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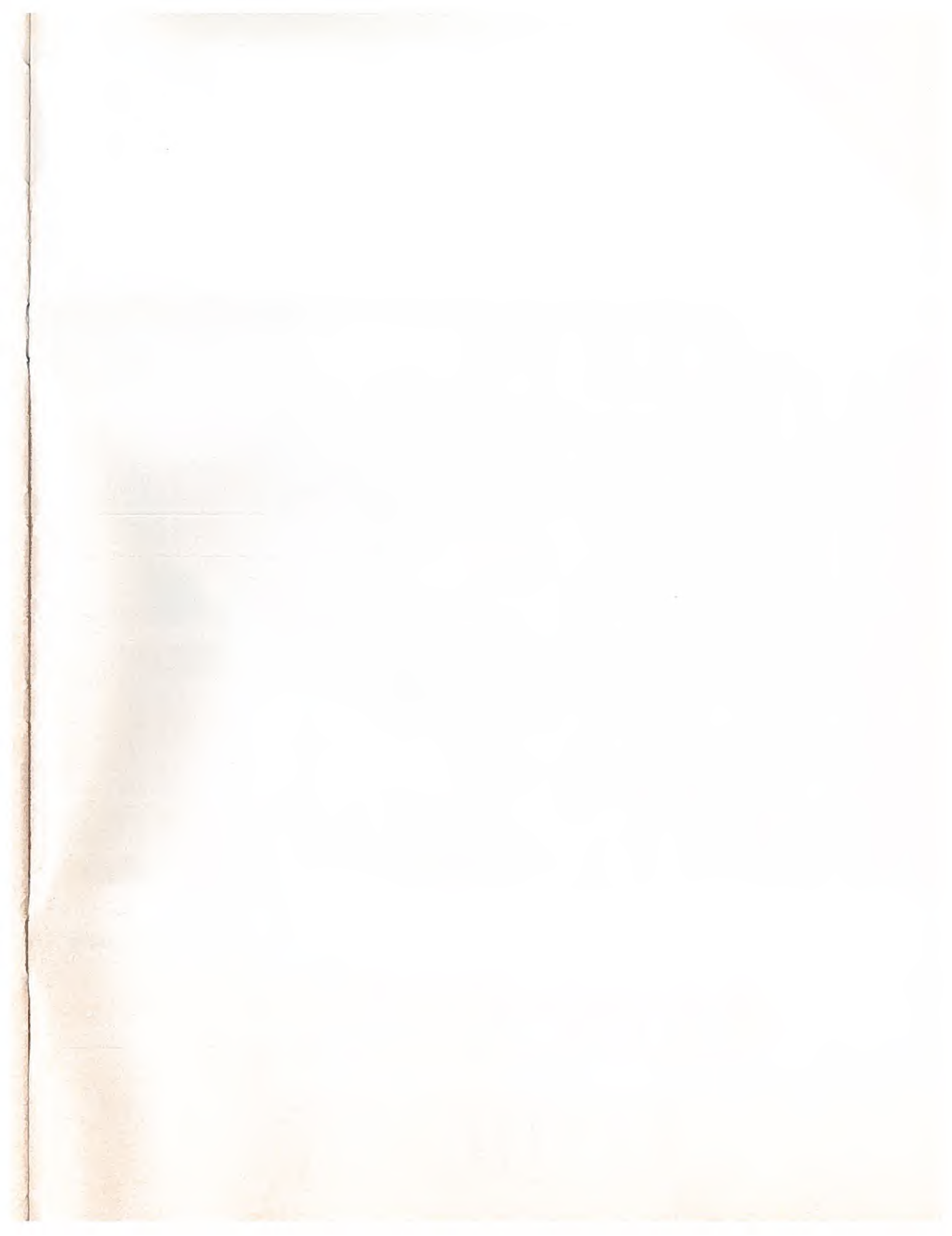
Canada Commerce

June 1983



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Construction



Canada Commerce

The Honourable Edward C. Lumley
Minister of Industry, Trade and Commerce
and
Regional Economic Expansion

The Honourable William Rompkey
Minister of State for Small Business and Tourism



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Business Review

Industrial Co-operation on Robotics Discussed

Industrial co-operation in the development of industrial robots was a major topic discussed in recent meetings between French and Canadian manufacturers and research experts.

The meetings, in which 25 French industrialists met their Canadian counterparts in Toronto and Montreal, followed an earlier Canadian mission to France a year ago which included meetings with French robot manufacturers and attendance at an industrial robot exhibition and symposium in Paris.

A large part of the recent French visit to Canada was one-on-one interviews between the visitors and Canadians during which discussions were held exploring areas which might lead to industrial co-operation in the development of robots and robot technology.

Technical papers, in-depth workshops and one-on-one interviews were featured in both Toronto and Montreal. Some 140 Canadians attended the two meetings.

Saskatchewan Manufacturing Opportunities Catalogue Available

The new Saskatchewan Manufacturing Opportunities Catalogue '83 is now available.

The catalogue lists important replacement opportunities that were identified at a recent manufacturing opportunities show in Regina. Copies of the catalogue may be obtained by writing directly to the Saskatchewan Department of Industry and Commerce or, alternatively, by contacting the city of Regina.

Plastics Plant to Expand and Modernize

The oldest plastic company in Canada, Plastique DCN de Warwick, Québec, is investing more than \$1.2 million in a project of modernizing and enlarging its facilities over the coming year. Grants for the project have been obtained from the federal Department of Industry, Trade and Commerce and Regional Economic Expansion and from la Société de développement industriel du Québec.



Canadian Trucks Shipped to Colombia

A shipment of 15 huge trucks, manufactured by Wabco in Paris, Ontario, had to be reassembled in Montreal by Versatile Vickers Inc. before they could be sent on to their destination, Colombia.

The trucks, each of them weighing more than 100 metric tons, were too large to be shipped in one piece from the factory in Paris so they had to be taken apart and sent in pieces to be reassembled in Montreal prior to being loaded for shipment to Colombia.

The trucks will be used in a \$3 billion (U.S.) coal project in the South American country.

Omnimax Theatre to be Built In Ottawa

The Canadian Film Institute will spearhead efforts to raise \$10 million for construction of Canada's first Omnimax theatre complex in the National Capital Region. Government and industry officials have endorsed the project following results of a feasibility study indicating the cinema is economically viable.

Omnimax, claimed the world's most sophisticated motion picture technology, uses a "fish eye" (wide angle) lens to project film on a giant screen similar to a tilted planetarium dome. The audience is surrounded by a continuous image and loudspeakers are behind the screen to allow the sound to move across the room.

\$16.5 Million for Labour Education

Labour Canada has allocated \$16.5 million for a three-year extension to its labour education program. The program is aimed at improving the industrial relations system by providing assistance for the operation of current and potential programs for union leaders. It is designed to provide such officers and other members of labour organizations with opportunities of acquiring a comprehensive knowledge of the goals, policies and responsibilities of the Canadian labour movement.

Since its inception in 1977, the labour education program has distributed more than \$16 million to help education programs for Canadian unions.

Spar Linked to European L-Sat Communications Satellite

Spar Aerospace Limited has announced a major new space program that will link Canada and the European Space Agency (ESA) in the production of the L-Sat, one of the world's most powerful communications satellites, scheduled for launch in 1986.

The L-Sat project has been described as the largest program ever undertaken by ESA and indications are that there will be a need for more than 100 such satellites through this century and beyond.

L-Sat will provide a range of services including direct-to-home TV broadcasts, high density international communications, voice, data and video links to small earth terminals on business premises and very high capacity intercity telecommunications service.

Ocean Industries Exhibition Slated for October

The Ocean Industries Exhibition — MARINE '83 — will be held October 26 to 29 in St. John's, Newfoundland.

The repeat of the highly successful 1982 show, MARINE '83 will feature a comprehensive display of fishing and offshore equipment as well as in-depth seminars.

Further information may be obtained from: Atlantic Expositions Ltd., P.O. Box 402, Gander, Newfoundland A1V 1W8.

SITEF '83 to be Held In October

The second Salon international des Techniques et Énergies du Futur (International Show of Techniques and Energies of the Future) — SITEF '83 — will be held in Toulouse, France, October 18 to 23.

More than 35 000 professionals and 350 high technology companies from 45 countries, including a strong contingent from Canada, are expected at SITEF '83 which will feature symposia and conferences attended by noted scientists, company executives and professionals.

Further information on SITEF can be obtained from Chambre de commerce et d'industrie de Toulouse, M. Bernard Volk, 2, rue d'Alsace-Lorraine, 31000 Toulouse, France.

\$32.9 Million for P.E.I. Program

Prince Edward Island will receive a total of \$32.9 million in federal and provincial funding during the final year of the 15-year Comprehensive Development Plan. The plan, begun in 1969, is considered unique because it is an umbrella plan, dealing with all aspects of life in P.E.I. including schools, roads, family farms, business and industry.

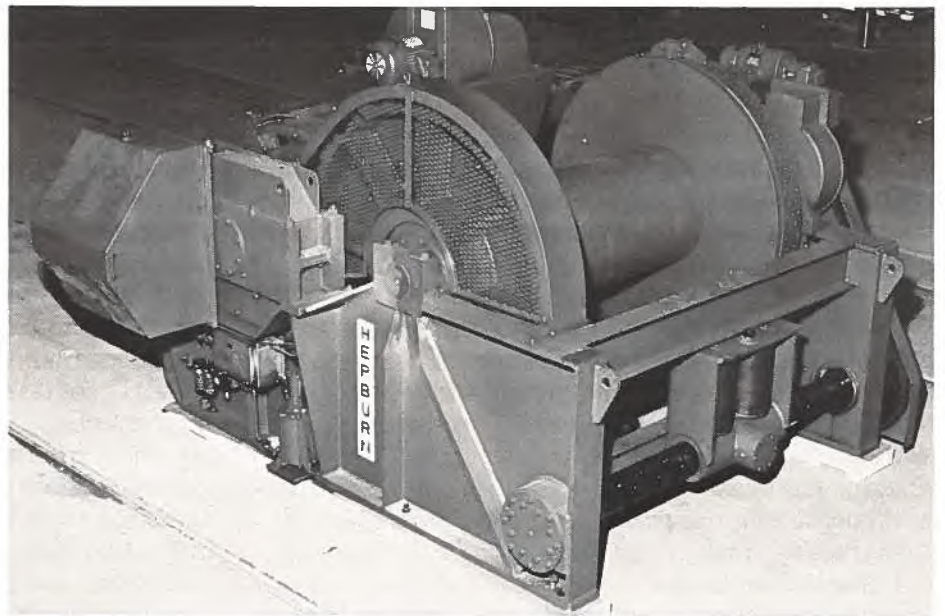
Ed Lumley, Minister of Industry, Trade and Commerce and Regional Economic Expansion, has announced that the province will receive roughly \$23 million in direct-delivered federal programs in the third phase of the plan, which began in 1981. Joint federal-provincial funds will total \$9.6 million.

Rendez-Vous Canada Venues, Dates Chosen

Rendez-Vous Canada, the international tourism marketplace designed to increase the sale of Canadian tourism products and services, will be held in Ottawa, April 29 to May 3, 1984, and in Edmonton, April 28 to May 2, 1985.

Canada's Capital Congress Centre in Ottawa will host the 1984 event with functions in both Ottawa and Hull. The Edmonton Convention Centre will be the site of the 1985 marketplace.

Rendez-Vous Canada has generated more than \$244 million in tourism sales for Canada since its inception in 1977.



Winches for Arctic Work Barge

One of six HEPBURN single drum mooring winches recently supplied by John T. Hepburn, Limited, Toronto, Ontario, to Arctic Transportation Ltd. of Calgary, Alberta, for installation on a work barge that is under construction for use in oil exploration in the Beaufort Sea.

Five of the winches, as shown, have a pull of 55 tons with drum capacity for 915 m of 5 cm diameter wire rope while the sixth has a pull of 72 tons and drum capacity of 915 m of 7 cm wire rope. All the winches incorporate Hepburn's proprietary spooling adjustment mechanism.

Canadian Film Awarded Special Medal

The most recent film production of the Standards Council of Canada, *Quality Starts at the Top*, has been awarded a special medal by the *Association française des qualitiens* in Paris. The medal bears an inscription describing the film as "an exceptional tool for the promotion of quality".

The film is oriented to small and medium-sized business management and has as its purpose to inform business people of the advantages of introducing an in-house quality management program.

Coming Soon — New Department — New Program

Legislation to create the new federal Department of Regional Industrial Expansion (DRIE) will be presented to the House of Commons shortly. When approved, the departments of Regional Economic Expansion (REE) and Industry, Trade and Commerce (ITC) will cease to exist.

With the arrival of DRIE will come a major new national economic development tool, the Industrial and Regional Development Program (IRDP).

Ed Lumley, Minister of Industry, Trade and Commerce and Regional Economic Expansion, in support of the April budget, said, "The Industrial and Regional Development Program will be my department's major instrument to support industrial development and reduce economic disparities among regions. It is designed with business in mind and will be delivered more efficiently through our local regional offices.

"The system of programs the two departments offered in the past was too complicated, particularly for smaller firms," said Mr. Lumley.

IRDP will be available to manufacturing and processing companies and related service industries in all parts of Canada and it will provide added incentives to companies in the more economically disadvantaged areas.

