

INFORMATION CIRCULAR IC 165

THE DISSEMINATION OF TECHNICAL INFORMATION  
TO CANADIAN INDUSTRY

by

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## **FOREWORD**

This is one of a series of studies on research in Canadian industry sponsored by the Applied Research Committee of the National Productivity Council. This study has been carried out as a contribution to the following objects of that Council:

- (i) The extension of industrial research programs in plants and industries as a means of achieving greater productivity, and
- (ii) The dissemination of information related to applied research.

## CONTENTS

	<u>Page</u>
Summary .....	iii
Introduction .....	1
The Information Problem .....	2
Technical Information for Industry in the United States from Federal Agencies .....	5
Government, Industry and Information .....	5
Organization for Federal Science and Technology .....	6
President's Science Advisory Committee .....	8
Federal Council for Science and Technology .....	9
National Science Foundation - Office of Science Information Service .....	10
National Aeronautics and Space Administration - Office of Technology Utilization .....	12
United States Atomic Energy Commission - Division of Industrial Participation .....	13
United States Department of Commerce - Office of Technical Services .....	14
Small Business Administration .....	15
Science Information Exchange (SIE) .....	16
National Referral Center for Science and Technology ..	17
Technical Information for Industry in the United Kingdom ....	18
Department of Scientific and Industrial Research .....	18
National Lending Library for Science .....	18
Association of Special Libraries .....	19
Industrial Research Associations .....	19
Recommendations for Improved Communications .....	20
Technical Information for Industry in Canada from Federal Agencies .....	21
Introduction .....	21
Department of Agriculture .....	22
Department of Fisheries .....	25
Department of Forestry .....	27

	<u>Page</u>
Department of Mines and Technical Surveys .....	28
Department of National Defence - Defence Research Board .....	30
National Research Council .....	31
Conclusions .....	34
References .....	37

## SUMMARY

The purpose of this report is to stimulate growth in Canadian industry by promoting more rapid and more widespread adoption of new technical developments through better means of communication.

A survey is presented of the main government sources of information now available to industry in the United States, the United Kingdom, and Canada and the following recommendations are made for improving Canadian services and assisting Canadian business to take full advantage of new advances in science and technology.

There should be a small, full-time organization representing industry, labour, governments, and universities. As a leader, this organization would develop an overall policy for the active promotion of better dissemination of technical information to industry, particularly through personal contacts.

All of the information services currently available should be made known to industry.

There should be a single agency to which industry can send technical inquiries in order to be directed to the best specific source of information.

Critical technical progress reviews of carefully selected subjects should be provided at regular intervals.

Increased financial support should be given to existing government information centres, including libraries, both to improve current services and to make possible continuing systematic searches for new knowledge useful to industry.

The main findings of such searches should be made known through one new technical periodical and person-to-person through field officers.

If the application of new knowledge to industry is to be effective, the information retrieval system must be thorough in the areas selected as most promising and the active cooperation of the industries concerned must be obtained. Whether these aims can best be attained through a government information service (such as the agriculture extension service), through a co-operative industry-government-university organization (such as a research association), or through some other means should be the basis for a further study.

Regardless of the new methods of communication that may be developed, it is fundamental that government and industry should strive for an active and willing partnership alert to the importance of applying new technology to nourish Canada's economy.

## INTRODUCTION

All modern nations are recognizing that their continuing industrial growth rests on scientific and technical progress, which is itself dependent on the application of scientific knowledge. This study was undertaken as a contribution to the former National Productivity Council, one of whose primary aims was to promote the dissemination of technical information to assist the Canadian economy in becoming more efficient and productive.

Although some industries such as the chemical industry are aware of the importance of technological developments, the majority of Canadian business firms do not make full use of the technical information available. There are a number of possible advantages to be gained from the proper use of technical intelligence (1)\*:

- (1) Guarding against technological surprise and anticipating breakthroughs.
- (2) Identifying long term technological changes in advance and providing data for remaining competitive through planned research in product design, process changes and automation.
- (3) Avoiding capital expenditures where markets are dwindling or technical changes are imminent.
- (4) Avoiding duplication of research expenditures where others have made substantial progress.

