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Canada

2 DEPARTMENT OF INDUSTRY, TRADE AND COMMERCE

3 OFFICE OF SCIENCE AND TECHNOLOGY

THE INDUSTRIAL RESEARCH INSTITUTE PROGRAM
THE CENTRES OF ADVANCED TECHNOLOGY PROGRAM
THE INDUSTRIAL RESEARCH ASSOCIATION PROGRAM

4 1974 PROGRESS REPORT



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THE INDUSTRIAL RESEARCH INSTITUTE PROGRAM

Introduction

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The Industrial Research Institute program was introduced in 1967 following discussions between the Department and several universities. The universities wished to improve communication between themselves and industry and, also, through close association with industry, to modify their educational and training programs to better suit the needs of industry. At the same time, it was recognized that there are many industrial firms that are too small to sustain effective, in-house research and development activities. It was considered that such firms, and larger firms requiring specialized equipment or assistance, might be encouraged to make use of the equipment and expertise of the university.

Consequently, the objectives of the program are:

- to encourage universities to provide scientific services and to conduct research and development projects for industrial firms unable to maintain adequate facilities and personnel of their own;
- to encourage universities to provide specialist services to larger companies wishing to enter new fields or to undertake special research projects which do not justify the acquisition of permanent staff;
- to help alleviate the shortage of scientific and technical resources existing in some areas of Canadian industry;
- to provide universities, through closer association with industry, the opportunity to co-ordinate more closely their educational and training programs with the current requirements of industry;
- to foster greater interaction between industry and universities, and thus assist universities to gain a better appreciation of industrial problems and enable industry to become aware of pertinent scientific and technical work being undertaken in universities.

Form of Assistance

Assistance takes the form of grants to help cover the cost of salaries and wages of a director, his assistant, a small secretarial or clerical staff, and certain administrative costs of maintaining an institute. Such assistance is only available during the formative years of an institute when the contractual research performed on behalf of industrial clients is likely to be relatively small. The direct cost of carrying out research or other technical activity is paid for by the client for whom the work is done. In addition to this direct cost, the client's fee also includes an overhead charge designed to provide monies that can supplement and eventually replace the assistance provided by the Department of Industry, Trade and Commerce. It is expected that institutes will become self-sustaining in five years but assistance may be provided for seven years when this is warranted.

Grants authorized to date (March 31, 1975) amount to \$2,158,452 and are summarized below:

<u>University</u>	<u>Authorized Grant and Term</u>	<u>Termination Date</u>
Nova Scotia Tech.	\$270,000 - 7 years	March 31, 1974
Windsor	236,895 - 7 years	June 30, 1974
McMaster	358,000 - 7 years	Sept. 30, 1974
Waterloo	244,557 - 6 years	Nov. 30, 1973
McGill	204,000 - 4 years	Aug. 15, 1975
Ecole Polytechnique	260,000 - 5 years	Sept. 30, 1976
Ryerson	90,000 - 3 years	July 31, 1975
Guelph*	150,000 - 3 years	March 31, 1976
Université du Quebec à Montréal	180,000 - 3 years	May 31, 1976
University of Manitoba	165,000 - 3 years	Sept. 30, 1976

* This grant was terminated July 31, 1974 after payment of \$65,383 and operation of the Food Industry Research Institute is presently in abeyance.

Progress in 1974

Among the ten institutes that have been established under this program, progress was very mixed in 1974. The following table shows the annual value of work performed by each institute during the past five years. (The actual fiscal year for each institute is different. The figures shown in the table represent billings in the fiscal year pertaining to each institute which ended in the calendar years indicated at the head of each column).