A unique characteristic of the new program will be its application to six separate phases of the corporate and product life cycle. The phases are:

- industrial infrastructure;
- industrial innovation;
- plant establishment;
- modernization/expansion;
- marketing; and
- industrial renewal.

Mr. Lumley emphasized the new program's intent is to make Canadian industry more competitive in order to maximize potential in both domestic and foreign markets.

Spearheading the business development aspects of both the budget and the new DRIE programs are measures to assist research and development, innovation and modernization of Canadian businesses.

Programs of REE and ITC from which the best features have been taken for IRDP and provided with greater flexibility for innovation, broader coverage for modernization and productivity, and improved regional sensitivity are:

- Enterprise Development Program
- Support for Technology Enhanced Productivity Program
- Montreal Special Areas Program
- Co-operative Overseas Market Development Program
- Institutional Assistance Program
- Regional Development Incentives Act
- Magdalen Islands Special Area Program

Eligible to apply for aid will be individuals, corporations, partnerships, co-operatives and non-profit organizations, regardless of ownership or taxation status if the project is undertaken in Canada.

Mr. Lumley announced the creation of an Industrial and Regional Development Board "with both business and labour representatives from across Canada". The board will advise the government, through the minister, on overall industrial policies and strategies.

"We are closer to a national industrial strategy than ever before," said Mr. Lumley. "To assure the success of the new program, we have over the past few months established a number of sector task forces consisting of the main actors in industry — namely business managers and labour.

"These task forces — in the aeronautics and automotive sectors, for example — have been asked to examine their industries in depth and arrive at feasible strategies for growth. I believe that this is the best way available to ensure government is aware of specific industry concerns. Using this approach, we will be able to develop sector specific development programs."

The new department will spend more than \$2.5 billion in direct assistance to industry over the next two years.



Budget Provides Needed Impetus For Growth of Small Businesses

While all Canadian business will benefit, small and medium-sized businesses were particular beneficiaries from changes outlined in the recent budget. The three-pronged assistance package for the small business sector includes tax incentives, simplified program delivery through the proposed Department of Regional Industrial Expansion (DRIE) and a renewed mandate for the Federal Business Development Bank.

In keeping with the advice of the small business community to the responsible minister, Bill Rompkey, Minister of State for Small Business and Tourism, both on an individual basis and through the Consultative Committee on Small Business, that their needs be addressed through the tax system, the budget paid particular attention to tax measures aimed at this sector.

Among these are:

The measures addressing business losses:

- Increasing the carry-back to three years, instead of one and providing the alternative of carrying them forward seven years instead of the previous provision of five years, will have an immediate impact on small business. More importantly, this measure will stabilize small business cash flows once the recovery takes hold and profitability returns.
- The provision for the carry-back of capital losses from one to three years will have a similar impact on improving a company's cash flow.

Revisions to investment tax credits:

- Removal of the upper limit of the Investment Tax Credit;
- Remission of a portion of the tax credit directly to the business;
- Refunds of 40 per cent (as compared to 20 per cent for larger firms) of tax credits directly to the firm;
- Tax credits to purchasers of common shares.

These measures will assist firms finance research and development and the purchase of certain manufacturing, transportation and construction capital assets as well as reduce their cost of new equity issues.

The Minister of Finance also proposed discussion on a number of measures that could enhance the ability of small firms to benefit from R&D tax incentives and announced a national symposium on the subject of simplifying the tax system.

Other budget provisions of interest are:

- Bringing forward major capital projects will have a spin-off impact on firms which supply the prime contractors.
- The addition of \$355 million to speed the recovery of the housing industry will have a favourable impact on the sector since some 98 per cent of construction firms are categorized as small business.
- An additional \$180 million to assist in developing export opportunities will also provide spin-offs for small businesses and assist in financing deals for medium sized ones.

As Mr. Rompkey said in his budget speech to the House of Commons, "I believe this budget recognized the importance of small business to the economy. These firms will play a significant role in leading us on our road to recovery. They have the flexibility to move quickly into promising new products and processes and they are the network of suppliers who enable larger firms to continue.

While the Federal Business Development Bank has been the traditional term lender to small and medium-sized businesses its renewed mandate also includes:

- The expansion of client services, particularly outside Canada's major urban centres.
- The development of its merchant banking role, by packaging a deal using other sources for a fee; by participating along with other financial institutions or by guaranteeing loans made by other institutions.
- The Bank may also take a minority position in the firm with the intent to sell the shares in a few years.
- The Bank has been provided with up to \$50 million annually to cover term lending operating costs. This is to cover its position as a 'lender of last resort'.

Up to \$5 million in additional funding will be provided to the Bank so that it may enhance and automate its information and management services, such as CASE, and establish client service projects in each province.



NEED: A Program with Benefit

THE SCENE

A small Canadian company. It has successfully weathered the recession so far and wants to modernize its plant to be able to take advantage of the upturn in the economy that many economists claim is coming or even already started.

THE PROBLEM

The proposed modernization was delayed by the recession and now the company is reluctant to allot finances to such a project in case the economists are wrong.

ONE SOLUTION

NEED (New Employment Expansion and Development program)!

Anounced in the late fall of 1982, NEED is a \$500 million program (recently increased by \$180 million in the April 19 budget) sponsored by the Department of Employment and Immigration and designed to create some 60 000 jobs over a period of 18 months to support Canada's economic recovery and stimulate regional development. The program is scheduled to end in March 1984.

Small businesses, including those in the tourist industry, can benefit from NEED to carry out those projects they might not otherwise attempt, such as that described above. Such projects can include modernization of plant or facilities; development of sites for future construction; energy conservation programs; pollution abatement; development of tourist facilities.

Through NEED, an employer may be able to hire the kind of skilled workers required. Such workers must have the appropriate skills to perform the specific tasks of the project thus allowing the employer to get on with the work without having to spend any appreciable time training staff. There is no limit to the number of workers an employer may hire provided it is for job creation and not for work already being performed by existing staff.

NEED will contribute up to an average of \$200 a week towards the wages of each eligible worker with extra contributions available for key skilled supervisory personnel.

The NEED program's prime objective is to create new, productive employment for persons who are unemployed and have exhausted their entitlement to Unemployment Insurance benefits or are receiving social assistance. It will also allow them to perform jobs that will use and maintain their skills.

Work done through NEED will have a lasting benefit, such as improved facilities, on participating company.

The minimum length for any project that qualifies under the program has been set at 12 weeks with a maximum length of 12 months. Projects may go beyond the maximum limit if other funding is made available. New NEED projects will be created and approved through the life of the program and this is expected to generate a steady flow of jobs creating new employment opportunities each month.

Among the advantages the NEED program has for a small company are that the work done during the program will have lasting benefit to the company (improved facilities, new construction, etc.); the workers would be able to upgrade their skills which would then be useful to business when the economic upturn occurs (retraining, etc., would not be needed).

Apart from private sector small businesses, sponsors of NEED can be federal government departments and agencies, voluntary non-profit organizations, unions and provincial and territorial governments and agencies.

Municipal and non-profit organization projects such as tourism development may have some spin-off benefits for small business as well.

Projects that qualify under the program must be consistent with regional strategies and must demonstrate that they will create extra employment and not replace activities undertaken by current employees.

Apparatus has been set up to ensure that applications for projects will receive prompt attention. NEED Advisory Boards in each province will recommend regional strategies designed to ensure that the employment created matches regional requirements.


The boards will have members representing communities, women, business and labour and representatives of the federal government plus officials of the participating provinces.

Applications to sponsor NEED proposals are available from Canada Employment Centres or Employment Development branch offices. NEED field officers are good sources of information for the small entrepreneur, especially regarding application procedures and regional employment strategies. Also, the initial proposals should be prepared in co-operation with the field officers.

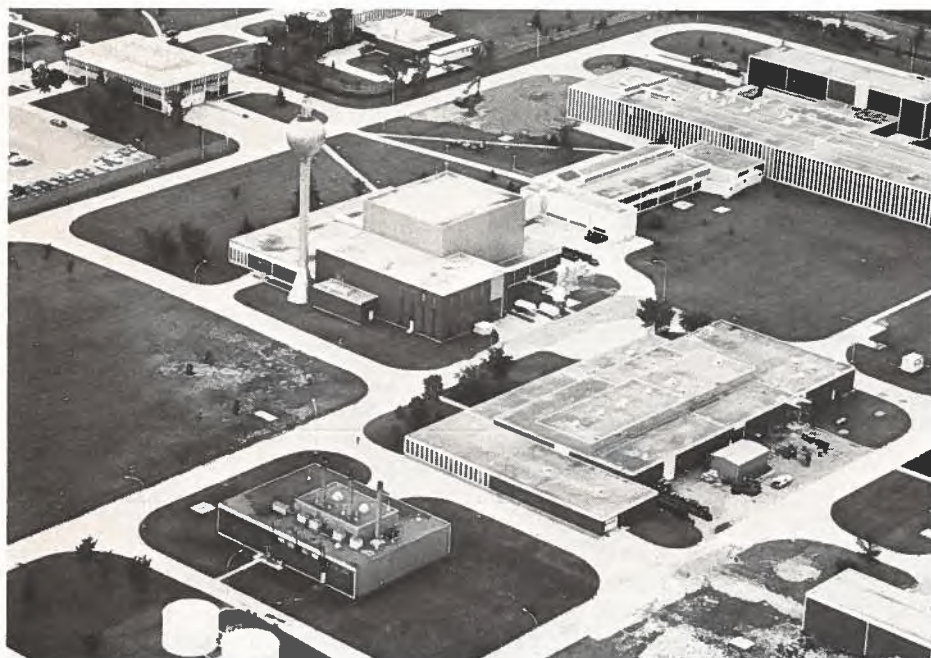
While approvals are expected to come relatively quickly, the actual process will vary according to regional requirements. Total turnaround time should be from 10 days to three weeks depending on when applications are received by the NEED Advisory Boards which meet once every two weeks.

Participation in the program will involve standard bookkeeping activities, a single page monthly report (estimated to take about two hours to prepare) to apply for monthly installments, and a final report (which should take one person-day to prepare).

To quote from a specially-prepared brochure on the NEED program:

"The NEED program presents an opportunity for firms to undertake projects which will improve their productivity. At the same time, they will be helping workers who, through no fault of their own, have fallen on hard times. Business participation . . . will benefit both unemployed workers and employers. It will also speed up Canada's economic recovery." 

WHITESHELL: Western Canada's High Technology Centre



An aerial view of Atomic Energy of Canada Limited's Whiteshell Nuclear Research Establishment. The site is located on the Winnipeg River, approximately 100 km east of Winnipeg.

Rural Manitoba is an unlikely place in which to find high technology, yet it boasts some of the finest research facilities in Canada.

The Whiteshell Nuclear Research Establishment, located 100 km northeast of Winnipeg, was set up in 1963 to pursue research in support of the Canadian power reactor program, and now embraces a surprisingly broad range of disciplines in its research activities. The specialized personnel, techniques and facilities necessary for the study of nuclear processes and fundamental principles of industrial technology are today prompting a new awareness of Whiteshell's capabilities in non-nuclear industries.

The marketing of the site's multi-disciplinary skills to Canadian industry is the responsibility of the Commercial Operations Office, and its manager, Ray Sochaski, is confident that the current commercially-oriented trend will continue and will result in a growing commitment to the support of all Canadian industries.

One of Whiteshell's most powerful facilities, the organic-cooled WR-1 research reactor, has been the focus of the site's activities since it began operation in 1965. It is used primarily as a tool for the testing and development of nuclear fuels and materials, but its usefulness extends into many other areas. The reactor is used to heat the site's research and office buildings and surplus heat from WR-1 could be provided economically to industries that might wish to locate near the site.

A recent study has shown that a reactor based on organic coolant technology would be the most economical way to provide steam for the extraction of heavy oil from the tar sands. In addition, WR-1 will soon have an increased capacity for Neutron Activation Analysis, gaining wide recognition for mineral assays and trace-element analysis.

A brief look at Whiteshell's major research programs and some current projects shows the wide range of facilities and techniques that are available to both nuclear and non-nuclear industries.

Chemical and Physical Analysis

The growing demand by industry for research and analysis is perhaps most evident to the chemistry and materials researchers. Topics include the behaviour of metals and other materials at elevated temperatures and pressures; the fracture and deformation properties of materials; and the control of potentially polluting industrial by-products.

Whiteshell researchers have developed a unique method that combines electrochemistry with surface analysis techniques to study the processes controlling the corrosion of surfaces. Researchers are also analyzing the vibrational and damping characteristics of metals.

Experiments involving gas-phase chemistry are concentrating on the development of methods that could be used to control air pollution, specifically sulphur and nitrogen oxides.