This progress report has been prepared to focus attention on the importance to Canadian industry of the rapid transfer of the results of relevant research, development and innovation. Its essential points are as follows:

- (1) There is a technical information problem for Canadian industry, particularly for medium and small-sized manufacturing firms.
- (2) Existing Canadian information services should be fully utilized.
- (3) Developments in other countries should be studied and adopted if considered useful.

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\*References are listed on page 37.

## THE INFORMATION PROBLEM

The problem of using scientific and technical information to the best advantage has been studied intensively in recent years, particularly in the United States. The following statement of the problem is based mainly on a recent report (2) by Dr. A.M. Weinberg, chairman of a special panel on science information of the President's Advisory Committee.

Although a fact is published in some document, it is in fact lost if it fails to reach the mind of the man who needs it and who may not even know that the fact exists. The information problem really consists of two separate problems. First, there is the problem of identifying, indexing, storing, and retrieving documents. Second, there is the equally important problem of communicating information to the user's mind.

Much has been written of the ever-growing flood of scientific and technical literature. For example, there are now one and a half million items in the science and technology section of the Library of Congress, twice as many as in 1945. Coping with this mass of information has become a major problem in all research and development work. The individual scientist or engineer may attempt to solve the problem by becoming more and more specialized, but this results in fragmentation in science where unity is essential.

Specialized libraries using mechanization are only a partial solution to the problem; they find it difficult to obtain sufficient funds and suitable staff. Traditional abstracting services are finding it difficult both financially and because of the sheer volume of literature. Mechanized information retrieval methods are promising in this area and the American Society for Metals is already operating both a retrospective and a current awareness service in the field of physical metallurgy. However, at this stage of its development mechanized retrieval retrieves documents, not information, and may result in larger piles of unread material on the scientist's or engineer's desk.

Therefore industry and government must allocate more resources to the solution of this problem, for the real value of information is not measured by the cost of obtaining it but instead by the cost of not having it. Hence, new knowledge must be made known quickly to avoid waste and duplication. It is not sufficient to store answers and wait for questions. The fundamental problem in communicating scientific and technical information is to find the most effective way of making the results of research readily available to scientists and engineers.

In the United Kingdom Professor J.D. Bernal of London University has stated (3) that the enormous task of information services, libraries, and individuals is largely due to an uncontrolled and increasingly chaotic primary production of scientific material. Possibly the people who most require information services are not research scientists working in relatively narrow fields, but practical scientists and engineers in industry who have to deal with questions as they arise in a variety of subjects. What they want is speed of reference and not necessarily exhaustive information.

However, a basic difficulty is that the scientist or engineer does not know the particular piece of information he wants or he does not know it precisely enough to make use of existing index systems. Further, he may not even be aware of the existence of the information or of his need for it. The task of the information service is, therefore, to provide its users with facts they do not even know they want. For this service to be fully effective, those engaged in it must be scientifically or technically competent in the fields that are covered.

If Canadian industry is to be competitive in the face of rapid technological change, then it must know the things that science and technology can be doing that are not being done to stimulate the Canadian economy. In a survey conducted in Scotland a few years ago it was found that seventy per cent of the problems submitted by the industrial firms surveyed could be answered by information existing but in sources unknown to the firms. The task, therefore, is to know what knowledge is available, where to obtain it, and how to bring the knowledge to the people who will use it.

There are six main sources of information for industry (4):

- (1) Research and development organizations, including federal and provincial agencies that publish individually.
- (2) Institutions that publish proceedings, transactions, and reports.
- (3) Book publishers.
- (4) Technical and trade periodical publishers.
- (5) Manufacturers of equipment and supplies.
- (6) The Canadian Standards Association.

These sources publish increasingly large amounts of technical information. Furthermore, information on any one subject may arise in any or all of these sources. As a result, the probable net effect on the busy industrialist seeking an answer to a technical problem is frustration.