	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>
Nova Scotia Tech.	\$312,860	\$341,365	\$275,671	\$217,412	\$264,124
Windsor	59,517	44,001	101,239	169,866	170,294
McMaster	198,947	122,003	120,562	138,695	203,344
Waterloo	248,080	284,666	438,929	514,229	604,596
McGill	-	-	47,851	236,965	417,176
Ecole Polytechnique	-	-	158,409	378,597	577,636
Ryerson	-	-	-	47,394	35,296
Université du					
Québec à Montréal	-	-	-	-	132,874
Univ. of Manitoba	-	-	-	-	-

Waterloo Research Institute, the first institute to become self-supporting, had a very good year and contract volume continues to increase. The institutes at Nova Scotia Technical College, McMaster University and the University of Windsor completed seven-year terms of grant support in 1974. Income from operations at present is sufficient to enable them to continue but their future viability will depend on vigorous efforts to reduce operating costs and increase contract income. The three institutes in Montreal have developed very well and it is anticipated that they will emulate the success story of Waterloo. Indeed, the Office of Industrial Research at McGill University has been most successful financially and should be self-supporting at the completion of only four years grant support. Ryerson Applied Research Limited is operating at a very modest level but costs are being kept to a minimum and the long term prospect is one of optimism. Difficulties at the University of Guelph caused the Food Industries Research Institute to terminate operations in 1974 and the University of Manitoba was only successful in appointing a director for the Office of Industrial Research very late in 1974.

The useful role that the institutes play can not be assessed only in terms of the dollar value of contract income. The institutes have awakened an interest within universities of the world of business and industry and have provided a mechanism whereby faculty and students can become involved in problems of the real world. For example, in 1974, 77 faculty members and 75 students were involved in contract activity at McGill; at Windsor, 39 faculty members and 37 students participated in the work of the Institute.

Management of research funds is becoming increasingly important in universities and there is now a trend towards the establishment of administrative structures that combine the responsibilities for contract research funds and grant research funds. The Waterloo Research Institute has now been incorporated into the operations of the Office of Research Administration and similar steps are in various stages of development, or are under consideration, at McMaster University and the University of Windsor.

Such restructuring activities may well see the phasing out of Industrial Research Institutes as discrete organizational entities but the work carried out by the institutes will continue and, undoubtedly grow, under the new administrative mechanism. Even though the names of the institutes might change or even disappear, the objective of the program will have been met with the establishment of a continuing activity within the universities that attempts to make the knowledge and skills of university faculty available to industry and business for the solution of unique problems.

Besides dealing with specific industrial problems, the institutes also foster greater interaction between government, business, industry and the university by organizing courses and seminars. Typical examples are courses on "Stack Sampling" by the University of Windsor and courses on "Audiometric Testing" for industrial nurses and "Measuring Noise Levels" for plant engineers organized by IRI McGill. The Atlantic Industrial Research Institute at the Nova Scotia Technical College promoted the International Conference on Strontium Containing Compounds and the proceedings of the Conference are presently being published. This activity is particularly relevant to the work the Institute has been carrying out on the use of strontium compounds as glazes for brick and tile.

The range of problems handled by an institute on behalf of industrial and government clients often encompasses the total spectrum of resources within the university. However, since the work is performed in confidence for the client, it is not possible to elaborate on specific contract activities. Nevertheless, it is interesting to note the following:-

- a) A major project for IR McGill last year was to work closely with MacDonald College to obtain funding for, and eventually establish, the MacDonald Embryo Transplant Unit. The Unit includes an operating clinic, offices and barn and commenced offering commercial transfer services in early 1975. Forward contracts prior to commencement of operations exceeded \$350,000.
- b) The institute at the Université du Québec à Montréal - le Centre des recherches en sciences appliquées à l'alimentation (CRESALA) - has developed the Catalasimètre. This instrument, which gives a rapid estimation of the amount of the enzyme catalase in a solution, has been licensed for manufacture by a Montreal company. Since catalase is present in many fluids of vegetable, animal and human origin in amounts that vary according to the condition of the material, this test is a convenient way of assessing the state of purity or health of the vegetable or animal, respectively. The new test method replaces a laborious and time consuming method and opens the way for the use of catalase determinations as a routine diagnostic tool in medical and food manufacturing operations.

- c) The Atlantic Industrial Research Institute has successfully developed salt water batteries for long term application as well as flexible electrodes for other applications. Long term testing is currently underway in a seawater laboratory at the Dalhousie Institute of Oceanography.