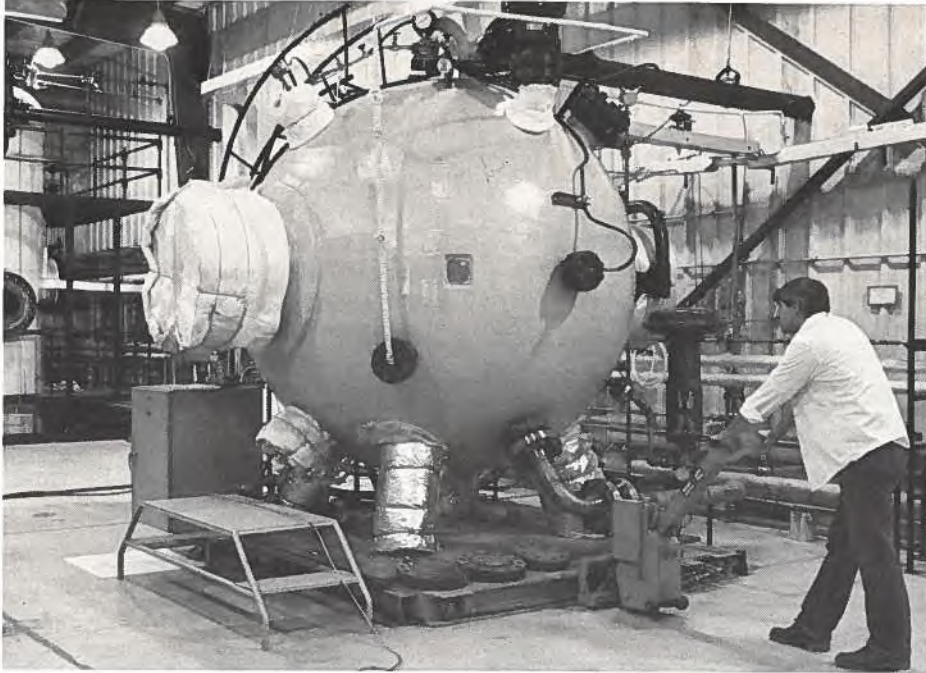
The wide range of Whiteshell's analytical services is well known following the exhaustive analysis of fragments of the Russian satellite that disintegrated over northern Canada in 1978. The site boasts a comprehensive range of highly-specialized, sensitive equipment for materials and systems analysis — facilities that are finding increasing use in environmental monitoring.

Recent commercial work has shown that it is possible to identify the origin of particulates in air, water and other materials. During analysis of lead particulates, Whiteshell technicians were able to determine whether they had originated from smelting operations or automobile exhaust. The development of process instrumentation for industry as a spin-off of research work has recently led to two new products, an automated analyzer to monitor uranium in process streams, and a hydrogen analyzer to measure dissolved hydrogen in water.

Whiteshell is also acting as consultant for the petroleum and other industries in the use of radiological techniques, and two recent products for in-line process instrumentation integrate two new technologies — microelectronics and radiation technology — a combination that could have considerable impact in the process industries.

Safety Studies

Whiteshell's expertise in predicting the behaviour of materials and processes under various operating conditions



The Containment Test Facility could prove useful as an experimental testing chamber for industries that deal with combustion processes or potentially explosive materials.

stems, in part, from a comprehensive Reactor Safety Research Program. Researchers have developed mathematical models for the components and processes involved in the cooling system of a CANDU reactor and these models are being validated using experiments of increasing complexity. By simulating accidents in model systems, scientists have gained an understanding of fluid mechanics and heat-transfer processes that are common not only to nuclear reactors but to many other industrial process systems.

The same methods of model development and experimental testing are being applied to combustion processes, using a new Containment Test Facility. This facility is currently being used to explore the behaviour of explosive mixtures of gases, particularly hydrogen combined with air and steam. Although the reactor safety experimental facilities have immediate relevance for the nuclear industry, there is a strong potential for applications of this technology in non-nuclear systems.

Waste Management

The largest research program at Whiteshell is devoted to the safe management of Canada's nuclear fuel wastes. Materials science, engineering, computer science, chemistry and other disciplines all contribute to the program's objective — to assess the concept of deep underground disposal in a stable rock forma-

tion, using a multiple barrier system to contain and isolate the wastes. Whiteshell scientists are developing the technology for engineered barriers — fuel waste immobilization materials, waste containers, and buffer and backfill materials — and are also studying the geological properties of several plutons, rock masses common in the Canadian Shield, considered to be the most suitable hosts for an underground waste disposal vault.



The Whiteshell research reactor, WR-1, is an effective tool to test and develop nuclear fuels and materials.

Two test facilities have been developed to support these activities. A Hydrostatic Test Facility capable of testing metallic containers at elevated temperatures and pressures and a Borehole Instrumentation Test Facility that will be used to test instrumentation systems required for geoscience field work.

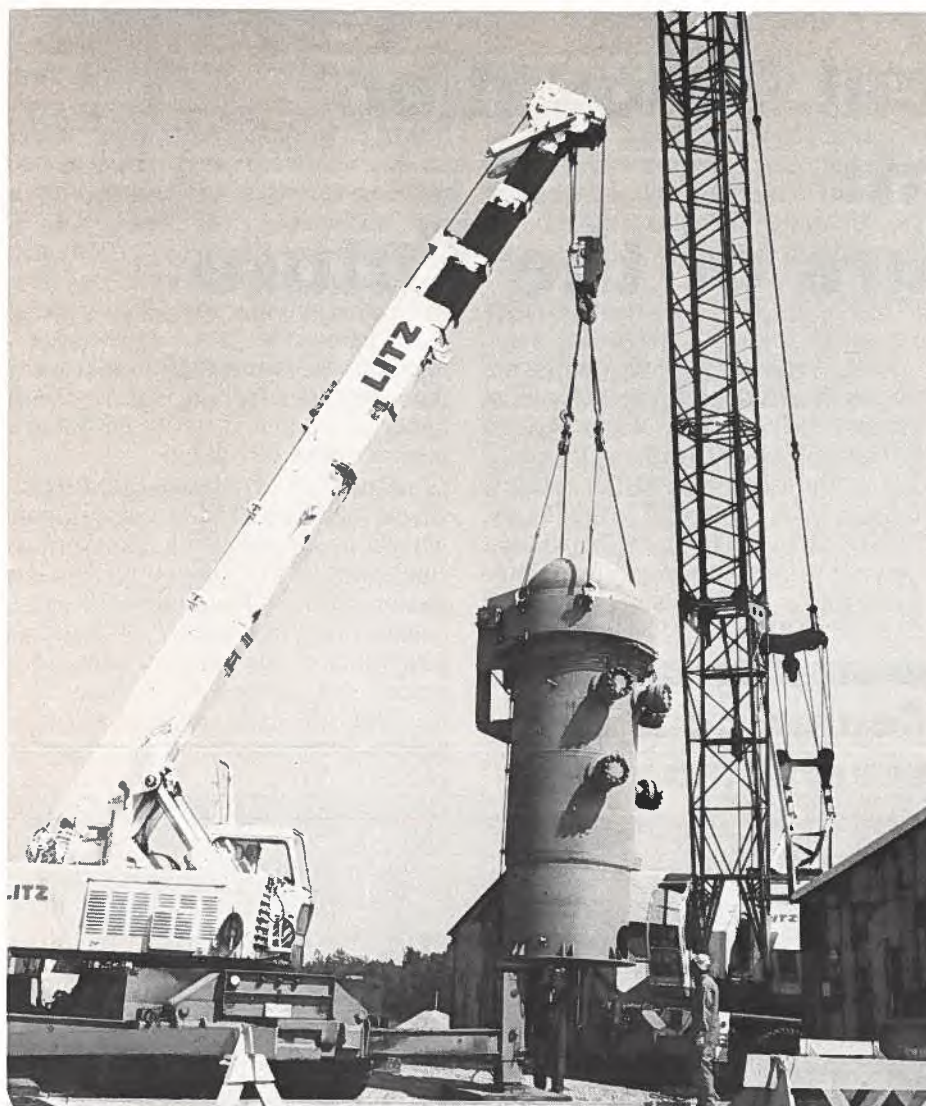
An important addition to the nuclear fuel waste management program is the Underground Research Laboratory (URL), currently being constructed to allow the properties of a pluton to be studied in an underground environment. The project will help determine how man's intrusion and the future emplacement of radioactive wastes in a vault might affect the rock and the surrounding environment over the long term. However, no radioactive wastes will be used or emplaced in the URL at any time.

The URL will be the first such test facility in the world to be built below the water table in an undisturbed rock formation. New tools and techniques being developed to improve methods of observation and measurement offer the opportunity for significant advances and uses beyond the nuclear fuel waste disposal studies. For example, the testing of very low permeability crystalline rocks and the hydrogeological tools and methods being developed could be of use in other geological exploration, e.g. in the oil industry.

Environmental Studies

An integral part of the waste management studies is the environmental and safety assessment of nuclear fuel waste disposal. Computer models are being developed to represent each aspect of the disposal concept — the engineered barriers, the geological environment and man's environment. Experimental research data are integrated in a model that estimates the degree to which radioactive elements could migrate from the waste vault to the environment, and the resulting radiation dose to man at any time in the future. These models could be useful in predicting the migration of any waste product through the environment to man.

Whiteshell's Environmental Research Program contributes extensively to the development of computer models that represent natural ecological and environmental processes — models that are applicable to other industries undertaking environmental impact stud-



A Hydrostatic Test Facility, recently commissioned at Whiteshell, designed to test prototype metal containers for nuclear fuel wastes by simulating the expected underground conditions of temperature and pressure, could serve as an experimental test chamber for equipment or components designed to operate under similar conditions.

ies. The pathways or routes travelled by materials as they move from one part of the environment to another, through either natural or man-made systems, and their ultimate ingestion by man are investigated and modelled.

A food chain model, developed at Whiteshell, was recently used by a Canadian provincial utility to assess the environmental effects of radioactive particles emitted into the atmosphere from a proposed coal-fired electric-generating station.

The Environmental Research Program also includes studies of the effects of radiation on plant and animal life in a natural setting, and a meteorological monitoring program to develop and validate models for the transport and diffusion of airborne materials in the lower atmosphere.

Life Sciences

Opportunities for commercial development have also emerged from the Medical Biophysics Research Program. Although primarily concerned with the study of the effects of radiation on cells, researchers are also conducting experiments with chemical carcinogens. The use of these toxic chemicals raises questions regarding their disposal, or management, after use. One possibility is to irradiate the chemicals and convert them to stable, non-toxic compounds, and Whiteshell scientists have already demonstrated the process with polychlorinated biphenyls (PCBs).

Other research in the medical biophysics laboratories may lead to advances in cancer therapy techniques. Studies have identified an enzyme that operates as a protective agent against

radiation damage — a possible future antidote against the adverse effects of radiation for cancer therapy patients. In some experiments, heat has been found to increase the effects of radiation on cells, and application of this in the treatment of cancer is now being studied.

Nuclear Safeguards


Whiteshell, along with its sister site at Chalk River, plays a major role in the International Atomic Energy Agency's development of safeguards technology — instrumentation and equipment to account for and control the use of nuclear fuel. The development program calls for the design and fabrication of highly reliable and tamper-resistant devices for use in CANDU reactors and other nuclear facilities.

The equipment includes: bundle counters to count and record the flow of fuel bundles discharged from a reactor; electronic and ultrasonic sealing equipment for irradiated fuel bundles stored under water; and surveillance techniques such as film cameras and closed-circuit television systems.

The safeguard equipment has been installed in new 600 MW CANDU reactors in Quebec, New Brunswick and South Korea, and is being installed elsewhere in Canada and abroad.

A Resource for Canadian Industry

The prospect for growth in commercial operations is reflected in the fact that commercial revenue was \$9.2 million in the fiscal year 1982/83, up 27 per cent over the previous year, and prospects for the upcoming year are also promising. The large number of excellent programs, the technological depth and the broad range of expertise have led to a realization and appreciation of the site's capabilities in non-nuclear research and development.

While Whiteshell's work is still necessarily devoted largely to support for CANDU reactor technology, important contributions could be made in many other industrial sectors. 

For further information, contact the Commercial Operations Office, Atomic Energy of Canada Research Company, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba R0E 1L0.

— by D.O. Pronger and R.S. Dixon, Atomic Energy of Canada Limited

Technological Innovation Management: Entrepreneurs of the Future

Successful technological innovation — the process whereby an invention resulting from research and development is converted into a socially useful and commercially profitable new product or process — requires the combined skills of science, engineering, entrepreneurship and management.

This is the basis of a course established several years ago in the Centre for International Business Studies, School of Business Administration of Dalhousie University, Halifax, Nova Scotia.

The course, "Managing Technological Innovation and Entrepreneurship", recognizes the need for Canada to develop its technology if it is to maintain, let alone improve, its international trading position. It soon attracted considerable attention and today about 50 business, science and engineering students enrol each year.

The innovation process in both large and small firms is studied, with specific reference to national and Atlantic regional needs. Small firms receive special attention for two reasons.

First, although it is sometimes claimed that the age of the "heroic entrepreneur" is past, evidence suggests otherwise. Important and fast changing developments in the electronics and computer industries indicate that larger organizations often act as "incubators" for inventor-entrepreneurs who spin off new ventures to exploit their inventions and then become leaders in specific sectors of those industries.

Second, although most students will begin their careers in large organizations, some have ambitions to set up their own businesses later. Therefore, a large part of the course focuses on entrepreneurship and new venture start-up operations so that the risks and rewards of such a move can be thoroughly assessed.

The course begins by considering several innovations — successful, unsuccessful and unproven — to illustrate the process.

The "successful" innovation chosen was the development by Marconi of wireless telegraphy, demonstrated dramatically in 1901 with the transmission of the first transAtlantic wireless message from Signal Hill in St. John's, Newfoundland. The need for wireless telegraphy at sea was tragically pointed out by the disastrous sinking of the liner *Titanic* in 1912.

Course considers several innovations — successful, unsuccessful and unproven — to help illustrate the innovation management process.

The "unproven" example is Telidon, the interactive videotex system undergoing extensive field trials at the present time. Like the wireless earlier in the century, Telidon is a technologically impressive invention. However, unlike the wireless, a market need for it at an acceptable price has not yet been established.