While a number of government agencies operate established information centres for their own areas of interest, a national problem is developing in the effective communication to primary and secondary industries of the rapidly growing volume of technical and scientific information being developed in the world. There is, therefore, a need for a single agency to be concerned with the most efficient means of dissemination of information rapidly and selectively so that there are no gaps and no duplication of effort. Its function is to cooperate with the groups that collect and generate technical information and to coordinate their efforts with the needs of industry. A part of the function is educational, since there will be cases where industry may not be aware that a need exists or that a means to satisfy the need is available.

According to the Canada Year Book 1963-64, the total number of manufacturing establishments in Canada in 1960 was 36,682. Of these, 102 firms had over one thousand employees each, 238 had between five hundred and one thousand employees, and 36,332 had less than five hundred employees. Most of these firms do not have the resources for independently investigating the potential value of new technological developments. This problem was recognized in the following statement by Mr. Ian McRae, Chairman of the Board of Canadian General Electric Company and Chairman of the Canadian Manufacturers Association Research and Development Committee: "One of the greatest single difficulties which confronts us is the dissemination of research information among the industries of this country. This difficulty arises not simply from the mechanics of making information available, which are difficult in themselves, but also because in industry there are many small and medium-sized firms which remain unaware of the nature and amount of information at their disposal, and often do not recognize the problems which face them." (Industrial Canada, p.30, October, 1961). However, before recommending what should be done in Canada, it will be useful to consider a number of solutions to the problem used or proposed in other leading industrial nations.

## TECHNICAL INFORMATION FOR INDUSTRY IN THE UNITED STATES FROM FEDERAL AGENCIES

### GOVERNMENT, INDUSTRY AND INFORMATION

The role of the United States Government in stimulating productivity by assisting civilian technology is described in the following excerpt from President Kennedy's economic report to Congress, January, 1963:

"The Government has for many years recognized its obligation to support research in fields other than defense. Federal support of medical and agricultural research has been and continues to be particularly important. My proposal for adding to our current efforts new support of science and technology that directly affect industries serving civilian markets represents a rounding out of Federal programs across the full spectrum of science.

Since rising productivity is a major source of economic growth, and research and development are essential sources of productivity growth, I believe that the Federal Government must now begin to redress the balance in the use of scientific skills. To this end I shall propose a number of measures to encourage civilian research and development and to make the byproducts of military and space research easily accessible to civilian industry. These measures will include:

1. Development of a Federal-State Engineering Extension Service;
2. New means of facilitating the use by civilian industry of the results of Government-financed research;
3. Selected support of industrial research and development and technical information services;
4. Support of industry research associations;
5. Adjustment of the income tax laws to give business firms an additional stimulus to invest in research equipment;

6. Stimulus of university training of industrial research personnel.

Together, these measures would encourage a growing number of scientists and engineers to work more intensively to improve the technology of civilian industry, and a growing number of firms and industries to take greater advantage of modern technology. For Americans as a whole, the return will be better products and services at lower prices. A national research and development effort focused to meet our urgent needs can do much to improve the quality of our lives."

## ORGANIZATION FOR FEDERAL SCIENCE AND TECHNOLOGY

During and since World War II the United States Government has become increasingly involved in scientific research and now provides about sixty-five per cent of all United States expenditures on research and development; as a result, a number of new agencies concerned with the promotion of science and technology have been established. These will be reviewed briefly together with some of the older established agencies that have important scientific activities (5) of interest to industry.

The review and supervision of federal scientific activities is carried out in the President's office as follows:

(1) Special Assistant to the President for Science and Technology

Responsible for keeping informed of the progress of scientific and technical efforts in federal agencies, and for presenting his findings, evaluations, and recommendations to the President.

(2) Office of Science and Technology

Composed of a Director and a permanent staff capable of advising and assisting the President on national policy matters concerned with science and technology. The Office uses its own staff, personnel of the federal agencies, and non-federal sources of the scientific community to prepare recommendations on policy and administration for the President.

