPELA is more than just a single product," says McKeown. "We're trying to span the breadth of accelerator technology. The strength of the IMPELA design is that we can use variations of the basic technology for a large variety of applications to meet different customer needs. At the same time, the design team that we're building up will be able to handle other accelerator systems and concepts currently under development at AECL's Chalk River Laboratories."

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FORWARD

CMAC

What did it take to become the largest independent sub-contractor in microelectronics in Canada? Insight, knowledge of the marketplace, initiative, effective marketing, technology transfer and ongoing personnel training. CMAC Industries has this combination working overtime.

CMAC is a full-service supplier to the electronics industry that has established a reputation for high quality and competitive prices in only three years. It custom-designs and manufactures a variety of components and systems, including thick film hybrid circuits, resistor networks, surface-mount and through-hole printed circuit boards, and custom electronic controls and systems.

The company offers assembly services from the smallest part to the complete packaged system. Other services include multi-layer high precision printing on ceramics, laser scribing and machining.

When asked what makes CMAC unique in the international marketplace, Vice-President of Research and Development Denis Marchand replies that it is the only independent sub-contractor in North America able to offer "total service and total quality."

CMAC provides all types of manufacturing technology from its 10 000-m² facility. A 4 000-m² plant houses the hybrid circuit and surface-mount operations and the most modern thick film facility in Canada. The printed circuit board and system assembly operations are concentrated in a 6 000-m² plant that CMAC acquired in 1990 as part of its expansion plan.

CMAC's R&D programs and continuous engineering efforts ensure customers always benefit from the best and latest technology.

Consistent, high quality screen printing is achieved by CMAC through maximum automation in the printing and drying processes in a tightly controlled environment — 1 500 m^2 of class-10 000 clean rooms. This rating, which is calculated using an algorithmic scale, means that there are only 10 000 particles in a cubic metre of air. To put this in perspective, a very clean house would have a rating of several million.

Quality control is an overriding concern, and at CMAC product quality starts at the design stage. In both facilities, the use of robotics, statistical process control, just-in-time manufacturing and MRP-II systems ensure quality products at very competitive prices. At present, CMAC follows Canadian Standards Association (CSA) and other Canadian norms, but is working to meet the International Organization for Standardization (ISO) standards over the next year. In recognition of its consistent performance, Northern Telecom has awarded CMAC certified supplier status — a designation that is difficult to attain.

How CMAC Began

The idea of manufacturing hybrid circuits in Sherbrooke first surfaced in the 1970s among professors in the Electrical Engineering Department at the University of Sherbrooke. At that time, the market for hybrid circuits was relatively new, but the professors felt that it had great growth potential.

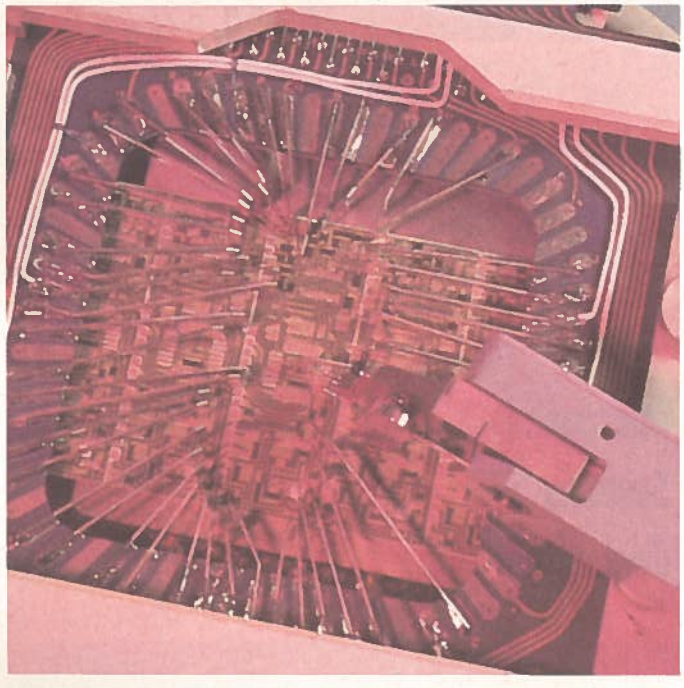
With the assistance of some major enterprises, the federal government and the university, these professors began work on a hybrid microelectronics laboratory. The facility was unique in Canada at that time, and the professors involved students who were then at the leading edge in terms of technological knowledge and ready for new challenges.

In the late 1970s and early 1980s, their activities had gained the attention of businesspeople who wanted to get involved in the venture. CMAC was created in 1983-84 when a market study confirmed that the time was right — the product was in demand and local expertise was plentiful.

For the community of Sherbrooke, the introduction of a new industry was timely. The local economy had been dependent on manufactured products such as textiles, and production was steadily decreasing. As a result, CMAC qualified for assistance from the Canadian Industrial Renewal Board, a federal government body that provided aid to regions that had lost their industrial base.

Poised for Success

Timing was key to CMAC's start-up. In the first couple of years, business was slow, but CMAC established itself and put all of its equipment in place. About this time, some large Canadian high technology companies were starting to favour contract arrangements with suppliers rather than manufacturing each component of their final products in-house. Since most preferred to buy Canadian, competitive firms based in this country were at an advantage in winning their business.



High speed YAG laser trimming systems are used to precisely adjust resistor values at tolerances as tight as 0.05 percent.