Although the individual institutes have exhibited various degrees of success (and failure) the Industrial Research Institute Program has been quite successful. Figure 1 shows a comparison of the annual grants made under the program with the total annual incomes from contracts of the institutes. It is anticipated that the total annual contract income of the institutes will continue to increase in the future whereas the grants made under the program will begin to decline in 1975. Grants presently in force are scheduled to terminate before or during the fiscal year 1976/77. Extensions to some of these grants may be made but it is unlikely that more than one new institute will be established in the future. Consequently, annual expenditures under the Program should gradually decrease and finally cease completely within the next five to seven years.

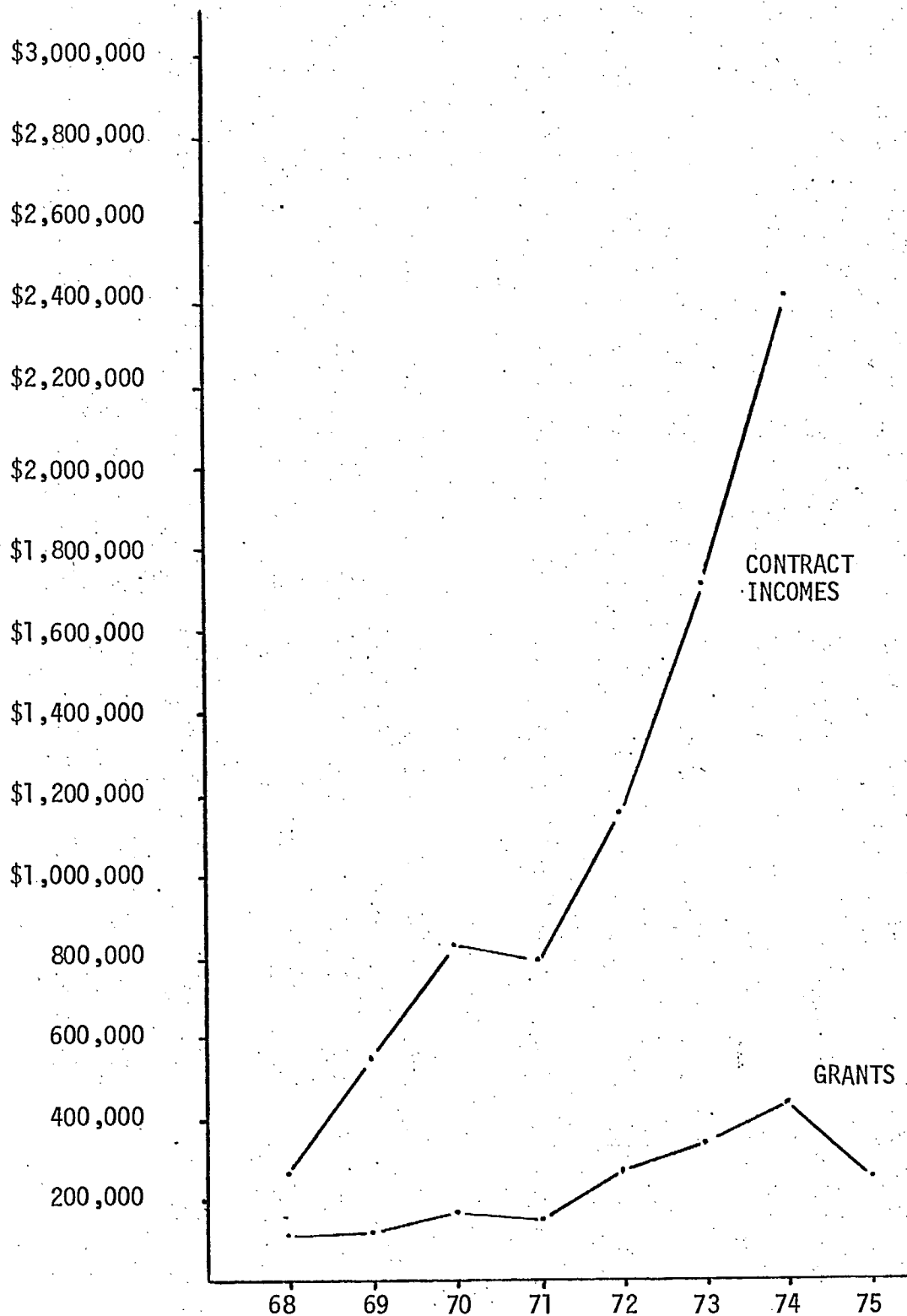


FIGURE 1. TOTAL ANNUAL GRANTS MADE TO INSTITUTES AND TOTAL ANNUAL CONTRACT INCOMES OF INSTITUTES.