This provides for lively discussion in the course. On the one hand it arouses patriotic support for a "made-in-Canada" technology. On the other hand, the difficulties of identifying and assessing potential markets (to justify the considerable initial investment required) are studied. In addition, political considerations in the adoption process of products such as Telidon are also discussed.

The course employs a mixture of lectures, case studies and talks by Canadian technological entrepreneurs and

managers to ensure proper coverage of the concepts involved, their real-life applications, and to encourage involvement through discussion.

One of the problems faced by the course is a shortage of case studies written about Canadian high technology companies. Since a major purpose of the course is to stimulate students' interests and future participation in Canadian technological innovation, this is a serious and embarrassing situation.

The Technological Innovation Studies Program of the Department of Industry, Trade and Commerce and Regional Economic Expansion is working to overcome this handicap. Four case studies have been completed based on Nova Scotia companies and more are planned based on larger companies throughout Canada and including their experiences in setting up subsidiary operations overseas.

The four companies involved so far have experienced mixed fortunes in their innovation attempts. Two were in the "start up/early growth" stage at the time the case studies were written. The other two, somewhat larger and more mature, are trying to broaden their product bases.

Micronet Limited is one of the newer firms. It was incorporated in 1980 to specialize in microcomputer-based products that monitor and control energy use. Like many high technology companies, Micronet grew quickly to sales of \$1 million but suffered a number of growing pains along the way. Managing the company's employees and marketing its output were two problems the co-founders faced. At the time of the case study the future looked reasonably good but only a year later the company was struggling for survival.

Internav Limited was established in 1976 as an offshoot of International Navigation Limited of Woburn, Massachusetts. The company manufactures

Loran C navigation systems used on small fishing and pleasure boats operating in seas with Loran C coverage. Military sales go to the Canadian Armed Forces (Navy) and export markets are also important. The case study describes the company's early operations and examines its growth plans which include products for the offshore oil industry, airborne navigation equipment and further products for the Canadian navy. Microwave landing systems for airports provide the greatest potential opportunity.

ASDIC Limited is one of the more mature companies. Founded shortly after the Second World War, the company is mainly involved in the production of sensing buoys for the military market. Environmental data systems and communications systems are also produced for government and private markets. The case study describes the development of the company's expertise

in producing drifting buoys to record and transmit oceanographic and atmospheric information. Although accumulated experience is considerable, the company is uncertain about how much business this will generate in the future and this leads to consideration of long-term plans and technology development.

ABCO Limited was the subject of the final case study. Founded in the late 1940s, the company made a number of moves over the years so that its technological skills would enable it to exploit various market opportunities. Now it is a multi-divisional company. The case study focuses on ABCO's experience in two divisions — plastics and manufacturing. Both divisions have pursued "market-pull" innovation strategies but consciously tried to develop distinctly different and better products than those of competitors, making wise use of government research and development inventions and assistance programs.

Case studies add considerably to the learning experience and have received very favourable student response.

By providing relevant, up-to-date, Canadian materials, these four case studies add considerably to the learning experience of the course. Student response has been encouraging and class members have been bright, emotionally mature and industrious, ranging from senior undergraduate to post-doctoral levels and sharing a common desire to work in high technology environments, according to course directors, Michael Martin and Philip Rosson.

The pay-off of the course has been described as potentially high. While the process of developing a technological entrepreneur is often a lengthy one, if even only one student "goes on to become a Robert Noyce of Intel or a Michael Cowpland of Mitel, the social and economic benefits generated will justify the many person-years of university teaching efforts".

Further details about the course may be obtained from:
Professors Michael Martin or Phillip Rosson
School of Business Administration
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 6152 Coburg Road
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The four case studies are available in a report form from:
Program Manager
Technological Innovation Studies Program
Technology, Productivity and Innovation Policy Branch (36)
Department of Industry, Trade and Commerce and Regional Economic Expansion
 235 Queen Street
 Ottawa, Ontario
 K1A 0H5



Four by Five

Innovation — training now for tomorrow.

Herring Roe — Export with Difference



Herring roe. To most Canadians it sounds highly unappetizing, certainly without the glamour and apparent appeal of, say, caviar (sturgeon roe). But to the Japanese it is a prized delicacy. To Canada's west coast fishermen, it is a million dollar industry.

Every year at carefully controlled times hundreds of herring fishing vessels congregate at designated spots off British Columbia's coast — and they wait. They are waiting for the signal from officials of the federal Department of Fisheries and Oceans announcing the start of the season's herring roe fishery, the "opening" which can be as short as 30 minutes or as long as a week.

When the signal comes, there is a seemingly mad scramble for the fish. And they must be just right — female fish bearing roe almost ready for spawning although, of course, both sexes are caught without discrimination.

When the fisheries department officials decide the time is up, another signal is given and all fishing stops. In fact, so strictly controlled are these "openings" that a fisherman caught still fishing after the stop signal can be subject to serious charges and penalties.

It is a race, from the start to finish signals, to catch as much of the valuable fish as possible.

Why the strict controls? Herring roe is, after all, fish eggs. If the species is to survive, some of those eggs must be allowed to hatch and mature. Nature provides for a huge excess over what is required for sustained propagation but there is a limit and, to avoid the stock decimation that closed the herring fisheries in other parts of the world, the marine biologists of the Department of Fisheries and Oceans stepped in and imposed a strict resource management régime on the fishery.

The race the fishermen engage in is to cash in on the lucrative market for what the Japanese have long considered a delicacy.

Herring roe (or as the Japanese call it *Nishin* roe) is a specialty of the Japanese New Year festivities. It is as much a part of that festive season as the Christmas turkey is to Canadians. More so, in fact, because in addition to being an important part of a familiar tradition, *Nishin* roe is also a symbol of good luck and fertility. It is traditionally exchanged as a highly welcomed gift during the season.

Until the early 1970s, the Japanese demand for herring roe was satisfied by the domestic fleet and imports were strictly controlled at a low level. However, as stocks available to the domestic fleet became exhausted, it was necessary to turn more and more to new sources of supply.

Not just any supply would do. Even though the same species of herring can be found in many parts of the world's oceans, only a selected few stocks were found to satisfy the gourmet Japanese palate for the tasty, crunchy delicacy they had come to love.

The herring stocks off British Columbia filled the bill more than adequately and in 1970 British Columbia Packers made the first sales to Japan using processing and quality control technology supplied by the eager Japanese customers.

The business grew and, as the Japanese lifted import restrictions on the roe, a whole new industry developed on the B.C. coast. It has become a multi-million dollar industry bringing in to Canada more than \$75 million in 1982.

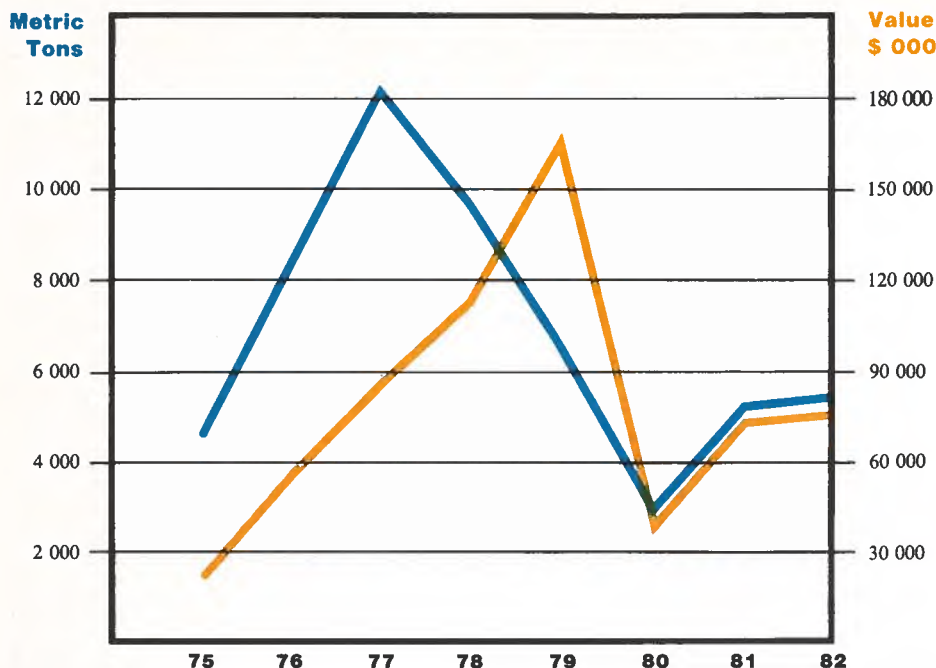
The Department of Fisheries and Oceans carefully monitors the herring stocks for quantity and maturity and fishing in each area off B.C. is allowed only at the right moment to catch the roe at its peak and only for long enough to restrict the catch to what the biologists determine can safely be caught — the "opening" for which the fishing vessels race.

In some cases the "opening" might last only a few minutes but the value of the catch is so high that swarms of boats, some with nets worth more than \$40 000, would be poised to take up to 50 tonnes of fish in less than an hour and sail into port with a cargo worth as much as \$200 000.

When the market first opened, in the early 1970s, these high prices were caused in part by the simple forces of supply and demand. The Canadians limited the catch to what the stocks could bear and the Japanese bid the prices up to what the market would bear.

As a speculative fever swept Tokyo, cash buyers would go right out into the fishing grounds to pay up to \$5 000 a short ton for the fish itself before it ever reached the docks (this despite the fact that the highly prized roe only constitutes approximately 10 per cent of the fish).

HERRING ROE EXPORTS TO JAPAN



However, in December 1979 the inevitable occurred. The Japanese consumer said "no more" and the market collapsed. Several Japanese companies, caught with large over-priced inventories, declared bankruptcy.

In 1980 there was a strike among British Columbia fishermen so that only the non-union co-operatives and a few small independents were in business. At the same time there was a huge inventory carry-over and a disillusioned consumer in Japan.

Canadian herring roe sales which had been 6 580 metric tons worth \$168 million in 1979, fell to less than 2 900 metric tons valued at only \$36 mil-

lion in 1980. On top of all that, pure food advocates in Japan publicly challenged the safety of the process by which the Japanese converted herring roe to its most popular consumer form — *kazunoko*.

At this point, the Japanese importers and traders and the major Canadian exporters got together on a program to stabilize and rebuild the market. A major consumer-oriented promotional campaign, funded by the Japanese, was conducted during the holiday season in December 1981 and other programs at the trade level were conducted jointly by the Canadians and the Japanese.

As a result, Canadian herring roe sales to Japan in both 1981 and 1982 were around 5 300 tonnes (5 262 in 1981 and 5 348 in 1982) worth approximately \$75 million. This accounts for about half of Japan's herring roe consumption. The balance comes from the domestic fishery plus imports from other north Pacific Rim countries.

The Canadian product, however, is still tops thanks to the quality of the B.C. fish and the technical co-operation between Canadian suppliers and Japanese customers and their mutual best interest approach to marketing.

Initially, the Japanese bought "full" herring from Canada and extracted the roe in their own plants. As a condition for allowing the trade to be conducted, Canada required an increas-

ing proportion of extraction to be performed in Canada. Not only did the Japanese agree to this, they supplied technicians to teach Canadian workers how to do the job to their specifications. Today, all herring roe exported to Japan must be extracted in Canada.

The Japanese are particular about their Nishin roe. Unlike caviar which is served loose, herring roe is served still in the membrane sack in which it is stored inside the fish. The extraction is a delicate operation because, if the sack is broken, the value of the catch goes down considerably.

There are several methods of extraction. The fish can be brined and the roe extracted after the brining is completed. Unfortunately, the fish is of little use after the process, as to get the roe in proper condition for extraction more salt is needed than for normal salting of herring.

One of the most practical methods is freezing the fish and extracting the roe. With this method, the quality of the roe is better, the yield is better and the fish carcass can be used more profitably. It can be ground into fish meal or, if economically practical, could be filleted and sold as frozen fillets.

To date, it has not been economical to fillet frozen fish, partly because the value of the fillet is low in comparison with the roe. Also, there are few plants in B.C. (Canada's herring fillet industry is almost exclusively in the east).

However, there are growing complaints from environment protection groups that the discarded fish from both salting and freezing operations constitute an environmental hazard. Because of this, consideration is being given to finding practical methods of using the waste from one of Canada's most unique small industries.

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 — by **John Hughson**
Canada Commerce



Royal Plastics, A Vinyl Extrusion Leader

In May 1970, a brand new Canadian company entered the increasingly important and highly competitive field of vinyl plastics extrusion. Today, Royal Plastics Limited of Weston, Ontario, and its Royal Group of Companies are among the leading vinyl extrusion sources in North America with sales for Royal Plastics alone topping \$30 million in 1982.

Royal Plastics has come a long way from its \$273 000 in sales in its first year of operations from a small, rented plant of 185 m² in Toronto. It started with a single extrusion machine and contracted to supply window system manufacturers with custom extruded vinyl window profiles.

Products today run a wide gamut including extruded vinyl profiles for the window, swimming pool, appliance, automotive and construction industries throughout North America.

From its formative years, the company concentrated on design assistance, quality production and quick and efficient service which enabled it to develop steady and profitable growth and establish a reputation as an industry leader.

Over the years, it has strengthened its position as an innovator in creative design. As the company grew, its president, Vic De Zen, began to earn a reputation as an expert in the field of vinyl extrusion and his pre-occupation with quality and technological improvements became a Royal Plastics ideal.