One of CMAC's first major clients was Northern Telecom — a very important player in the Canadian telecommunications marketplace. This gave CMAC an immediate edge. The increased volume made CMAC's products and services competitive worldwide.

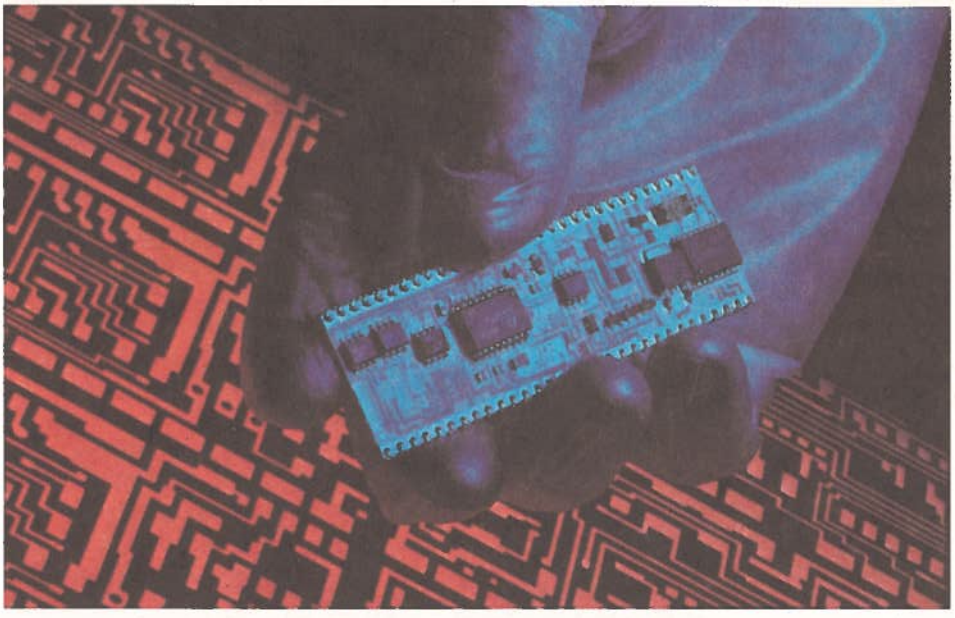
Now CMAC's client list is both long and impressive — nine divisions of Northern Telecom, IBM Canada, Compaq Computer, Litton Systems, Computing Devices Canada, Philips, Silicon Graphix, Ametek, U.S. Print, Telenet, Apple Computer, Hydro-Québec, Vidéoway, etc. And CMAC is supporting some projects that would have been considered inconceivable at the time of its inception — for example, one of Vidéoway's endeavours is the development of interactive television.

In terms of technology transfer and research and development, CMAC benefits from its association with Microtech at the local CEGEP (community college) and la Société de microélectronique industrielle de Sherbrooke, an organization based at the University of Sherbrooke that was one of the first microelectronic research centres in Canada. Formed in 1982, as part of a federal government effort, the organization is self-funding and continues to operate successfully. Ongoing training keeps employees on the leading edge of technology.

"Sherbrooke was the second Canadian university to establish a cooperative program in engineering, administration and sciences," says Marchand. "Students gain 16 months of work experience while they are still in the school system, which is invaluable." He says the program allows CMAC to evaluate students while they are working and to offer positions to those who perform well.

CMAC annual sales figures indicate that the company is flourishing. In 1989, sales were $6.5 million, in 1990 $22 million. Sales projections for 1991 are $35 million plus. The company's work force has climbed to 425 people.

In part, this substantive growth can be attributed to CMAC's international marketing efforts. According to Marchand, the guiding philosophy of



CMAC products are used in a wide variety of applications.

- Where miniaturization is essential — computer and telephone system components and medical devices like pacemakers.
- Where a stable and dependable material is needed that can withstand extreme temperature change — such as telecommunications systems, electronic car ignition systems and many military applications.

CMAC has always been, "You must have the highest quality product in the marketplace at the lowest price; you have to be globally competitive to excel."

CMAC has sales people working in North America, and has already established clients in Europe, including major telecommunications firms in France and Ireland as well as Bosch in Germany.

Marchand says "CMAC is satisfied with its growth to date, but is planning for the future in order to remain competitive."

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Mintronics Systems Corporation

System Puts Mining Shuttles on Automatic Pilot

"The Opti-Trak laser guidance system is the story of an idea that has been totally developed in Northern Ontario," says Glen Brophey, president of the Mintronics Systems Corporation of North Bay.

And the conclusion of this story will benefit the mining industry, because this product was specially designed to improve and enhance it. Opti-Trak was specifically created for automatic control of underground haulage vehicles at every stage of their operation.

The results of a four-month trial period prove conclusively the operation of the system and its attractive cost reduction advantages. For example, in a medium-volume stope (step-like excavation) where one miner operates both the scoop and the truck, production could double. Moreover, where two truck operators are necessary, the cost of labour could be cut by two thirds.

Opti-Trak is the result of the collaboration of many partners: Mr. Brophey, who made his idea a reality by founding Mintronics Systems; Donson Engineering, which provided the electronic and computer knowledge necessary at every stage of the project; the Government of Ontario, which contributed $147 715; and FedNor, the federal government body whose mandate is the economic development of Northern Ontario, which contributed $315 900.

"From the beginning, I knew I had to find a superior level of electronic and computer expertise, and Donson has met all of my expectations," says Mr. Brophey. "As well, a

business as new as mine would not have been able to carry Opti-Trak out to its completion without government financial support. In our way, each of us has contributed to create a system to give us 'smart' trucks."