THE CENTRES OF ADVANCED TECHNOLOGY PROGRAM

Introduction

The Centres of Advanced Technology program was instituted in 1968 for the purpose of providing funds to universities and other organizations with research capabilities for the establishment of research programs in specific technological areas of interest to industry. As a result, universities and other organizations now are able to establish centres of expertise in fields where industry is unable to conduct the research necessary to develop new areas of technology, or where many industries seem likely to benefit from research in a common technological area.

The objectives of the program are to establish centres of specific technological expertise which can:

- provide assistance to industry in the form of basic and applied research;
- provide technical development assistance to industry;
- provide training to industry in specialized techniques of management, operation and evaluation;
- provide training relevant to industrial needs to graduate and senior undergraduate students;
- provide programs of research, relevant to industrial needs, to graduate students and to faculty.

Form of Assistance

Assistance takes the form of grants to support the establishment and initial operation of a centre. Payments during any one year are limited to a fixed amount and can be applied to cover:

- purchase of specialized equipment;
- salaries and wages of the professional and support staff;
- rental of space and equipment;
- cost of materials and supplies;
- travel and similar administrative expenses.

Such assistance is only available in the formative years of a centre when contract research performed on behalf of industrial clients and other forms of income are likely to be small. As a centre develops expertise in its specific technological area, it is expected that it will obtain sufficient funds from industrial sources to enable it to continue in existence. Assistance from the Department is limited to a maximum of seven years.

Grants authorized to date (March 31, 1975) amount to \$5,275,000 and are summarized below:

<u>Name of Centre and Parent Institution</u>	<u>Grant, Term & Termination Date</u>
Canadian Institute of Metalworking (McMaster University)	\$600,000; 4 years; Sept.30/74
Systems Building Centre (University of Toronto)	\$300,000; 3 years; Sept.30/74
Centre for Powder Metallurgy (Ontario Research Foundation)	\$450,000; 3 years; June 30/74
Centre for Ocean Engineering (B. C. Research Council)	\$1,225,000; 3 years; Mar.14/76
Systems Analysis, Control and Design Activity (University of Western Ontario)	\$525,000; 3 years; Oct.31/76
Centre for Ocean Technology (Nova Scotia Research Foundation)	\$875,000; 5 years; May 31/79
Centre de technologie de l'environnement (Université de Sherbrooke)	\$300,000; 3 years; Oct.31/77
Canadian Food Products Development Centre (Manitoba Research Council)	\$1,000,000; 5 years; Mar.31/79

Negotiations are proceeding with the Ontario Research Foundation, the University of Toronto and McGill University concerning additional centres.

Progress in 1974

Two Centres of Advanced Technology, the Centre for Powder Metallurgy and the Systems Building Centre received their final grants under the program in 1974 and are now continuing on the basis of support by the parent institution

and revenue from services rendered to industry. The grant in support of the Canadian Institute of Metalworking ended in 1974 but, since the Centre had difficulty in commencing operations due to the unavailability of equipment, negotiations are being completed to extend the grant for a further two years.

Two centres (SACDA and the Centre for Ocean Engineering) were established in 1973 and three more were established in 1974; the latter being the Centre for Ocean Technology, the Canadian Food Products Development Centre and the Centre de technologie de l'environnement (Environmental Technology Centre).

Activities of New Centres

The Centre for Ocean Technology at the Nova Scotia Research Foundation is concerned with the development of devices and equipment to be used in, or on, the ocean and particularly items which can be manufactured by firms in the Atlantic Provinces. The Centre will carry out research and development work either under contract, in which case the results of the work will be the property of the client, or using its own funds, in which case the results will be the property of the Centre and will be the subject of manufacturing licences granted to firms interested in producing the new devices. Royalties derived in the latter case would be used to carry out further R&D work.