As demand for the company's products and services grew, so did the plant. New machines were added and increased manufacturing space leased to keep pace with the new customers brought in by the combination of aggressive sales and marketing programs coupled with high quality products.

Not content to rest on their laurels, De Zen and his staff set out to meet the increasing demand for products and services by investigating and implementing programs for greater production efficiency and improved methods of extrusion technology that would create a superior product in a more cost-efficient manner.

Expanding into new 3 700 m² facilities in 1979, Royal Plastics resisted pressure from its many United States accounts to establish branch operations in the U.S. Instead, the company invested in new machinery to compete more effectively in the northeastern U.S.

The company's concept of the "total system" included an automated PVC compounding facility; computerized tool and die making; an in-house laboratory under a staff chemical engineer; and advanced quality control techniques for inspection of raw materials as well as finished products.



Royal Plastics President Vic De Zen (left) and David B. Woolf, Sales Manager, examine some of the company's many products.

The new plant brought even greater demand for products and the company has since grown into four new plants in the Toronto area bringing the number of extrusion machines close to the 100 mark.

In addition, companies in related fields were established including a machine manufacturing firm, a zinc die casting company, a tool and die facility specializing in window fabrication equipment, a construction and land development company.

These are now all part of the Royal Group of Companies which, with a number of other Ontario-based companies in vinyl extrusion and related industries, today consists of some 15 companies.


Included In the Royal Group of Companies are: Royal Plastics Ltd., Weston, Ontario, custom vinyl extrusions; Amcan Plastics Ltd., Weston, Ontario, custom vinyl extrusions; Dominion Plastics Ltd., custom vinyl extrusions; Pillar Plastics Ltd., Weston, Ontario, custom vinyl extrusions; Yorkview Plastics Ltd., Concord, Ontario, custom vinyl extrusions; Ultimate Plastics Ltd., Maple, Ontario, custom vinyl extrusions; APB Extrusion Tooling Ltd., Mississauga, Ontario, fabrication tooling; Baron Metal Industries Limited, Weston, Ontario, steel entrances and door frames; Becz Machine Mfg. Limited, Maple, Ontario, machinery; It-Can Tooling & Mfg. Ltd., Weston, Ontario, die and stamping; Ondrus Machinery Int'l Ltd., Weston, Ontario, tool and die making facilities; Ontario Die Casting, Barrie, Ontario, zinc die casting parts; Jovien Associates Ltd., Weston, Ontario, land development and construction; Screenco Mfg. Ltd., Weston, Ontario, window screens; Westeele Properties, Weston, Ontario, property management.

The 1980s brought the introduction to the North American window industry of the all-vinyl window, a product well known in Europe.

To help customers enter this growing market, De Zen invented and patented a unique vacuum-sizing tooling and die design for the manufacture of sophisticated die and calibration systems — closely approximating the existing European method but a tenth the cost.

With the aid of an Enterprise Development Program (EDP) contribution from the then federal Department of Industry, Trade and Commerce, De Zen's system brought increased interest from the U.S. and Canadian window manufacturers plus new licensing opportunities for this new technology from custom extruders in Europe and Asia.

Royal Plastics Ltd.'s experience and success have taught the company to be constantly striving for improvement and effort in the area of technological advancement using the most modern and automated techniques and equipment available.

In addition, the company maintains continuing dialogue and communications with customers in order to maintain its position as an industry leader by keeping completely in tune with industry needs and wishes. 



Ed Lumley, Minister of Industry, Trade and Commerce and of Regional Economic Expansion, inspects the Canbra Foods plant.

All Canadian Product Given Boost in Alberta

Canola, a uniquely Canadian edible oil product — and one of its largest producers is Canbra Foods Ltd. of Lethbridge, Alberta.

The company, the largest canola crushing and processing operation under one roof in Canada, recently accepted an offer of \$1.5 million as part of a \$14.5 million modernization and expansion project currently under way. The offer was made under the Nutritive Processing Assistance Agreement jointly funded and administered by the federal Department of Industry, Trade and Commerce and Regional Economic Expansion (IT&C/REE) and the Alberta Department of Agriculture.

Canola is the successful result of a concerted effort by Canadian plant breeders and researchers to improve on rapeseed by reducing to acceptable and safe levels two substances which, besides being somewhat bad tasting, are thought to be possibly harmful to humans and animals.

"Canola" is the name chosen for this rapeseed derivative and the oil is processed further into shortenings, salad oils and margarines.

Canbra Foods, which began in 1957 as a sunflower seed crushing operation, later shifted to canola. Today, the company's plant has a crushing capacity of 600 tonnes per day and its refining capacity is just under

220 000 kg per day. This output represents an estimated 11.6 per cent of Canadian capacity, a share that is expected to rise to 13.9 per cent when the modernization and expansion project is completed in 1985.

The company's sales in 1981 (the latest complete figures available) totalled \$122.2 million, producing a net income that year of \$5.8 million.

The proposed \$14.5 million modernization and expansion project will replace obsolete equipment and processes at the company's 25-year-old Lethbridge plant, according to D.W. Hughes, Canbra Foods president. This, he noted, will maintain and even increase the company's competitiveness and protect its present 300 on-site jobs.

When the project is completed, production is expected to be 20 per cent higher than current output.

Canola is Canadian

Canada is the only producer, and exporter, of canola products. Domestically, canola accounts for the largest proportion — 52 per cent — of the market for vegetable oils and, in 1981, the value of canola exports was estimated at \$190 million.

In announcing the \$1.5 million development grant offered Canbra Foods under the Nutritive Processing Assistance Agreement, IT&C/REE

Minister Ed Lumley said that the modernization and expansion project would allow the company to capture new markets it is now unable to serve.

"Canbra Foods has already been successful in establishing both domestic and export markets for its products but its sales are limited to the capacity of its aging equipment," he said. "The increased production resulting from the expansion will remove this limitation. And here in Western Canada canola oil will further replace imported oil such as soya and palm oil."

At the joint announcement ceremonies, Alberta's Minister of Agriculture, LeRoy Fjordbotten stressed the importance of the value-added processing in Alberta of food products grown in the province.

"The crushing and refining of higher volumes of canola oil will benefit Alberta farmers since there will be increased demand for seed," he said. "At the same time, the export of raw canola seed will be reduced and the Lethbridge area will receive the increased benefits of value-added processing including, in this case, an increase in local construction contracts."

The Nutritive Processing Assistance Agreement was signed by the federal and Alberta governments in 1975. Cost-shared equally by both governments, it is aimed at strengthening the economic viability of rural communities by further processing in Alberta those nutritive products which have, or may achieve, a competitive position on national or export markets.

Offers of assistance are made to businesses to enable them to establish, modernize or expand nutritive product processing facilities in rural Alberta.

The offer to Canbra Foods is the 301st such offer made under the agreement and the second for Canbra. In 1979, the company received an offer of \$18 582 to assist in a margarine packaging project. In 1981, there was a further offer of \$373 500 for a modernization project. Back in 1971, the company was also offered assistance under the Regional Development Incentives Program of the then Department of Regional Economic Expansion to introduce a salad dressing line of products.

Canbra Foods Ltd. is the sole owner of Stafford Foods Limited of Toronto, Ontario, which manufactures and processes food products for sale to restaurants and institutions. □



As at any christening, great expectations for the new baby, still to spread its wings.

Six Aircraft in Head-On Competition

Because of the prohibitive costs in developing a brand new aircraft, the de Havilland DASH-8 may be the last all-Canadian airliner enterprise

Aerospace manufacturers representing nine countries are producing six new aircraft types which will compete head-on in world markets. Canada's entry in the international free-for-all is the de Havilland DASH-8, a 36-seat commuter powered by two turboprop engines specially designed by Pratt and Whitney of Longueuil, Montreal.

Not since the earliest days of flying have so many rivals grabbed for a slice of the same sales pie. Whether that pie will be big enough to satisfy all competing manufacturers is a question market

researchers cannot answer. Yet these same air transportation analysts assured plane builders in the mid-seventies, soon after OPEC oil prices began their giddy climb to successively higher peaks, that what the world needed was a cost-effective, advanced technology short-haul aircraft. Passenger capacity was quoted as somewhere between 30 and 50 seats, and the new fuel-thrifty commuter must offer amenities close to the creature comforts enjoyed by jetliner voyagers.

Market studies were commissioned by individual aircraft companies in

Canada, Britain and Brazil, and by duonation teams in France and Italy, Sweden and the U.S., Spain and Indonesia. In the matter of passenger accommodation, which dictates such basics as fuselage dimensions, wing area and engine horsepower, the market researchers seemed to have reached contradictory conclusions, because only two of the six planes have the same number of seats — 36 — which is six more than the smallest turboprop commuter and 12 fewer than the largest rival. Not surprisingly, aircraft cost and size go together: the 30-seater is almost \$2.5 million cheaper than the 46-seater.

But market appeal is not merely a question of price tag or payload. Arguably the best bargain in terms of aircraft price per passenger seat is the Shorts Brothers SD360. This British commuter, like the de Havilland DASH-8, accommodates 36 passengers. But it is unpresurized, which means that it cannot operate high above the bad weather that plagues sky routes in many parts of the world. The DASH-8 is much faster, cruising at 260 knots, as against the

SD360's 211 knots. The Canadian plane also has a range advantage, 600 nautical miles versus 230 nautical miles. And being the product of a company that has long specialized in STOL performance, the de Havilland takes off from a 826 m runway, whereas the SD360, with less engine power at its command, needs 1 319 m.

Some experts argue that the slow, unpressurized British plane is not in direct competition with the five pressurized commuters. However, the SD360, and only the SD360, is already in production, and it is nibbling away at that 30/50-seat market pie. Shorts Brothers proudly claim "a clear lead of two revenue-earning years over all other 30 to 40-seat airliners now being developed for the regional market". The SD360 is in service in the United States, the world's largest market for short-haul airliners. The U.S. has been de Havilland's best customer for the 20-seat Twin Otter and the 50-passenger DASH-7, and the advance order book for the new DASH-8 shows a preponderance of American airline operators.

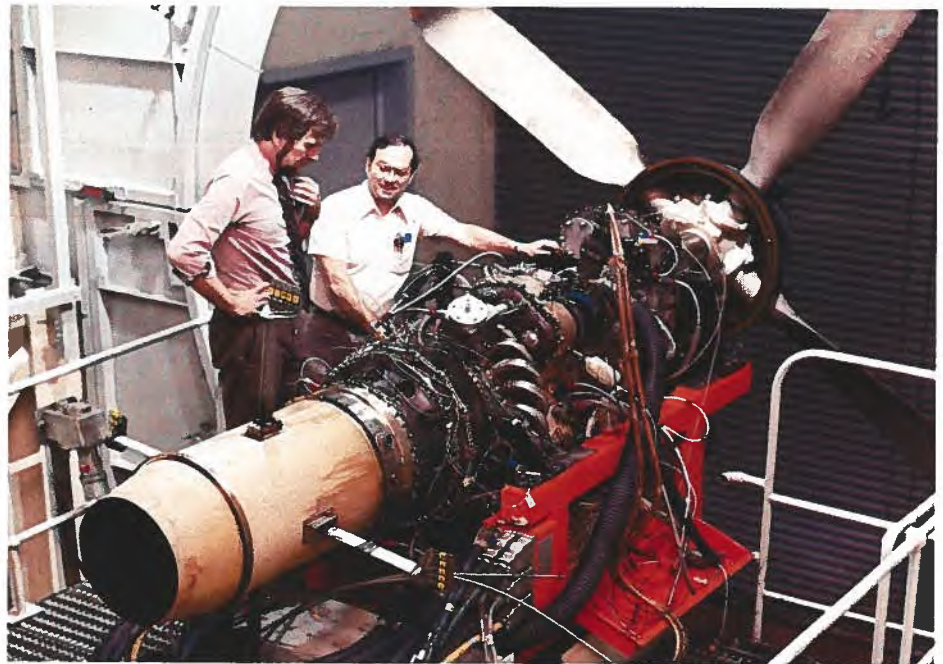
New business from south of the border is especially significant, because for the first time in decades a de Havilland civil plane is in direct competition with an American equivalent. The machine in question is the joint venture of Fairchild Swearingen Corporation of San Antonio, Texas, and Saab of Sweden. Fairchild is one of the most respected names in the small aircraft field, while Saab has an enviable reputation as builder of potent military hardware.

The Swedish-American partnership is a sign of the times: research and development costs for major aerospace programs have become prohibitive except where there is joint investment by the private sector or some form of government support. A classic example is the 150-passenger jetliner sought by leading airlines until last year's catastrophic decline in air traffic. Engines for the proposed 150-seater would absorb an estimated \$1 billion in development overheads. That kind of money being far beyond the budget of even the world's largest manufacturer of jet engines, Pratt and Whitney considered some form of technical collaboration with Britain's Rolls-Royce, Fiat of Italy, M.T.U. of Germany and a Japanese consortium.

Compared to such mammoth enterprises, getting a short-haul commuter

ready for the market is a minor league operation, and U.S. aerospace giants have been content to leave that small and uncertain segment of the aircraft industry to de Havilland and other specialist foreigners. But all that has changed with the Saab-Fairchild SF.340, which made its first test flight in January, five months ahead of the DASH-8. First deliveries of the SF.340 are scheduled for the summer of 1984, with de Havilland in close pursuit. The Swedish-American plane has a higher price tag, longer range and slightly better cruising speed, but the DASH-8 scores with its airfield performance and its ability to take bigger payloads.