Opti-Trak combines reliable scanning laser technology with radio remote control technology. It can be retrofitted to virtually any centre-articulated truck in any trackless environment. To assure maximum efficiency, speed is determined by the surface over which the truck travels. The prototype was tested on a two-thirds scale mining vehicle. Mintronics then fitted its system onto a 13-tonne vehicle in order to prove its commercial reliability. Testing for the latter fitting was conducted over a four-month period in a local mine.

"For several years," says Mr. Brophey, "I worked for a major mining supply company. In discussions with my clients, I learned of the opportunities for innovative products to improve their productivity. That was always uppermost in my thoughts, and eventually the idea came to me for a completely automatic truck."

Next, Mr. Brophey held a full-time job as an instructor at North Bay's Canadore College. For two years, he worked on the project in his spare time. An additional two years saw the financing for the project completed.

Here is how the Opti-Trak system works. Scanning lasers are installed at the front and rear of the vehicle. Depending on the direction of travel, the appropriate laser projects a visible red guidance beam at a reflective strip installed on the roof of the drift, a horizontal passage. The truck is capable of driving forward or in reverse because of the dual laser system. A built-in micro-computer decodes the information received at a 20-beat per second rhythm and operates the vehicle, including steering, brakes and throttle.

And that's not all. A specially coded bar system is installed on the roof of the drift beside the overhead reflective strips. These bar codes send specific messages to the computer that translate into maximum control around sharp corners, over rough ground, up ramps, or down inclines. When the vehicle reaches the ore pass, Opti-Trak reads the bar codes and empties the dump box.

When the dumping cycle is completed, the front-end scanning laser is activated, and the computer guides the vehicle back into the mine to the waiting scoop operator. When the truck arrives, the operator fills the scoop and activates the automatic remote control guidance system. While the truck is on its own making another return trip, the operator can resume other work.

Every component and technological idea has been performance proven. The steering, brakes and throttle components were chosen for their successful remote control performance. Opti-Trak also features a reliability factor: it will not read unintentional signals. The scanning lasers used to read instructions use the same basic technology as those used in steel mills and grocery store check-out counters.

The housing of the scanning laser is so sturdily built that it could lift and sustain the weight of the entire truck. The Opti-Trak's computer is housed in a special case to protect it from moisture and corrosion. The case meets the same specifications as those used in coal mines.

Opti-Trak was tested in tough jolting and vibration conditions, and has proven it can see better than a human operator. The system automatically conducts its own safety tests. The bar codes are programmed to perform a brake check at the top of each ramp and to control speeds according to surface conditions at every stage of operation. It also checks the oil pressure, the temperature of the motor and sluggish response due to mechanical difficulty. If a problem arises, Opti-Trak shuts down the truck's operations, displays a message identifying the problem on its panel, and waits for the scoop operator.

The system is also designed to detect, at a 15-metre distance, specially coded safety tags worn by the operator. When the vehicle senses the tags, it comes to a complete stop within a distance of less than three metres. Even in poor conditions, Opti-Trak can detect the presence of a miner before the miner sees the truck.

"The assistance of FedNor in this research and development project has been crucial to its success," says Mr. Brophey. "The extent of the work and investment put into the project would have been impossible for me to achieve alone. We now undertake with confidence the marketing stage."

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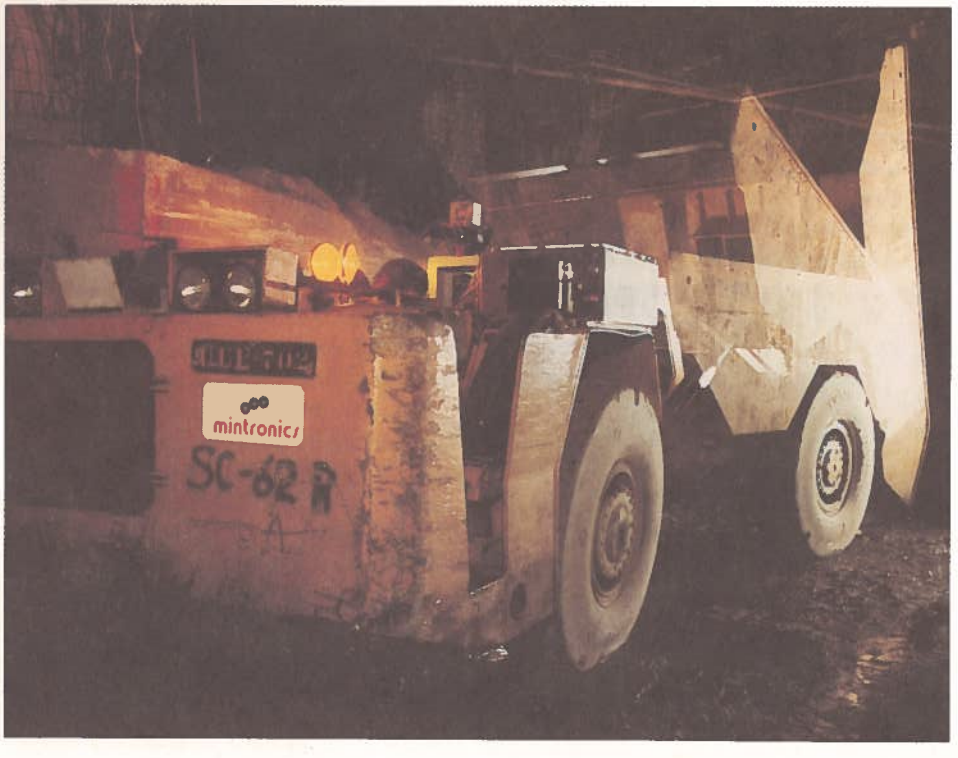