(3) President's Science Advisory Committee

Composed of eighteen eminent scientists and engineers from private life and the Special Assistant. Responsible for providing answers to questions raised by the President and for recommending ways in which United States science and technology can be advanced.

(4) Federal Council for Science and Technology

Composed of the Special Assistant, the Chairman of the Atomic Energy Commission, the Director of the National Science Foundation, the Administrator of the National Aeronautics and Space Administration, and ranking officials from the Departments of Agriculture, Commerce, Defense, Interior, and Health and Welfare.

The Council evaluates scientific and technical problems involving more than one federal agency and recommends policies for more effective planning and administration of federal scientific and technical programs, for identifying research needs, and for utilizing the facilities of federal agencies more effectively and without duplication.

(5) National Science Foundation (NSF)

Composed of a Director and a permanent staff. It replaced the wartime Office of Scientific Research and Development and has broad responsibilities to develop national science policies.

Its specific responsibilities include provision of a central clearinghouse for information covering all scientific and technical personnel in the United States and also leadership in arranging for more effective dissemination of scientific and technical information, including the development of new methods, by its Office of Science Information Service (OSIS).

The review of the other federal agencies with major scientific activities will be confined to those that are operating significant programs aimed at assisting private industry with technical information. These agencies include the following:-

(1) National Aeronautics and Space Administration (NASA)

Office of Technology Utilization (OTU).

(2) United States Atomic Energy Commission (USAEC)

Division of Industrial Participation.

(3) United States Department of Commerce

Business and Defense Services Administration  
Office of Technical Services (OTS)  
Office of Industrial Growth and Research  
Office of Economic Programs

National Bureau of Standards  
Office of Technical Information

Patent Office  
Office of Research and Development

(4) Small Business Administration

Office of Procurement and Technical Assistance

(5) Smithsonian Institution

Science Information Exchange

(6) Library of Congress

National Referral Center

In addition, comprehensive technical information programs are operated by the Department of Agriculture, the Department of Defense, Department of Health, Education, and Welfare, and the Department of the Interior. However, these will not be considered in this report.

**PRESIDENT'S SCIENCE ADVISORY COMMITTEE**

In its report "Science, Government, and Information", which deals with the responsibilities of the technical community and the government in the transfer of information, the special panel maintains that there is no single cure for the problem of information dissemination but that many approaches must be tried.

One development is the specialized information centre of which there are over four hundred in the United States. Ideally, such a centre is a technical institute (not a library) manned by working scientists and engineers who critically compact and review specialized information (e.g., Cobalt Information Center). The input of these centres is documents and uncorrelated data. The output is critical reviews, correlated data, and compilations.

A second development has been the central document depository. In the United States much of the original concern with the information crisis was due to a growing realization that much of the information contained in the flood of government reports was being lost. To prevent this, central depositories have been set up. About one hundred thousand reports are issued each year by government contractors; most of these are stored in the major government central depositories: DOD's Armed Services Technical Information Agency (ASTIA) now redesignated as the Defense Documentation Center, USAEC's Division of Technical Information Extension (DTIE), and NASA's Office of Scientific and Technical Information (OSTI). Since these collections are fairly small compared to that of the Library of Congress, their entire catalogues can be handled by computers.

The Committee has proposed that the United States government should allocate responsibility for information in each field of science and technology it supports to one appropriate agency (e. g., nuclear reactors to the USAEC). This agency would assume many responsibilities beyond merely collecting, announcing, and abstracting relevant material. It would establish and support specialized information centres and it would actively encourage better communications. Since communication is essential for the conduct of research and the application of its result, adequate resources are necessary for it to be effective.

#### FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

The importance of an effective science information system was emphasized by Dr. J. B. Wiesner, Chairman of the Council, in a recent report (6) in which he stated:

"The federal government also recognizes the obligation to make sure that the results from (its) research are equally accessible to individual scientists and engineers, to industrial enterprises, and to other non-government institutions.