Going for the Canadian is a lineage exclusive to thoroughbreds.



Designed and manufactured in Montreal by Pratt and Whitney.

Will national sentiment rather than price or performance give the SF.340 a sales advantage over the Canadian DASH-8 in the U.S. marketplace? Whilst the name Fairchild does identify an American progenitor, assembly of the SF.340 will be completed in Sweden. By contrast, the DASH-8, product of a wholly Canadian company, fairly bristles with instruments, components and materials which originate south of the border or are manufactured in Canada by subsidiaries of U.S. corporations. Add the two engines, made by Pratt and Whitney in Canada, which is owned by United Technologies of Hartford, and the de Havilland DASH-8 would seem to be as American as the SF.340.

Four of the six new aircrafts battling for a slice of the commuter market pie are powered by engines which were designed in Canada and give employment to 6 300 in the Pratt and Whitney plant at Longueuil, Montreal. The British SD360 has two turboprop PT6A units similar to those employed on the four-engine DASH-7. The DASH-8 has new-generation Pratt and Whitney PW120 engines, derivatives of which power the French-Italian ATR42 and Brazil's Embraer EMB120. To complete the engine picture, it should be mentioned that General Electric turbo-prop units, manufactured in the U.S., are specified for the Saab-Fairchild SF.340 and the Spanish-Indonesian CN235.

That three aircraft manufacturers should settle for the same basic Pratt and Whitney power units, with two of their close rivals specifying similar General Electric engines, is not coincidence: the choice is limited, and it so happens that Canada currently satisfies almost 60 per cent of the market for turboprop plane engines.

The PW120 was designed expressly for the de Havilland DASH-8. Had such an engine been available 10 years earlier, de Havilland's manufacturing and marketing strategies would have been different. An airliner of DASH-8 dimensions and seating capacity was the obvious progression from the 20-seat Twin Otter. But in the mid-seventies, before

Market Development

market researchers began their advocacy of a short-haul 30/50-passenger airliner, de Havilland designers considered, then rejected the 36-passenger concept simply because appropriate power units did not exist. It had been decided that the Twin Otter's new stablemate must be pressurized, take a bigger payload, cruise faster at a higher altitude, have a longer range — and in addition to all that guarantee low operating costs, maximum versatility and reliability. Since the horsepower required for such a machine could not be generated by two engines, de Havilland opted for a four-engine, 50-seat commuter, the DASH-7, which made its debut in 1977.

De Havilland expertise in engines dates back to 1909, when Geoffrey de Havilland, founder of the company, designed a four-cylinder 50-horsepower unit to get his first aircraft off the ground. A quarter of a century later, in 1934, to prove the merits of his new six-cylinder, 450-horsepower Gypsy engine, Geoffrey de Havilland built the Comet 1 Racer “because it looked as if American aircraft might be easy winners unless something out of the ordinary were designed”. The American planes in question were Lockheed and Douglas entries in the 17 700-kilometre England to Australia Air Race.

Geoffrey de Havilland recalled that period: “I don't think any of us would care to live again through the weeks of agony that preceded the start of the



The new 36-seat, twin-engine airliner inherits the best features of this four-engine classic.

race. Our test pilot was forced to do the work which usually lasted many months in only a few weeks. The effect of this type of testing on many of us, and certainly on me, was to make it difficult to believe that the machine could ever be capable of a really long flight. But this feeling was, of course, psychological: the Comet had a thorough if unorthodox testing. By the time we arrived at Mildenhall for the start we were half dead from exhaustion.”

Three Comets were built. They finished first and third, with second

prize going to a Douglas DC 2 airliner. The third-placed de Havilland, rather than wait for the award ceremonies in Melbourne, headed back to England to claim the 35 400-kilometre round-trip record.

The 1934 race victor has a place in Canadian aviation history. De Havilland had indeed created “something out of the ordinary”, for as war clouds gathered over Europe, the sleek racer was transformed into what would prove to be the most formidable fighter-bomber of World War II. Two Rolls-Royce engines replaced the original twin Gypsies, raising the total horsepower from 900 to well over 2 000, making the de Havilland Mosquito the world's fastest flying machine. Production of the Mosquito started at Downsview in 1942, launching de Havilland Canada as a manufacturer of aircraft rather than assembler of parts designed and fashioned on the other side of the Atlantic.

Some of the men who learned their crafts with the incomparable Mosquito are making their final contribution to aerospace in preparing four pre-production DASH-8s for test flight programs which stretch from June 1983 through to the summer of 1984. Throughout their entire careers these men, all dedicated enthusiasts, have been at the leading edge of high technology. De Havilland has always been in the forefront, advancing aeronautical science.



De Havilland four-engine Comet, the world's first jetliner.

Geoffrey de Havilland's first engine and the plane it powered lead the way in 1909. De Havilland fighters and bombers were the envy of enemy and U.S. fliers in the first World War. The 1934 Comet triumphed in the world's longest air race. The World War II Mosquito flew faster and higher than friend or foe, carried heavier bomb loads than aircraft twice its size, was one of the first night interceptors equipped with airborne radar equipment and pioneered the use of sophisticated navigation systems.

De Havilland developed the first Allied jet aircraft and designed and built (including engine) its immediate successor, the Vampire fighter which gave the RCAF its first jet squadron.

De Havilland research and development thrust the company's experimental jetplanes through the seemingly impenetrable sound barrier and into the supersonic age. The price was high: Geoffrey de Havilland's eldest son was killed at the controls of a tailless prototype "flying at a speed greater than had previously been attained by man".

The de Havilland four-engine Comet, the world's first jetliner, exposed a new terror in the sky: metal fatigue. The disintegration of two Comets in flight and the subsequent test to destruction of a complete airliner — 375 days and nights of non-stop metal torture — are universally recognized as a watershed in the evolution of aircraft design. Far from directing the quest for fail-safe flight to the absolute limits of speed, altitude and payload, de Havilland Canada has earned international renown with design concepts that compensate for the inhospitable terrain and weather common to many commercial air routes. Canada itself presents an object lesson to aerospace engineers. It stretches from the Atlantic to the Pacific, across a vast continent, most of it at the mercy of climatic extremes, with the seemingly endless patchwork of forest, lake, rockland and mountain seldom relieved by soft green carpets to welcome pilots in distress.

The aircraft designer's recognition of everyday operational hazards is reflected in the short take-off and landing characteristics which have distinguished a string of post-war de Havilland classics, from the Beaver, capable of clearing 15 m obstacles at the end of a 300 m runway, to

the 50-passenger DASH-7, which the March 19, 1983, issue of FLIGHT International described as "unique and offers a level of performance which none of its competitors can match". The British magazine revealed that de Havilland plans to develop a second DASH-7 by stretching the fuselage to accommodate 75 passengers and more freight. Pratt and Whitney Canada would raise the PT6A-50 output to 1 500 shp, improving the cruising speed by 30 knots. In terms of net operating costs, the proposed 75-passenger DASH-7 would show a 22 per cent improvement over the original 50-seater.

De Havilland test pilots knew they had a winner during the first test flight of the DASH-7. Their reports and subsequent customer reaction tempted de Havilland engineers to make the DASH-8 a shorter, two-engine derivative of the DASH-7. In fact, as well as being 4.5 m shorter, the overall diameter of the new plane is 10 cm less.



Prime Minister Trudeau at the DASH-8 rollout, Toronto, April 16.

In terms of passenger comfort, basic statistics are the same for both planes, yet there are subtle ways in which the DASH-8 benefits from the DASH-7's years of operational experience. And the new airliner has that heritage stretching back to 1909, when the cost of progress was measured not by figures in the next annual balance sheet, but in terms of personal endeavour, human accomplishment, product performance and resultant world acclaim.

Technological progress in aerospace has now reached the point where the estimated \$1 billion research and development costs for a new engine for a new 150-seat airliner may have to be shared by a five-nation consortium.

That same trend is evident in the 30/50-seat commuter field. Canada, Britain and Brazil are individually financing their respective enterprises, but the remaining three rivals are products of two-nation manufacturing alliances.

"As development costs grow, you find yourself wondering, could we ever do another brand new airplane alone, or would we have to go out and seek a partner?" That observation was made by John Sandford, de Havilland President, in a CBC television interview on April 29.

Some aerospace experts think that de Havilland's obvious collaborator in some future commuter program might be Shorts Brothers, manufacturer of the unpressurized 36-seat Shorts SD360. But de Havilland also has historical ties with Australia, where the federal government, as in Canada, has ultimate responsibility for an aircraft manufacturer. General Aircraft Factories (GAF) produce 12 and 16-seat versions of the Nomad 22, but in a country as vast as Australia there is need for larger commuters, and indeed the de Havilland Twin Otter, slightly larger than the Nomad, has sold well in the South Pacific. The Canada-Australia aerospace link dates back to 1942, when de Havilland in Toronto sent to Melbourne the Mosquito blueprints that launched the aircraft manufacturing industry in Australia.

Australian operators have placed orders for the DASH-8, as have U.S. airlines. But according to FLIGHT International, the total world market for 30/50-passenger aircraft during the next 20 years may be as low as 1 500, and no more than 3 500.

Divide even the highest estimated total between six rival planes and the average income per manufacturer is dangerously close to the dollar break-even point. For de Havilland, dependent mainly upon exports, and whose traditional customer is the United States, the commuter aircraft market pie must be divided according to product quality rather than national sentiment. ☐

Certain it is that if advanced technology, manufacturing expertise, product excellence and past proven performance determine the bulk of commuter sales, the DASH-8 will earn the lion's share of the pie in the sky.

— by Harry Traynor
Canada Commerce

Public Warehousing — A Cost-Efficient Distribution Alternative

Despite (and possibly because of) the difficult market conditions businesses are facing these days — and will probably continue to face throughout the 1980s — some beneficial side-effects are emerging.

Companies of every size are examining their operations more closely now. They are focusing on methods of using available resources more efficiently; of reducing fixed overheads and improving customer service to maintain and increase their share of the market.

The biggest expense for many companies is distribution — that complex process of getting goods to market.

But most companies are unable to get an accurate fix on just how much their distribution systems actually cost because most of the expenses are buried in a sea of general operational costs. As a result, they are unaware of how efficiently or inefficiently they utilize storage, shipping and transportation resources.

This is not true of all businesses, however. Many of North America's

most successful companies have found a way to make their distribution systems efficient and responsive to customer and market needs by using public warehousing. These companies understand perfectly the high costs of acquiring and maintaining buildings — plus all the other resources needed to operate a distribution system today.

Here's a quick run-down on some of the key costs of having one's own distribution system:

- Land and building construction
- Interest on bank debt
- Heat, light, fuel, insurance, telephone
- Labor
- Transportation and materials handling equipment.

Whether warehouses are filled to the rafters or are half empty, these expenses must still be paid. But with public warehousing, the only costs are for the actual space and service used. And this is one of the key reasons so many businesses are turning to this effi-

cient alternative to owning buildings and incurring the constant overhead expenses that go along with the complexities of distribution in Canada.

There are some general misconceptions that need clearing up about what a public warehouse is, however. It may be perceived as "just a place to store goods" and "hardly the most modern of buildings". There is also the concern about possibly inexperienced people handling goods that need special treatment.

Let's set the record straight.

Today, public warehousing in Canada is a \$250-million industry, and growing. Forecasts estimate the size of this industry will double over the next few years. "There are between 3 and 4 million m² (30 and 40 million sq. ft.) of public warehousing capacity in Canada, including specialized facilities for handling products that need cooling and refrigeration," says the president of the Canadian Warehousing Association (CWA), David Kentish. "Some of the most modern distribution facilities in Canada, with the latest in mechanized equipment, are found in public warehouses, too," he adds.

The CWA, established in 1917, represents more than 80 per cent of public warehouse capacity in Canada. Its 45 member firms operate under a strict set of standards and the association's code of ethics.

Let's take a look at an example of how public warehousing can service a customer.

The Art Company manufactures a wide range of gift items. Its plant is in the Maritimes, but it sells its lines in every province, servicing both large retailers and independent gift and specialty stores. The plant is bursting at the seams, with very little room for storage of raw materials or finished goods.

So the company uses public warehousing to:


- Inventory raw materials and supplies such as packaging. The public warehouse arranges transportation of these items to the factory, as and when needed, and also keeps inventory records for the customer.
- Store finished goods and arrange shipping to other public warehouses in key markets. These shipments are arranged in the most efficient form — using freight consolidation for example.



Some Canadian Warehousing Association members provide more than storage. Modern, computerized distribution management for faster customer service is one key benefit.

Public warehousing provides customers with the most modern and secure facilities and services.

As a service business, geared to meeting the needs of manufacturers, processors, retailers and the public sector, the public warehousing industry must show a high degree of flexibility and cost-efficiency.

The industry is growing — operators are continually investing to provide users with the most up-to-date, secure facilities and reliable distribution services. There are positive signs. The end result is that businesses will have the option of a range of distribution services that can help them lower costs and increase the return on investment. 

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- Process orders to local customers via the public warehouses in key markets. A retailer in Red Deer, Alberta, for example, can get overnight delivery by way of a public warehouse in Calgary or Edmonton. Otherwise, if the goods had to be shipped from the factory, it might take two weeks. Public warehouses in some markets also handle returns and invoicing.