PROFILE

ULTIMATEAST

"Bridge" over Troubled Airwaves

"INTEGRATING TECHNOLOGY CAN HELP A FIRM TAKE A QUANTUM LEAP FROM CONCEPT TO WORLD-CLASS SALES," SAYS DERRICK ROWE, PRESIDENT OF ULTIMATEAST DATA COMMUNICATIONS LIMITED. FOR THE ST. JOHN'S, NEWFOUNDLAND, TECHNOLOGY DEVELOPER, "IT MADE IT HAPPEN AT A RATE WE COULD NEVER HAVE CONSIDERED."

When Derrick Rowe and Rod White were working on communications systems on oil rigs in Newfoundland's offshore oil industry in the early 1980s, they found that high-frequency (HF) radio communication can be unreliable. Fading signals and static are common off Canada's east coast due to geomagnetic storms that disrupt radio wave signals.

They knew that satellite-based systems are less affected by geomagnetic storms than HF systems; but whereas the oil and gas business can afford a custom-built satellite link for improved sea-to-land data transmission, small fishing fleets and transport businesses using the ocean cannot. "We saw a need and searched for a method," Rod White explains. Ultimateast is the firm they set up in November 1985 to develop a new communications technology.

Meanwhile, at the Communications Research Centre (CRC) operated by Communications Canada at Shirley's Bay near Ottawa, scientists had developed a technology that uses HF radio signals to send digital information to and from remote areas. This device, called a digital signal processing modem, relays messages as well as location reports automatically and reliably under difficult radio-propagation conditions. Since the CRC did not have a mandate to commercialize its research results, it invited private sector people to participate in the commercialization of the new technology.

Since Ultimateast was shopping around for a way to develop a communications network, Rowe and White wondered if the CRC modem might help. "It offered us a piece of the puzzle," says White. "We saw a business opportunity to take a piece of equipment, commercialize it and make a successful product."

The bridge linking the private and public sectors in this exchange was the federal government's technology transfer program. Basically, it set up a licensing agreement that paid a royalty to the Crown for the research work and gave the commercial user development rights.

At that time, the transfer of technology from government laboratories to the private sector was administered by Canadian Patents and Development Limited, a federal Crown corporation based in Ottawa. It studied the CRC's report on the experimental modem with an eye on its potential for commercial development and then arranged patent protection. Then it sat down with Ultimateast and the CRC to negotiate the terms of a licensing agreement, which was signed in 1986.

Future opportunities for technology transfers between federal research centres and the private sector will be handled directly by individual departments, as legislation has been drafted to dissolve Canadian Patents and Development Limited. Interested entrepreneurs can contact the research centres directly regarding transfer possibilities.

Rowe credits the CRC with being instrumental in advancing Ultimateast's technological capacity. "The signal processing manager at the CRC cut through red tape and gave us a two-year advance in our capability," he says. In only 18 months, following the technology transfer, the firm grew from an exploratory innovator to a fully operational communications network developer.

Along the way, two things were required to facilitate the process of developing a piece of laboratory research into a range of marketplace services. "We set out to identify technology gaps and develop products to fill them in a timely manner," Rowe explains.

The technical requirement for Ultimateast involved modifying the modem's internal circuitry and creating new versions of it. The business requirement involved developing a package of three integrated products based on this technology. "We took existing technology and built a whole range of products around it," explains Rowe.

Research and development costs approached $1 million over the next few years. While some of the funding came from equity financing and private investment, other funding came from the federal government's Atlantic Canada Opportunities Agency, which is based in Moncton, New Brunswick. This agency was set up in June 1987 to develop and implement programs contributing to the long-term economic development of Atlantic Canada. Between 1988 and 1990, Ultimateast received $271 070 for research equipment and another $505 137 to hire scientists and researchers, for a total of $776 207 in grants from the agency.

Since the technology transfer, the staff of Ultimateast has grown from Rowe and White to about 35 people, comprising electronic and electrical engineers, computer scientists, and support staff. Annual sales reached $2.5 million in 1990, with 40 to 50 percent of shipments in the past six months going to the United States. "Our success lay in applying technology to real applications, not just building boxes," says White.

The first product Ultimateast developed was a system for relaying data messages ship-to-shore. Whereas land-based businesses could have access to microwave systems that use stationary transmitting and receiving structures, mobile marine industries did not. Instead, fishing boats had to rely on variable HF radio to hail their dispatchers and report their daily catches; little else, in terms of useful information, would be transmitted.

Ultimateast took the word "hail" as the name for its data link, which is marketed as the DataHail HF Link. A key element is its flexibility. It allows much greater variation in the type of signals sent from a ship, so messages received are more uniform, secure and reliable, even when geomagnetic conditions are poor.

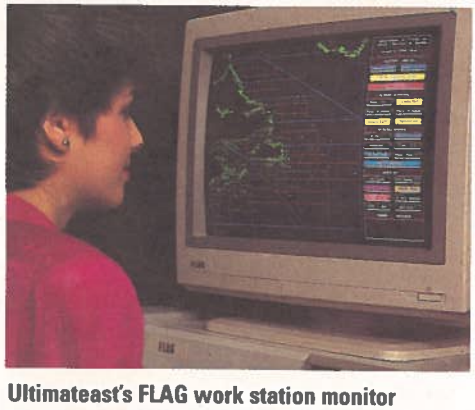
Ultimateast's DataHail system is less powerful than some custom-built systems but more cost-efficient for marine users. It permits regular transmission of such data as position, destinations, engine status, fuel consumption, cargo and weather conditions — all gathered automatically by a small on-board computer.