There is a clear recognition that research conducted for the solution of one problem is frequently employed in unexpected ways for the solution of other problems. In the process of conducting federally sponsored research in the interest of defense or in the exploration of outer space, we develop an enormous reservoir of scientific information. And it is from this reservoir that we have grown to expect important contributions to be made to our civilian technology, to that part of our economy which must compete in the world market with superior goods and services."

In order to co-ordinate the flow of scientific and technical information to scientists and engineers, the federal government has set up the following mechanisms:

- (1) An expansion of the Science Information Exchange to include all the natural sciences,
- (2) A network of twelve regional reference centres for all government report literature,
- (3) A national referral centre to information sources, and
- (4) A major program by the National Aeronautics and Space Administration, the U.S. Atomic Energy Commission, and the U.S. Department of Commerce to improve the rate at which technological advances are recognized and adopted by industry.

A more detailed discussion of these measures follows.

The Council is assuming increased government-wide leadership in the dissemination of information through its Committee on Scientific Information, which is composed of representatives of the principal science-oriented agencies. The staff work of this committee is largely carried out by the National Science Foundation's Office of Science Information Service (OSIS).

#### NATIONAL SCIENCE FOUNDATION - OFFICE OF SCIENCE INFORMATION SERVICE

Through this office the National Science Foundation (7) is developing a fully integrated national scientific and technical information program aimed at insuring that all United States scientists have ready access to the world's current and past output of significant scientific literature. In order to accomplish this goal, OSIS maintains close contacts with all parts of the scientific community, both government (through the Federal Advisory Committee for Scientific Information) and private (through the Science Information Council) as well as through other channels.

The purpose of OSIS is not to conduct information services, but instead to promote coordination among all information services through meetings with professional and private groups, through displays at conventions and at libraries, and through the NSF bimonthly journal, Scientific Information Notes. Emergency aid is provided for the improvement of existing information services through grants.

The overall OSIS program is carried out through four divisions:

- (1) Scientific Publications Program - Its objectives are, first, to assist in solving present problems of scientific publications and abstracting and indexing services, and, second, to develop long-term solutions to scientific publishing problems.
- (2) Foreign Science Information Program - Its activities are designed to assure widespread availability of the results of foreign scientific research to U.S. scientists and to facilitate communication of scientific information between the United States and foreign countries.
- (3) Research Data and Information Services Program - Grants have been made to the Office of Technical Services, U.S. Department of Commerce, for increasing the acquisition and announcement of scientific and technical literature generated by the U.S. Government. Similar support has been provided to the Science and Technology Division of the Library of Congress for an improved reference centre for unclassified reports of Government-sponsored scientific research. A survey of Federal scientific and technical information activities and services is in progress. A description of the services available is given in the National Science Foundation publication NSF 62-37, "Federal Organization for Scientific Activities, 1962". Supplementing this is a series of NSF reports entitled "Scientific Information Activities of Federal Agencies"; each of these reports describe in detail the information services of a single government agency.

The RDIS Program has also published a directory entitled "Specialized Science Information Services in the United States" (NSF 61-68) and describing the information service activities of 427 organizations concerned with research in the physical and biological sciences.

- (4) Documentation Research Program - Supports research directed toward more efficient and effective methods of processing, storing, searching, retrieving, and disseminating scientific and technical information. In connection with this program two series of publications are issued by NSF entitled "Current Research and Development in Scientific Documentation" and "Non-Conventional Technical Information Systems in Current Use".

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
OFFICE OF TECHNOLOGY UTILIZATION (8)

NASA's program for determining industrial applications of its research results was initiated in late 1961 and is the most advanced of any U. S. Government agency. A key feature of the program has been the formation of an Industrial Applications Advisory Committee composed of outstanding research administrators from private industry.

The main objective of the program is to identify new materials and processes or new applications of known materials and processes arising from NASA's research and development work and to communicate this information to industry.