The above example is just that, an example. Let's hear now from a few actual users of public warehousing. "The main feature of public warehousing is its economy," says an executive of The Quaker Oats Company which uses public warehouses in major markets across Canada. "In these times especially, it is simply economical to use public warehousing to cope with the ups and downs of inventory cycles — rather than build our own warehouses."

"Public warehousing is necessary to maintain customer satisfaction as well as to fill orders quickly," stresses a representative of a Toronto-based manufacturing company. His business finds that using public warehousing allows it to provide better customer service. "If we had warehouses in Ontario only," he explained, "it would take between 14 to 21 days to fill orders in B.C.

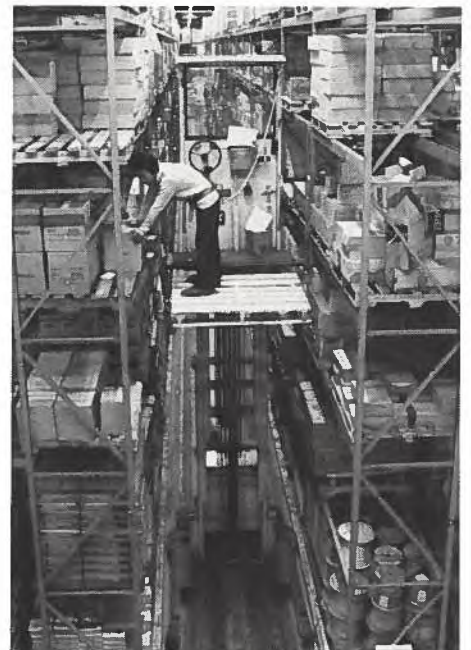
Perishable goods such as foodstuffs require and get the best and most modern refrigeration facilities in public warehouses of the Canadian Warehousing Association and the Canadian Association of Refrigerated Warehouses.

With a public warehouse there, however, we can fill an order in two days."

David Kentish reminds anyone considering utilizing public warehousing that the CWA has high standards that members must maintain to ensure that goods are being handled in the most cost-efficient and reliable manner. Member firms' facilities are inspected annually.

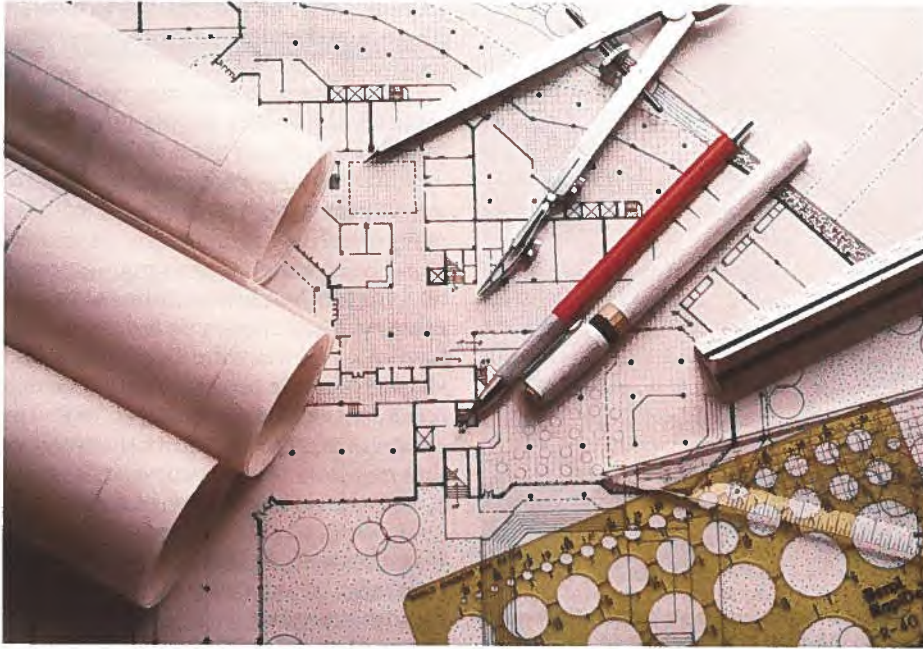
The association's Program of Accredited Service Standards (PASS) spells out the capabilities of a particular warehouse to handle different types of products. These include food, non-food, raw materials, goods needing cooling, refrigeration, or other types of controlled environments.

In addition to the PASS test, members must follow the CWA's code of ethics which outlines methods of general business operation. Public warehouse users must be supplied with detailed information regarding costs, security, and other proper handling procedures.



CWA warehouses have the most modern, efficient equipment and facilities.

Foreign Markets for Construction Projects



Four by Five

Canadian construction techniques go worldwide.

Foreign markets for construction and public works projects present extremely profitable opportunities for Canadian contractors interested in broadening their prospects. These unfamiliar markets are often not adequately developed, and the business community's idea of them is not always consistent with reality. Access to foreign markets is strewn with obstacles, and the only advice that can be given to anyone wishing to venture into them is to be careful to anticipate every eventuality and plan accordingly.

Before tackling a foreign market, a company should first ensure that it has the required competence and can meet the requisite conditions. If so, the company should be able to perform the work specified in the calls for tender by using the right approach. Competitive techniques that have been put to the test will be needed if a business is to have any chance of obtaining contracts because, invariably, a number of companies will submit tenders for the same project. Consequently, the company's expertise and the amount of the tender are vital and determining factors in penetrating

a market — factors which the firm has to try to assess to the greatest possible extent.

It is important for the company to resist the temptation to dissipate its energies in an effort to secure several markets at the same time: such a course of action inevitably leads to failure.

A business wanting to successfully penetrate a foreign market will have to overcome numerous difficulties; for that reason, a comprehensive study of the situation is required. Every factor that

A Canadian construction company should be well established at home before taking its chances on the competitive foreign markets.

might be conducive to success should be taken into account: participation in trade missions; evaluation of the financial risks in relation to the host country's economy and its political system; choosing the most advantageous contracts; methods of financing; currency stability; trade relations with the different levels of government; financial assistance offered by various organizations; and recourse to resource persons familiar with the host country, its traditions and customs.

As a rule, a firm should be well established in Canada before it takes its chances on foreign markets. The economically difficult period through which we are now passing is prompting some Canadian contractors experiencing financial hardship to try their luck elsewhere. Their reasoning is erroneous from the outset because very costly and lengthy preparations are required to become established abroad and the endeavour entails higher operating costs. If the company is already in a precarious position, it runs the risk of seeing its situation deteriorate further because of the numerous expenses involved in establishing an overseas business office.

As soon as a construction firm considers itself capable of extending its services in a foreign country, its executive officers should get in touch with the Construction and Consulting Services Branch of the Department of Industry, Trade and Commerce and Regional Economic Expansion (IT&C/REE), as well as with the Export Development Corporation. Qualified personnel will be happy to provide the company executives with information on the opportunities offered by foreign markets, both in projects and in financing.

A contractor who wishes to carry out construction work abroad will benefit more by participating in a trade mission than taking a business trip on his own. In that way, he will avoid the often unpleasant occurrences and surprises which sometimes happen on business trips that are too short and not properly

planned. The organizers of a trade mission are well acquainted with the host country, have established ongoing relations with appropriate authorities, and have already found local trading partners who are familiar with the laws governing the building sector in that country.

Travel arrangements and access to interpreters are details whose importance becomes apparent upon arrival in a foreign country. The IT&C/REE officials are there to promote the success of the contractor's efforts and ask nothing more than to help find new markets. Finally, a trade mission should last long enough for making visits and courtesy calls and following them by more serious discussions, if satisfactory business arrangements are to be concluded.

Patience is another important quality which can mean the difference between success and failure. It takes approximately two to three years to gain recognition abroad and to study the market practices of another country. That means setting up an office in the host country and spending time and money on carving out a reputation in a business environment whose customs and traditions are new and unfamiliar,

but of paramount importance. Establishing an office abroad requires an annual investment of approximately \$250 000 and considerable energy. It takes persistent efforts to understand foreign trade mechanisms and to establish one's credibility. The conditions under which businesses operate vary from one country to another, and a company's ability to adapt is generally in proportion to the success achieved.

The assistance offered by departmental officials is not only financial; the experience of officers who have headed trade missions can prove helpful.

First, as Hubert Larose of IT&C/REE points out, an agreement needs to be negotiated before it can be concluded, and everything depends on how the negotiations are conducted. The approach to be taken differs from one country to another, and the results obtained from a business trip will depend on the understanding and observance of local traditions. Many contractors with prosperous businesses in Canada have experienced bitter failures abroad because they transposed their negotiating methods to the host country without making any allowance for the different procedures in effect there.

Latin American and African countries serve as good examples. For one thing, electronic communication systems and the postal services are less efficient than they are in North America or Europe. Also, business transactions, as well as confirmations, are conducted face to face, on a person-to-person basis.

Still further adaptation will be required of the Canadian contractor. His representative abroad will have to arrange the times for his appointments, taking into consideration the climate. In tropical countries, a meeting held in the morning when people are fresh and alert is more effective than a meeting on a stifling afternoon when the visitor, unaccustomed to the intense heat, is completely exhausted. Then, too, excessive wining and dining also makes the customers feel out of sorts and they then have little inclination for concluding contracts. It is also very helpful to become familiar with the ways and customs of the people of the host country so as to decide on exactly the right moment to negotiate a transaction. Some people discuss business only at the office, while others handle millions in business over lunch.

At the present time, there are about



Four by Five

Pipeline Construction — a Canadian specialty.

Business procedures differ from one country to another and it is essential that Canadian business persons adapt to each situation.

50 Canadian construction firms working on projects abroad, including a few manufacturers of prefabricated buildings who assemble their products on the site. Of these construction firms, about 30 are really what is usually meant by construction firms. The interesting fact is that half of these firms are from Quebec, a fact which is probably accounted for by a greater ability for linguistic adaptation (French, English, Spanish) among Francophone business people.

One can never place too much emphasis on the observance of protocol in any host country. The way in which business is conducted differs from one place to another, and it is essential for Canadian business people to adapt to each situation. A contractor who prepares building plans must consider the requirements of the people of the country and, if he finds that they are not the same as in Canada, he will have to change his plans accordingly. For example, standards in the North American housing sector allow the kitchen and bathroom in a home to be placed side by side to save on plumbing materials. This arrangement is unacceptable in most countries; the two rooms have to be located at opposite ends of the house.

A wise choice of person to represent the construction firm abroad is a matter of prime importance. The person selected will project the company's image in the host country and will have to make decisions whose consequences will be of the utmost importance in obtaining contracts. Experienced in communicating, independent, and respectful of the customs, he will be able to adapt quickly to the country's food, language and protocol. He will have a clear mandate and some decision-making authority and will, if necessary, be able to ratify agreements without having to be in constant communication



Canadian technology can help world construction.

with his firm's head office. Also, the company which hires him will see that he is suitably established in the host country to enjoy an attractive life style, travel around quickly and adopt a pace that facilitates his work.

Similarly, a wise choice of local partner in the joint venture is of equal importance. Whether an individual or an organization, the chosen partner must have considerable political influence. IT&C/REE and the Canadian Embassy, which maintain relations with the people of the country, can often recommend good partners.

It is also necessary to know one's competitors, both in Canada and abroad. If a firm's service or product is financed through the Export Development Corporation, it will not have to compete with other Canadian companies if its bid is the lowest. If a contractor tenders for a contract on a project financed by the Canadian International Development Agency, other Canadian firms may also be tendering. If a company is competing with other Canadian firms before it is even established abroad, its chances of earning any profits will be in jeopardy.


In the case of multilateral projects, the competition comes from the other member countries in the organization as, for example, in World Bank or Inter-American Development Bank projects.

Finally, it should be noted that most tenders, to receive favourable consideration, should contain a blanket offer with financing and personnel training, even though no such requirement is in the call for tenders.

The competition does not stop there. Canadian contractors have to withstand competition from local firms of the developing nations which have acquired sound capabilities through past links with foreign companies. These countries enjoy a distinct advantage over Canada as the volume of Canadian exports in the building and public works sector amounts to only some \$700 million or 1.5 per cent of the national volume of construction activities, while the international market is valued at hundreds of billions of dollars. A number of rival nations are now collecting 30 per cent of their gross receipts from construction abroad, and sometimes even up to 60 per cent.

Furthermore, the lack of colonial ties does nothing to help Canadian firms break into foreign markets. The commercial links with former colonies still maintained today by countries such as France, Spain, England, Holland and Portugal give these countries a distinct competitive advantage.

The complexity of foreign trade demands that a comprehensive approach be adopted to ensure the success of Canadian building contractors wishing to extend their activities into other markets. A concerted effort is needed to facilitate project financing and prevent unnecessary competition between Canadian contractors. A laissez-faire policy in this industrial sector inevitably leads to limited success. When Canadian companies vie with each other for a contract, they lessen their chances of achieving any substantial profits.

The intervention of government and paragonovernmental agencies in assigning firms their share of foreign markets is a regular occurrence in many countries. It remains to be seen whether Canada is ready to introduce such a procedure, considering that it is contrary to our current normal practices. A balanced measure of participation by government and private organizations in preparing businesses cannot fail to be of benefit to the entire foreign construction sector. 

— By Pierre Simard
Canada Commerce

Engineering Canada's Future

Canada's consulting engineering industry has been described as "aggressive, dynamic and modern" — competitive in both domestic and international markets and ranked among the most developed in the world.