Usage is less expensive than comparable systems. More importantly, fishing businesses are now able to coordinate their harvesting activities with greater efficiency and profitability through accurate and secure communication between the fleets and shore-based processing plants, dockyards and supply facilities.

The second product developed by Ultimateast was a communications controller — MNet (Marine Network Controller), which regulates and directs messages between a head office and its remote or mobile units. Messages are scrambled to ensure privacy, and are monitored at Ultimateast's office through a computer that automatically routes calls and bills users.

MNet is also the gateway from ships to existing land line networks such as the PSTN (Public Switched Telephone Network). The system allows anyone on shore with a computer and modem to communicate with ships anywhere in the North Atlantic.

The third product displays information graphically through Ultimateast's FLAG (Fleet Locating and Graphics) work station. It features a text computer monitor used to display data, plus a high-resolution colour monitor that can track as many as 5 000 vessels with a choice of overlays showing grid systems or maps.



Ultimateast's FLAG work station monitor tracks vessels and vehicles with map and grid overlays.

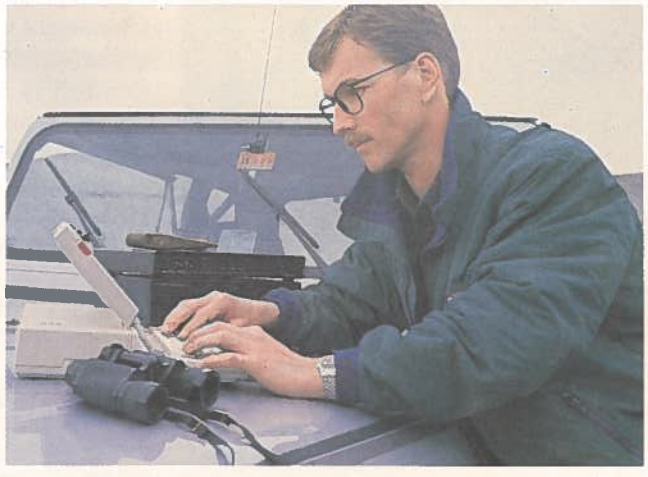
When the operator selects a symbol representing a vessel on the graphics screen, the text monitor gives the vessel's name and position, while the graphics display maps its course and speed. Other operational data might include oil pressure, coolant temperature or surrounding weather conditions. File data might include details on current or previous cargoes, destinations or schedule changes.

While Ultimateast does the exploratory work and develops new products, it has a sister company called Sea Link, which markets the products and provides common carrier services. Rowe is also the president of Sea Link. Both companies are wholly Canadian-owned subsidiaries of Neweast Technologies Inc.

The objectives of the marine trials are to establish system requirements, to adapt the existing HF technology for operation in the MSAT band of radio frequencies and to test the system. After completion of the trials (which used a leased satellite for early commercial service), a new MSAT satellite, costing over $120 million and many times more powerful than those currently available, is to be launched, probably in early 1994.

Ultimateast also has sold about $400 000 worth of equipment to the federal Department of Fisheries and Oceans to monitor offshore patrol vessels. It set up a pilot project using computer equipment and a DataHail placed on board a patrol vessel to report its location as well as its status.

Ultimateast's mobile systems can be used to send data from remote locations on land as well as water.



One advantage of the two-year business head start Ultimateast gained by purchasing the technology is a competitive edge in winning important contracts.

In November 1989, Communications Canada awarded the firm a $500 000 contract to conduct marine field trials of its MSAT (Mobile Satellite) Program. "Ultimateast had an excellent system to start with, so there was no need to develop our own," says Allister Pedersen, manager of the department's MSAT Trials Planning and Coordination unit in Ottawa.

The MSAT Program is seeking to enhance the efficiency of communications by using a satellite as a sky mirror, to reflect radio signals beamed into space back to earth. The satellite, owned by Telesat Mobile Inc. of Ottawa, orbits 40 000 km above a fixed point on the equator and gives continuous coverage of the entire western hemisphere.

These could be identified on a FLAG graphics monitor, using a choice of overlays such as latitude and longitude coordinates, North Atlantic Fisheries Organization zones, and contours of the continental shelf.

The Canadian Coast Guard Search and Rescue at St. John's has a FLAG/MNet to track virtually any vessel. While vessels equipped with DataHail can be tracked automatically, the system's *Dead Reckoning Capability* allows vessels not equipped with DataHail to be tracked. This is accomplished by manually inputting the position, course and speed of a vessel; the system then tracks the programmed course until new data are input. The graphic display also gives a complete view of what Search and Rescue resources are available during an emergency operation.

The FLAG/MNet system is not limited to tracking ships. The compact size and light weight of mobile satellite transceivers opens up the possibility of adapting the system for any mobile application. For example, Telesat Mobile Inc. uses a FLAG system that Ultimateast developed for the trucking industry. A compact box containing a transmitter and a cone-shaped antenna on each truck automatically sends out data via the MSAT link, showing where the truck is, what it contains, its average speed, and even the temperature of its refrigeration car, if it has one. The video display shows its location on a map of North America, with overlays for boundaries, different roadways and city names.