The input to the program is provided by industrial applications officers located at NASA field centres. This information is then screened and evaluated by specialists at NASA headquarters, assisted by several research institutes and one university. Their task is to relate the new ideas to specific industrial needs. A pilot program was undertaken in 1962 by Midwest Research Institute, Kansas City, in a six-state area (9). In order to determine which firms can best use specific technical developments, a series of meetings was organized in Middle West manufacturing centres. These were attended by over 2,000 bankers, businessmen, political leaders, and regional industrial development agencies representing 600 firms. This was followed up with personal visits to 250 firms and with distribution of specific information as well as answers to inquiries. The personal contact with the manufacturer is considered to be the key of this program.

Although it is too early for a complete evaluation of this pilot program, there have been a number of successful applications such as improved welding techniques of large sections, improved methods of electrical soldering to insure reliability, and extension of explosive forming techniques.

A second program is being carried out by Indiana University to determine the best approaches for transferring information to industry. In a third program, Denver Research Institute, Denver, is surveying 3500 industries to determine what industrial applications of aerospace research have already been made.

A series of publications known as Applications Notes is planned dealing with special techniques or material applications. A recent issue in this series is titled "Selected Welding Technique", NASA SP-501, April, 1963.

It is believed that the program will be of most use in transferring new information on technology rather than on new products and that the main benefits will go to small and medium size business.

## UNITED STATES ATOMIC ENERGY COMMISSION - DIVISION OF INDUSTRIAL PARTICIPATION (10)

The Atomic Energy Commission is unique among other U.S. federal agencies in the scale of its application of research to industry, particularly in the development of civilian nuclear power reactors. This has been the most promising application of atomic energy and has accounted for government expenditures of over \$1.2 billion to date.

In addition to this major application, there have been a number of other industrial applications developed such as the use of depleted uranium for counterweights in aircraft and the development of advanced technology in materials. An important secondary industry has resulted from the development of radiation detection instruments and from the rapidly-growing number of civilian applications of radioisotopes.

The USAEC has encouraged industrial participation in atomic energy research in many ways including the practice of having government owned production plants operated by private enterprise under contract. This has resulted in much of the new technology developed being available for civilian applications as well as the training of a large number of scientists and engineers in government laboratories and production plants, many of whom have migrated to private industry.

The USAEC has also encouraged industrial applications through the operation of training courses in the national laboratories and particularly through the publication of a large number of unclassified reports (6,700 in 1962) dealing with atomic energy.

The AEC has also been active in promoting good communication between government and industry through industrial associations such as the Manufacturing Chemists' Association, Inc., and the National Association of Manufacturers. The well-known Atomic Industrial Forum, Inc., was formed as a result of a USAEC recommendation.

The Division of Industrial Participation was formed in 1961 to serve as a focal point for industry. In addition, the division meets with state and local organizations (such as the U.S. Chamber of Commerce) and with labour unions and public power groups to acquaint the public with atomic energy programs and to encourage industrial applications.

The Division of Technical Information plans and directs a comprehensive technical information program aimed at serving the needs of all groups concerned with atomic energy. It is responsible for the technical report distribution system (through the Office of Technical Services), for developing and publishing critical reviews and bibliographies, and for libraries and document depository centres.

UNITED STATES DEPARTMENT OF COMMERCE  
OFFICE OF TECHNICAL SERVICES

The Office of Technical Services (OTS) in the Business and Defense Services Administration of this department is the major U.S. federal agency of interest in connection with technical information for industry (11). Its purpose is to act as a clearinghouse for scientific, technical, and engineering information by collecting and coordinating information (chiefly from unclassified federal R and D reports and from technical translations). This information is then made available to industry and the general public through reprints, digests, abstracts, indexes, etc. In effect, OTS aims to act as a clearinghouse of technical information for industry.

Information on current research is announced in the OTS abstract journal "U.S. Government Research Reports" covering progress in unclassified military research. Over 275,000 technical (PB) reports are available from OTS; these consist of German and Japanese technical reports and patents obtained in 1946-49 and reports from the U.S. armed services and its contractors. In 1962 over 38,000 reports were received and it is estimated that there will be an additional 70,000 in 1963.