The Canadian Food Products Development Centre at the Manitoba Research Council is being supported jointly by the Department of Industry, Trade and Commerce and the Government of Manitoba. It will seek to identify and develop opportunities for new or improved food processing activities in Canada and particularly in Manitoba.

The Centre de technologie de l'environnement at the Université de Sherbrooke will undertake investigations concerning solid and liquid wastes resulting from manufacturing and mining operations with the objective of either converting part or all of the waste into useful products or else rendering it innocuous and thereby permitting its ready disposal without causing a pollution problem.

Activities of Existing Centres

The basic purpose of the Canadian Institute of Metalworking is to assist industry with the introduction and use of numerically controlled machine tools by any of the following activities: analysing a company's production problems and recommending the appropriate numerically controlled machinery, preparing tapes for the machine tools, providing specialized training courses for company staff in the use of numerically controlled machinery, production of limited quantities of items using the Institute's numerically controlled machinery either to demonstrate the feasibility of the process or to fulfil a need that cannot be met by a normal machine

shop without significant disruption of operations. The Institute has its own staff who are capable of solving most of the metal cutting problems that can be handled by numerically controlled machinery. For assistance with unusually difficult metal cutting problems, the Institute can call upon the Metalworking Research Group in the University.

Although the Institute had difficulty in acquiring the necessary machine tools and ancillary equipment, it is now fully operational and developing considerable contract work. Revenue from operations in 1973 was \$33,000, in 1974 it was \$70,000, and in 1975 it is expected to approach \$150,000.

The Systems Building Centre at the University of Toronto serves as a focus within the University for the stimulation of academic courses in building science and for the involvement of faculty and students in practical problems related to construction activities. The concerns of the Centre have been somewhat different from those originally intended and implied in the name of the Centre. Emphasis has been placed on the evaluation of new construction products and the development of new techniques. A patented process for the production of reinforced cement products in a manner somewhat analogous to fibre-reinforced plastic products has been licensed and is expected to bring many research and development problems to the Centre. Contract activity has developed satisfactorily amounting to \$14,245 in 1972/73, \$35,009 in 1973/74 and \$70,000 in hand early in the year 1974/75.

The Centre for Powder Metallurgy was created at the Ontario Research Foundation to stimulate and support the development of the powder-metallurgy industry in Canada. Equipment for preparing metal powders and converting them into metal parts has been acquired. During the third year, two powder presses were added and a cracked ammonia generator for providing low dewpoint commercial sintering atmospheres has been ordered. Studies have been made of ferrous alloy powders, fracture properties of P/M steel forgings, sintering kinetics and preform forging techniques using conventional and high energy rate forming processes. The ultimate aim of the forging program is to produce commercial parts and thus demonstrate the applicability of the powder metallurgy forging approach to industry. Several such parts have been produced and strong interest has been shown by industry. Nevertheless, contract activity has remained relatively modest - of the order of \$70,000 per annum.

The Centre for Ocean Engineering at B.C. Research is being developed as a result of a grant effective March 15, 1973. During the first twelve months of operation, earned income from industrial contracts amounted to almost \$200,000. Work was carried out on towlines, wave compensating systems, strain gauging, wave buoys, testing of materials, ship modelling and various design problems. A comprehensive towing tank/manoeuvring basin with Arctic and shallow water capability is presently being constructed and should be completed in mid-1975.

The Systems Analysis, Control and Design Activity (SACDA) has been established at the University of Western Ontario (effective October 15, 1973) with the following objectives:

- a) the development of general mathematical and computer techniques for the analysis, control and design of complex manufacturing systems, service systems, and processing systems;
- b) the extension of these mathematical and computer techniques for the analysis of broader, complex problems such as ecological systems and econometric models;
- c) the evaluation and design of control systems for manufacturing plants through a mathematical modelling technique;
- d) the evaluation of computer programs developed outside Canada, and the transfer of these programs to Canadian manufacturing industry under suitable licensing or technology exchange arrangements;
- e) the development of a Canadian manufacturing systems library of computer programs.