Ultimateast supplies the software and gets a royalty on each unit sold. The company is also the original equipment manufacturer for a similar service offered by the American Mobile Satellite Corporation for U.S. trucking fleets.

Ultimateast's innovative product line allows Sea Link to provide turnkey integrated offshore communications and tracking solutions to oil companies engaged in exploration and development projects off the coasts of Newfoundland and Nova Scotia.

The firm's most recent achievement involved adaptation of the technology for use by international airlines. "We are pursuing contracts in the United States to develop an aeronautical messaging and tracking system," Rowe explains. He is also pursuing markets for similar mobile communications network systems in the United Kingdom, France and various countries in Southeast Asia. "Our business is applying technology to a market — for a profit," Rowe adds.

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NETWORK

Sources of Technology-Based Business Opportunities

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Techno Flanders
Sizable catalogue listing technology offers and requests for a wide range of industries.
Contact: Regional Development Authorities of Flanders, Flanders Joint Centre for Technological Innovation, Leuvensestraat 29, B-1800 VILVOORDE, Belgium;
Tel.: (32)-2-252.24.89;
Telex: 64207 gom.

Technology Available for Commercialization
Although this catalogue contains inventions arising out of research in 26 departments at the University of Virginia, it focuses on biotechnology, medical devices and pharmaceuticals.
Contact: Alumni Patents Foundation, University of Virginia,
Suite 6-211, Towers Office Building, 1224 W. Main St.,
CHARLOTTESVILLE, Virginia, U.S.A. 22903;
Tel.: (804) 924-2173.

Wastewater Technology Centre Newsletter
A free quarterly produced by the Wastewater Technology Centre, a Canadian government research facility that is part of Environment Canada's Conservation and Protection Service. It focuses on research and development in water pollution control and waste management technologies.
Contact: Wastewater Technology Centre, 867 Lakeshore Rd.,
P.O. Box 5050, BURLINGTON, Ont. L7R 4A6;
Tel.: (416) 336-4855;
Fax: (416) 336-4765.

DATABASES

Cantech Database
Over 3 600 Canadian sources of high technology products and services are listed. It encompasses industries such as factory automation, biotechnology, computer hardware and software, telecommunications, advanced materials, defence products, energy systems, etc. Updated quarterly. Annual subscription fee: $6 000.
Contact: Hutchison Research, Suite 202, King West Centre, 2 Pardes Ave., TORONTO, Ont. M6K 3H5;
Tel.: (416) 539-9220;
Fax: (416) 539-9225.

Tecnobase: Technology Opportunities
Technologies included are mainly French. Available from Tecnova, a jointly owned subsidiary of five large French firms (Banque française du commerce extérieur, Crédit agricole, Elf Aquitaine, Pechiney, Rhône-Poulenc) that provides a full range of technology transfer services. Major expertise is in agro-food and derivatives, parachemistry, energy, metal and plastics processing, construction and electronics.
Contact: Tecnova; Tour Manhattan - Cedex 21; 5-6, Place de l'Iris, 92095 PARIS-LA-DÉFENSE, France;
Tel.: (33) 17.33.12.34;
Telex: 610279F PROTECN.

CONSULTANTS

Goetz Schaude Innovation Service
Services include searching for new products and licences, marketing technologies, conducting seminars, planning diversification and training product teams searching for new opportunities for their companies. Offers of new technologies/products/inventions brought to the attention of the firm's clients at no charge through its Licence Data Bank, which includes over 4 000 offers. Founded in 1972.
Contact: Finkenstraße 14, D-7534 BIRKENFELD, Germany;
Tel.: 49-0-7231 480723;
Telex: 177231113 Schaude.

International Commerce Associates
Provides technology sourcing and transfer services, focusing on Canada-Japan and Canada-European Community arrangements. The firm has numerous government and private sector contacts, as well as access to data bases in Japan and the European Community. Combined with the multidisciplinary skills and experience of the firm's partners, this facilitates strategic alliances, joint ventures and other forms of technology transfer between Canadian and foreign firms.
Contact: Suite 403, 251 Laurier Avenue W., OTTAWA, Ont. K1P 5J6;
Tel.: (613) 230-4443;
Fax: (613) 230-4443.

SPECIALIZED CENTRE

Canadian Workplace Automation Research Centre
Acts as a catalyst for technological developments in telecommunications. Objectives: to provide leadership in applied research into computerized office systems and to utilize the related potential for enhanced productivity in the public and private sectors; to synthesize the needs of users and to contribute to problem-solving; to become the focal point of information exchange in the field of workplace automation and to foster cooperation between experts and different client groups. Research areas include organizational research, integrated systems, advanced technology and external cooperation. A list of publications is available.
Contact: 1575 Chomedey Blvd., LAVAL, Que. H7V 2X2;
Tel.: (514) 682-3400;
Fax: (514) 686-1990.

Business Opportunities

Offers

The following offers of and request for technology are based on information supplied by the contact listed for each one.