In addition, OTS has a number of its own compilations. These include a Patent Abstract Series describing royalty-free Government-owned inventions that are available; a Simplified Practice Series containing information and recommendations on the standardization of manufactured products and the improvement of production methods; a Commercial Standards Series containing reports on voluntary standard quality requirements and methods of testing, labelling, etc.; an Inventions Wanted Series describing current technical problems for which the armed forces desire solutions; and a series of directories describing U.S. national and trade associations, chambers of commerce, technical and professional societies.

In addition to the abstract journal "U.S. Government Research Reports", OTS technical reports are announced in a monthly series "Technical Reports Newsletter", which reviews in detail eight to ten new research reports of special interest to small and medium size business firms and furnishes information on new products and commercial applications. OTS also issues 35 to 40 news releases each month; these releases highlight the commercial applications of scientific and engineering results described in the research reports.

Bibliographies are compiled in many areas of interest (e.g., plastics, welding, transistors) and are available for a nominal sum. Special searches will be made and bibliographies prepared on a fee basis for individuals.

Early in 1963 the Department of Commerce launched (12) a civilian industrial technology program aimed at a wider use of science and technology in private industry through grants to universities for research and development on industry problems, through support of research and development in selected "technology poor" industries, and by establishing an industry-university cooperative effort similar to the Agricultural Extension Service. OTS is engaged in a series of studies to make its services more useful to business. Local business groups are being visited to determine their interests in technology and over five hundred cooperative offices have been set up in facilities of the U.S. Chamber of Commerce to assist businessmen in using the department's services. This is a free service.

The department has undertaken a survey (12) of information needs of the textile industry to determine what technical information the industry needs and how this information may best be used. This pilot survey may indicate how other specific industries may be studied so that their economics may be improved. This program is in line with the department's aim of becoming a technical information centre for search and reference for industry rather than being merely a document distribution office.

#### **SMALL BUSINESS ADMINISTRATION**

This U.S. federal agency (5) provides technical assistance to small American businesses in obtaining government contracts for research and development; obtaining benefits of government research and development; developing new products and processes; and determining and overcoming management problems.

A clearinghouse for small business provides guidance in locating and developing products and processes, and in locating and evaluating their markets. The "Products List Circular" is published monthly and contains information on patented machines, devices, or processes that are available.

When a small business presents problems in processing methods, products, and market development, the administration's Research and Development Division obtains recommended solutions from industry and government sources and consolidates them into a basic report.

The administration publishes an annual "Suggested Research Topics" to guide universities and research institutes in selecting projects for small business research; these projects are supported by research grants from SBA. When a project has been completed, a summary is prepared and distributed to depository libraries, to state commerce departments, to small business counselling centres, and to SBA field offices.

The agency issues publications on management and technology in nine different classes. Of particular interest is the bimonthly publication "Technical Aids For Small Manufactures", which is intended to provide small business operators with technical information useful to their work. These aids are subdivided into Operations, Care and Maintenance, and Recent Technical Developments. Commencing in 1956, these reports were collected and published in an annual volume series "Technical Aids for Small Business". These aids were prepared by authorities in private business, by trade association representatives, by university professors, and by government specialists.

Technical direction and coordination is provided in fifteen regional and forty-two branch field offices. Each regional field office has a research and development specialist, while eleven of the fifteen have products assistance specialists.

#### SCIENCE INFORMATION EXCHANGE (SIE)

This agency, a part of the Smithsonian Institution, is a clearing-house for information on current federal and private scientific research and development in progress. It receives information on current research from the federal agencies with major research and development programs as well as from foundations, universities, industry, and individual investigators. On request, SIE furnishes compilations of information for research management. It also serves the scientific community by answering questions from all research scientists about who is currently working on what projects and problems. Such information is extremely useful in preventing duplication of effort; such duplication is likely to occur otherwise since there is usually a gap of one to three years between the time of commencement of a project and the time when the results are published. In addition, the service reports current research that might otherwise not be reported at all because of negative results.