The first twelve months of operation of SACDA have been devoted largely to the acquisition of staff and equipment and the development of expertise. Arrangements have been made with the Computer Aided Design Centre at Cambridge University and the Computation Centre of the Japanese Union of Scientists and Engineers for the evaluation and marketing in North America of unique computer programs relating to process control and optimization. Two seminars have been organized: one dealing with the use of the above mentioned computer programs and the other concerning the modelling of air quality in a petrochemical centre based on a moving, remote sensing facility. Two graduate courses dealing with optimization and the modular approach to system analysis and design were organized by SACDA personnel and presented to both graduate students and participants from industry. Similar short courses on process simulation are to be presented for the Sheridan Park Community. Process simulation work on a chemical plant making a range of products has led to a 40% increase in production. Further work is being carried out on process design and equipment modifications to raise production capability a further 50% and, by designing more efficient pollution control equipment, to reduce pollution and give a higher raw material conversion efficiency. Although these activities provided only nominal income for SACDA in the first twelve months, they have materially assisted in establishing the competence of the organization. Income from contracts is expected to reach \$60,000 in the second year of operation.

THE INDUSTRIAL RESEARCH ASSOCIATION PROGRAM

Introduction

The Industrial Research Association program is intended to provide encouragement to sectors of industry to collaborate in supporting the establishment and maintenance of research and development facilities that deal with the gamut of technological activities common to the industry sector. The program has not developed rapidly for several reasons, not the least being the difficulty of awakening an interest in co-operative R&D activities in an industry sector and establishing liaison with a representative group from the sector prepared to negotiate within, and on behalf of, the industry.

Form of Assistance

Assistance provided under this program is similar to that described for the Centres of Advanced Technology Program. Grants authorized to date (March 31, 1975) amount to \$3,150,000 and are summarized below:

<u>Name of Association</u>	<u>Grant, Term and Termination Date</u>
Sulphur Development Institute of Canada	\$1,400,000; 3 years; June 30/76
Canadian Welding Development Institute	\$875,000; 5 years; July 31/78
Canadian Gas Research Institute	\$875,000; 5 years; Dec.31/79

Progress in 1974

Negotiations were completed late in 1974 with the Canadian Gas Association in Toronto for the formation and support of the Canadian Gas Research Institute. This organization will conduct research on the equipment and systems employed by the gas industry with the objective of developing equipment that is more reliable, more efficient, and less polluting.

The Sulphur Development Institute of Canada is a non-profit organization located in Calgary and supported jointly by the Department of

Industry, Trade and Commerce, the Alberta Government and 22 sulphur producing companies. Its basic purpose is to develop new uses for sulphur in order that the large stock pile of sulphur in Western Canada and the on-going production of sulphur associated with the production of natural gas may be consumed in profitable ways. Development work in progress is concerned chiefly with the use of foamed sulphur as an insulating material and the incorporation of sulphur into asphaltic mixes and concrete. The problems associated with transporting sulphur from the various producing sites, often not served by rail lines, to the possible points of usage are also being examined.

The Canadian Welding Development Institute was organized through the efforts of the Canadian Welding Bureau and came into existence as an incorporated body in mid 1973. The Institute's objective is to promote the advancement of the science and practice of welding by carrying out research, organizing seminars, providing expert advice and generally disseminating appropriate information. As part of this latter activity, the Institute has assumed the educational responsibilities previously undertaken by the Canadian Welding Bureau. The Institute has had discussions with provincial research organizations in Western Canada which it is anticipated will lead to the cooperative promotion of welding technology in those provinces by the Institute and the respective research organizations. The Institute's research program is gradually being organized following the appointment as technical director of Dr. N. F. Eaton, who was previously head of welding research at the Marchwood Engineering Laboratories of the Central Electricity Generating Board in the United Kingdom. Welding related to energy production, with particular emphasis on pipelines, power plant and nuclear pressure vessel fabrication, is to be the major technical concern of the Institute in the immediate future. Both Ontario Hydro and Atomic Energy of Canada Limited have agreed to support this work which will be carried out by Institute technical staff working in the facilities of Ontario Hydro. Suitable quarters to house the technical operations of the Institute are presently being sought and a campaign is being organized to obtain the necessary funds from industrial sources.

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