Canada

Artificial Nursing Device for Neonatal Pigs (TO-104), BOTCAST — **Fungicide Application Forecaster Model for Botrystis** (TO-298), **Computer/Sonic Digitizer Drawing Reviewer** (TO-303), **Films — Forest Ergonomics and Office Ergonomics** (TO-377), **Gamma-Ray Backscattering Spectrometer Alloy Composition Detection** (TO-402), **Glycoproteinase** (TA-289), **Immunotherapeutic Agent for Eye Cancer** (TA-290), **Sensor for Surface Wetness Duration** (TO-310), **Sexual Risk Board Game** (TO-266), **Spot Test for Bovine Leukemia Virus** (TA-257), **Thoughtware — Chemistry Lab Interactive Simulation** (TO-373), **Veterinary Medical Information Management System** (TO-099)
These products and technologies and others are available for licensing.
Contact: Executive Manager of Technology Development and Commercialization, Office of Research, University of Guelph, GUELPH, Ont. N1G 2W1; Tel.: (519) 824-4120, extension 2776; Fax: (519) 821-5236. Please quote the technology reference number.

Nail Clipper Attachment
A Canadian inventor is offering to license or sell manufacturing and marketing rights to a nail clipper attachment that will catch nail clippings. It can be sold separately or with a nail clipper. The inventor has Canadian patent protection; the American patent is pending.
Contact: Vince Campagna, 830 Westwood St., PORT COQUITLAM, B.C. V3C 3L2;
Tel.: (604) 941-3986.

Screw and Nail Guide
A Canadian company would like to arrange a joint venture, licensing or outright sale of patent rights to develop and manufacture its screw and nail guide tools. The tools are designed for accurate nailing and drilling on horizontal, inclined and vertical surfaces on shelving and furniture. Although they are designed for novices and disabled people, they will also speed up the performance of experienced carpenters. The invention is protected by Canadian and American patents.
Contact: B. Tanner, Tanner Engineering Ltd., P.O. Box 1402, Station T, CALGARY, Alta. T2H 2H6;
Tel.: (403) 253-4604.

Cellular Ceramic Building Material
A joint venture partner is sought to commercialize this new material for commercial and residential construction applications. It insulates and is of sufficient density to lend itself to acting as a structural core to which exterior and interior finish and trim may be applied in the factory. It is non-permeable and non-combustible with flame spread and smoke developed ratings of zero. It cannot wick to absorb volatile liquids or vapors and does not generate toxic fumes if a fire occurs.
Contact: F.L. Rogers, President, Rogers Bros. Limited, P.O. Box 2061, 80 Orange Street, SAINT JOHN, N.B. E2L 3T5;
Tel.: (506) 693-7271;
Fax: (506) 633-0076.

Meat Skinner
An inventor would like to license or sell the patent for this product, which he calls The Canadian. It quickly and efficiently removes the thin membranous skin (aponeurosis) attached to beef, veal, lamb, pork, horse, poultry, giblets, offal, fish, etc.
Contact: Simon Gilbert, 1410 Grant St., Apartment 2, LONGUEUIL, Que. J4J 3V4;
Tel.: (514) 651-9137.

Switzerland

Method for 100 Percent Metal Water Resistance
Involves obturation in all hydraulic and pneumatic systems.
Fastening Method
Involves a one-quarter turn fastening of any thread without having to use a spanner.
Contact: C. & P. Jaggi, Import and Export, orCHidée, P.O. Box 65, CH 2500 BIENNE 6, Switzerland; Tel.: (41) 32.42.20.88;
Fax: (41) 32.42.10.03.

Energy-Saving Remote Control for Televisions
Licence to manufacture this product is available. An infra-red beam of light from the unit directed to a photovoltaic cell on the television shuts off the flow of electricity that is normally present even when the set is not being used.
Contact: Daniel Chablaix, Avenue du Grey 76, CH-1018 LAUSANNE, Switzerland;
Tel.: (41) 21.36.35.40.

Table Grill, Steamer/Convector and Induction Hobs
Licensing arrangements for manufacturing and distributing these cooking appliances are available.
Contact: Menu System Wurt & Co. Apparatebau St. Gallen. Zurcher Strasse 204f, CH-9014, ST. GALLEN, Switzerland; Tel.: (41) 71.29.22.50;
Fax: (41) 71.28.65.73.

United States

Air Purifier for Motor Vehicles
An inventor is offering to license or sell patent rights to manufacture and market this product, which consists of a filter to be installed in the vent of a vehicle and a sensor to indicate when it needs to be changed. It will keep exhaust fumes, hydrocarbons, smoke, soot, dust, pollen and odors from polluting the air in the vehicle.
Contact: Thaddeus Kowalczyk, 8163 Lochdale, DEARBORN HEIGHTS, Michigan, 48127;
Tel.: (313) 274-4933.

Request

Canada

Cellulose-based, Air-laid, Non-wovens
A company is seeking business partners in the field of cellulose-based, air-laid non-wovens, using advanced technology. It plans to manufacture tonnage rolls for sale to converters in the paper, health care and consumer fields. The materials produced are unique in combining the advantages of fabric at close to the price of traditional paper. This ecologically sound process has been used extensively in Europe over the past 15 years.
Contact: Norman Muccha, Cirrus Textures Inc., 10 Lockie Ave., AGINCOURT, Ont. M1S 1N1; Tel.: (416) 483-9329; Fax: (416) 321-3542.

Leading Research State Looks to Canada for Business Partners

Information on technology development and acquisition opportunities in one of the most research-intensive states in the U.S. is being circulated in Canada under a new policy designed to encourage strategic alliances.

The state is New Jersey, which accounts for over 11 percent of U.S. research and development spending. The New Jersey Commission on Science and Technology has endorsed the policy to allow Canadian research organizations and companies access, through membership or other arrangements, to technologies developed in its 11 advanced technology centres.