In a recent report, presented to the Department of Industry, Trade and Commerce and Regional Economic Development (IT&C/REE), the industry is shown to support an annual payroll of approximately \$1 billion and to play an important role as a repository of technological and managerial expertise.

It has a further, less tangible but nonetheless real, impact on the country's economy because of its relationship with other industrial sectors. It provides for rationalization, design and management of expansion and development contributing directly to the economy and efficiency of those sectors. At the same time, the report shows, the industry has a direct effect on the manufacturing and supply industries through the specifications for materials and equipment.

The report, *Realizing the Potential*, was prepared by The Consultative Committee on the Canadian Consulting Engineering Industry.

Canadian consulting engineers have been successfully involved in major capital projects not only in Canada but around the world providing a wide range of services including:

- Feasibility Studies to determine the economic viability or broader impact of a project;
- Planning and Design Development including preparation of site development plans, preliminary layout of the facility, process studies, design standards and equipment requirements;
- Detailed Design involving all aspects of preparing final designs and drawings together with specifications for construction;
- Field Services During Construction including the verification of construction work for general conformity to drawings and specifications for the work;

- Project Management which involves representing the client and undertaking all or most of the administrative responsibilities for the project. In addition, this can include procurement of equipment and materials, management of construction and overall co-ordination of the project.

In many cases, the report says, consulting engineering firms can and do acquire the full range of Engineer, Procure, Construct (EPC) capabilities and, acting on behalf of owners/sponsors of a specific project, can carry out and oversee the design of the project, pro-

Many Canadian consulting firms are involved in a broad range of activities from urban planning through computer studies to market analyses.

urement of materials, special services, construction and commissioning of facilities.

In addition, many are involved in urban and regional planning, pollution control, arbitration and litigation, computer science, data processing and transmission, environmental impact studies, financial and market analyses, tender evaluation and commissioning of operations.

There are 12 basic sectors in which they are involved: municipal; buildings; petroleum and natural gas; power; mining and metallurgy; plant process; transportation; forestry, etc.; dams and irrigation; air and seaports; telecommunications; miscellaneous.

In 1980 there were approximately 1 700 firms in Canada varying in size from one-person operations to staffs of

several thousand and employing about 42 000 professional engineers, non-engineering professionals, technicians/drafting and administrative/clerical.

The foregoing indicates some of the pluses and the status of the industry. What about the minuses and potentials?

"There is an excellent opportunity in Canada for the development of a much stronger and more competitive consulting engineering industry than presently exists," the report states.

"The program for resource and energy development currently underway and projected for the year 2000 will impose a heavy surcharge of capital expenditure in the construction and development industries and will provide greater opportunity for the involvement of Canadian consultants in large projects.

"The potential for growth and economic strength of the industry will be constrained only by the size of the market available to it and its ability to service that market competitively."

The report points out that the size of the market available is "the total value of engineering done in Canada, less that carried out in-house by government and industry or imported.

"Therefore, the potential for the private sector consulting industry is greatly affected by government and corporate policy on 'contracting-out'. In fact, the consulting engineering industry is unique in that the principal competitors faced by its members are its hoped-for clients and those clients control the programs and the budgets."

The federal government has responded favourably to various submissions with a policy of "buy" rather than "make" but neither provincial nor municipal governments have adopted similar policies, the report continues. Both types of government tend to do much of their engineering in-house.

There is also a potential for carrying out increased engineering for private sector corporations which have extensive in-house engineering staffs of their own. In such cases "the opportunity for consultants would seem to lie in developing an understanding of the market and an ability to demonstrate special expertise and economy of delivery".

"In addition to expansion and development aspects, there are markets in private industry for process engineering and manufacturing, equipment, and machinery design which have not been seriously developed by consulting engineers. . . . The development of such markets will undoubtedly be related to the success of programs initiated to develop the research and development capability of Canadian consulting engineers."

Research and development (R&D) is one area in which the report states the industry is at present weak.

"The Canadian consulting engineering industry is not achieving its potential in research and development at a time when Canada is seeking initiatives that will increase participation in the private sector.

"The future of both Canada and its consulting engineering industry are vitally dependent on the exploitation of science and technology for the enhancement of life style, production of goods and services, and the improvement of our position in competitive world trade."

The industry, "with its vast reservoir of scientific and technological skills and its potential for effectively executing R&D programs, is ideally suited to making a major contribution to" the federal government's program of increasing R&D expenditures to 1.5 per cent of the GNP by 1985.

The report outlined the committee's belief that "the future competitiveness and prosperity of the consulting engineering industry is closely linked to its conduct of R&D on a much increased scale. In this way, the scientific and technological capability of the industry would not only be utilized but enhanced with a consequent overall improvement of performance by the sector and its client industries."

Three ways in which the industry can participate in R&D are — through sponsorship of government; through paid studies commissioned by private industry; and through the commitment of individual firms' "own account" to R&D programs.

"In all likelihood," the report states, "a healthy on-going research and development department in a firm would be sustained in all three ways. The immediate requirement is to stimulate the establishment of such departments."

Since exports of goods and services are extremely important to Canada's economy, it is natural that exporting is also important to the consulting engineering industry.

"In Canada's overall export effort," says the report, "the exports of engineering services may in many respects be considered unique because such exports can contribute to a realization of government objectives in several ways.

"For example, exports of engineering services, while having a positive effect on Canada's balance of payments account, can also be effective in opening markets for Canadian goods and follow-on services. Moreover, through the transfer of knowledge to the export marketplace in the conduct of engineering assignments, the image of Canada as a modern industrial state is enhanced.

Exports of engineering services serve to increase the number of satisfying jobs for Canadians domestically, specially in trained categories.

"This enhancement is complemented by the fact that exports of engineering services serve to increase the number of satisfying jobs for Canadians domestically, especially in the highly trained and professional categories."

According to the report, there is opportunity for much growth in the export of engineering services, particularly where the industry has achieved strength and diversification in the domestic market.

"Diversification of exports will allow more firms to take part in exporting services, open up new markets and allow the number of Canadian firms engaged in exporting to grow. As Canadian consulting engineering firms become more knowledgeable in exporting, imports (of engineering services) may be further reduced."

Looking to the future, the report states that by any standard of measurement, the future of the industry must be regarded as "very bright indeed".

"Even with this current economic recession which is creating unprecedented hardship for the industry in all ranges of company size and in all locations in Canada, the industry's leaders look to the future with great confidence."

This confidence is based on many factors among which are first rate technological capability and competitiveness in an extensive range of industrial activity; strong marketing orientation; widespread international acclaim and respect. This respect is not only for such spectacular achievements as the Canada Manipulator Arm of the Columbia Space Shuttle but for "the efficient, effective completion in distant locations of myriad assignments, great and small, that have extended the reputation of Canadian firms far beyond the locale of the individual project".

In addition, the confidence is based on the immense amount of work expected from major developments in Canada over the next 20 years. Also, the Canadian industry is strategically positioned "to offer leadership in engineering services to a world" demanding progress toward adequate food and water supply and distribution, good shelter and municipal and health services comparable with those of the West.

Further, Canada's technical colleges and universities "comprise a structure ranking high on the list of such institutions among advanced countries". From such institutions have come and will continue to come graduates with "increasingly higher educational attainments".

Finally, the Canadian consulting engineering industry appears to be better served than most by its professional and business associations, the report states. These groups "have been extremely effective in helping to foster the kind of climate that is most hospitable to its development".

"One of the outstanding characteristics of the Canadian consulting engineering industry is its flexibility in terms of survival, growth and adaptability to change. These characteristics will become in all likelihood much more apparent in the future which, it is anticipated, will be subject to new political and market trends." □

Pre-Job Planning Important To Construction Productivity

Mechanical Contractors Learn How To Increase Productivity Through ITC/REE-Sponsored Seminars Which Focus on Job Planning and Materials Handling

Since 1981, mechanical contractors across Canada have been learning the techniques of pre-construction planning for material handling on the site to increase their productivity.

According to John Long, executive director of the Mechanical Contractors of Canada (MCC), the seminar program was the direct result of a number of Interfirm Comparison Studies done by the former Department of Industry, Trade and Commerce (see *Canada Commerce*, April 1983, "Productivity: It Must and Can be Improved") for mechanical contractors started in 1979. These studies showed a very large discrepancy among firms in terms of value added per hour worked.

For example, in British Columbia, among firms with sales over \$3.5 million, the upper quartile had sales or value added of \$45.84 per hour as compared with sales in the lowest quartile of \$24.74, a difference of 85 per cent. For those firms with sales under \$1 million, the difference was even more startling — \$66.67 as compared to \$31.82 or 110 per cent difference.

For Paul Johnson, President of Archie Johnson Plumbing and Heating of Nanaimo, B.C., the Interfirm Comparisons results were a real eye-opener. But what to do about improving the situation was the real challenge to himself and other mechanical contractors. At about the same time Johnson learned of the then Department of Industry, Trade and Commerce (ITC) interest in the work of Kerry O'Brien, an industrial engineer who was developing work measurement studies in the construction industry. Unlike the stop watch method of measurement long associated with industrial plant productivity studies, the O'Brien method used work sampling surveys to get a reading on construction productivity.



Pre-construction planning of material handling increases efficiency.

Initial studies indicated that skilled tradesmen were spending 32 per cent of time on direct installation.

In operation, work sampling consisted of observing the tradesmen at random times throughout the day (four times an hour, eight hours a day for 10 days) and dividing their activity into five categories — direct installations, indirect operations, materials handling, ineffective activities and miscellaneous.

These initial studies showed that the skilled tradesmen — steamfitters, plumbers, sheet metal workers and electricians — were spending only 32 per cent of their time on direct installation.

This included on-site pre-fab, testing and actual installation and was fairly constant over a variety of projects during a five-year period. Other breakdowns showed ineffective activities took 26 per cent; materials handling 20 per cent; indirect operations 15 per cent; and miscellaneous seven per cent.

To increase productivity, O'Brien tackled two of the non-direct sectors — materials handling and indirect work. By pre-planning of the work so that these operations were reduced it was found that ineffective time was also reduced and as a result direct installation time went up from 32 to 52 per cent — an effective increase in productivity of 63 per cent.

To spread these ideas in the industry, ITC contacted John Long of MCC who, in turn through Johnson, arranged for a seminar led by O'Brien to be given to the members of the B.C. Mechanical Contractors. While the original seminars (1980/81) were aimed primarily at mechanical contractors, the current year's series is targeted to the entire spectrum of the construction industry — owners, architects, engineers, prime contractors, as well as mechanical contractors.

While many different factors affect productivity on the job site, O'Brien found job planning and materials handling the most promising places to start productivity improvement — the "starting wedge" where immediate results are evident.

But to be truly effective, materials handling must be pre-planned and it is at this stage that it becomes the business not only of the mechanical contractor but of all the segments involved in the construction cycle. By bringing together all the elements in the pre-planning sessions, most if not all the materials handling and scheduling problems can be worked out.

These elements include:

- Easy access and egress to the construction site;
- Delivery scheduling of materials from various sub-contractors to prevent traffic congestion;
- Design and placement of hoisting equipment to facilitate the use of pre-packaging and forklift handling;
- Adequate storage areas adjacent to the various work areas;
- Well planned loading docks;
- The use of off-site pre-fabrication to relieve on-site clutter;
- Maintenance of a rigid housecleaning regimen to improve material movement and job site safety;
- And, perhaps most important, the palletizing or containerizing of all material brought on the site to facilitate its handling by forklift, hand-truck or pallet jack.

While taken individually, the various elements seem to be very simple. When taken in the context of a large project the logistics become very complicated and require a serious commitment from all parties — from the company president down to the job foremen. Each in his own way, according to O'Brien, is able to contribute to the overall objective.

By applying his industrial engineering skills to materials handling, O'Brien developed a six-step sequence that materials and equipment must follow from supplier or fabrication shop to final installation.

Six-step sequence was developed for the general improvement of materials handling operations.

The checklist developed for each step includes these questions:

Packaging/containerization —

- What type of container should be used for the material being analyzed — pallet, custom made container, standard "off-the-shelf" container?
- What container details should be specified?
- What number of items per container?
- What protection will be required?
- What packing method?
- What about identification and destination?

Trucking to site —

- What methods will ensure maximum utilization of trucks and also ensure most effective truck unloading at site?

Truck unloading —

- What should be done to ensure minimal handling of material in unloading operations?

- What provisions will ensure that material can go directly to its final destination, the point where it is to be installed?
- Is there a proper truck level receiving dock at the material hoist?
- Is proper materials handling equipment and trained crew available?

Hoisting —

- What information about project hoists and cranes will be needed to permit design and use of the most effective materials handling equipment and systems?
- Will the locations, loading capacities and dimensions as well as erection and dismantling dates of hoists require special hoisting provisions to be addressed?

Horizontal handling on floors —

- How can minimal handling of materials be ensured?
- How can double handling be avoided?
- What are the requirements for material handling crews and equipment?

Vertical handling —

- How can indirect operations be reduced to a minimum?
- How can installations of the various components and work of the trades be integrated into a logical and efficient work flow?
- How can effective housekeeping be carried out with minimum disruption to other work patterns?

While pre-planning of materials handling was the wedge, Kerry O'Brien has found that the development of this exercise has resulted in the same approach being taken in other areas of the job, resulting in solutions and increased productivity. ☐

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— by **Bob McDonnell**
Canada Commerce



Four by Five

Planning also important in indirect operations such as moving equipment.

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