The policy, developed in the spirit of free trade, is based on the principle of reciprocal access for New Jersey organizations to similar research in Canada. Access is negotiated bilaterally with individual centres.

The 11 centres represent a co-operative commitment by universities, such as Princeton and Rutgers, and industry to excellence and leadership in four strategic technologies: biotechnology, advanced industrial materials, telematics and informatics, and environmental protection technologies.

Industry, Science and Technology Canada is gathering information on projects at the 11 advanced technology centres in New Jersey and distributing it to Canadian companies identified by managers within the department's various industry sector branches and to industry associations. The dissemination of information to date has sparked interest on the part of organizations on both sides.

Some Canadian companies and laboratories that have received information have visited New Jersey to further explore the possibilities. In addition, a wide range of Canadian company and institutional interests were represented in March at an International Business Day in Princeton that focused on medical, telecommunications and environmental technologies.

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08540
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Business Education Goes Global at Quebec University

Given the importance of international links in business today, the partnership agreement between the business administration department of the Université du Québec à Montréal and France's Toulouse Business School makes a lot of sense.

The agreement, which was finalized in late 1989 and early 1990, involves UQAM's Master's in Business Administration program and Toulouse's Mastere and DESCAF programs. It encourages exchanges of professors and students by providing for recognition of each other's diplomas, titles and grades.

Links between project management studies at UQAM and innovation management and technology transfer studies at Toulouse are emphasized. If students meet requirements specified by both institutions, they can qualify for a dual diploma. The criteria for selecting candidates will be established and reviewed periodically by a coordination committee. Tuition, transportation and other costs are the responsibility of the students.

In addition, the agreement encourages the following joint activities:

- Conducting research programs and publishing results.
- Developing a new course on the management of high technology projects in areas such as biotechnology, pharmaceuticals, aerospace and advanced materials.
- Developing instructional materials.
- Serving on thesis juries.
- Presenting colloquiums. (Both institutions participated in a colloquium on productivity in the aeronautical and aerospace industries in Montreal in autumn 1990.)
- Arranging practicums in the private sector.
- Exchanging pedagogical information.

Contact

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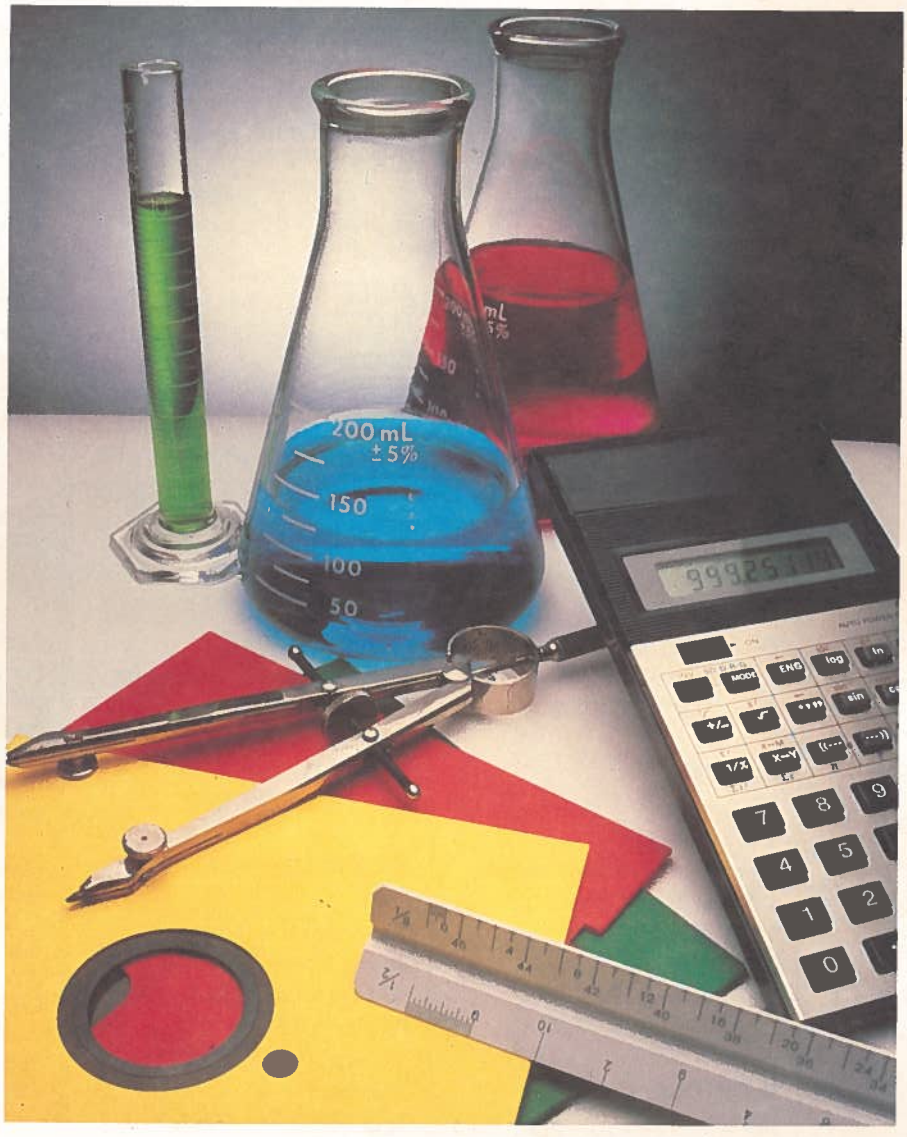

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