SIE differs from other library and technical information services since it is concerned only with records of research planned or actually in progress and before it has been reported in other channels. It obtains information on the sponsoring agency, the title, the names of the principal investigators, the location of the research, a two-to three-hundred word resumé, and the technical level of effort. SIE does not receive progress reports, abstracts, or other forms of published research results. The service is available without charge to any recognized research organization. SIE has a staff of one hundred and thirty who process about 75,000 Notices of Research Projects and Proposals annually.

## NATIONAL REFERRAL CENTER FOR SCIENCE AND TECHNOLOGY

The National Referral Center, which commenced operations early in 1963, is a part of the Library of Congress and is supported by the National Science Foundation. It is a clearinghouse for the information resources available to the scientific and technical community. As a clearinghouse, it does not answer technical inquiries directly, but refers inquiries to the organizations, institutions, or individuals (within and outside the government) capable of furnishing the material or information desired. In effect, it is a central switching point in the United States' scientific communication network.

The centre's primary purpose is to complement the existing information resources by making them better known and thus improving their use. It has three basic tasks. First, it must identify and catalogue in detail the large number of scientific and technical information facilities available. Second, it must answer inquiries as to where what kind of information may be found and publish directories of these information resources. Third, it must study the actual operation of the scientific and technical information complex to determine what information needs exist and how they are being satisfied.

The present staff totals twenty-six, two-thirds of whom are professional. This is expected to increase to thirty-six in 1964. The services of the centre are available without charge to any organization or individual working in science or technology.

## TECHNICAL INFORMATION FOR INDUSTRY IN THE UNITED KINGDOM

### DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

The Department of Scientific and Industrial Research (DSIR) is the major government agency in the United Kingdom concerned with the application of science and technology to industry. In addition to operating fifteen research stations (National Physical Laboratory, National Engineering Laboratory, etc.), DSIR provides a number of services of specific interest to industry (13).

At its Headquarters Information Division in London and at its three branch offices in Edinburgh, Cardiff, and Belfast, DSIR operates a technical inquiry service whose purpose is to direct inquiries to the appropriate literature or specialists. In addition, through grants it assists seven regional technical information centres whose aim is to assist local industry through personal contacts in applying technical information to industry's best advantage. Particular emphasis is given to assistance to smaller firms.

DSIR also produces a monthly series of technical digests of potential interest to industry and receives, on a cooperative basis, similar digests from the European Productivity Agency, which sponsors a program of international exchange of digests. The work of DSIR research stations is reported in the usual channels, including its own series of reports available from H. M. Stationery Office. As already noted, DSIR published in 1962 a guide entitled "Technical Services For Industry", which describes the information and other services available to industry from DSIR and the grant-aided research associations. The specialized technical information supplied by the various research associations is of particular interest to many smaller firms.

### NATIONAL LENDING LIBRARY FOR SCIENCE

Another important source of information in the United Kingdom is DSIR's National Lending Library for Science and Technology, which was opened in 1962. Its purpose (14) is "to augment existing library services with a fast, return-of-post loan service for Britain's research scientists and practising technologists, and to promote the effective use of scientific literature, especially in industry, by investigating established lines of communication and, where defects are uncovered, considering what remedial

action is necessary". This library is unique in that it was planned by scientists and its senior staff are all science graduates. Unlike most other libraries, its serials and books are arranged in alphabetical order by title on the shelves as soon as they are received. This eliminates the long delays and the appreciable expense of cataloguing. Since the library aims to collect all advanced scientific and technological literature, the world's bibliographies are in effect its catalogues. Service is very rapid, publications or photo-copies usually being mailed the same day that the request is received.

## ASSOCIATION OF SPECIAL LIBRARIES

As a further aid to industry, DSIR gives an annual grant to the long-established Association of Special Libraries (ASLIB). ASLIB directs member firms to sources of technical or commercial information, either by providing the information directly or by referring the inquirer to a specialist. Eight information groups have been formed to enable exchange of ideas between information staff concerned with aeronautics, chemical industry, economics, engineering, electronics, fuel and power, furniture and textiles. ASLIB also assists its members in operating library and information services by providing consultant services. It is also active in promoting conferences and training courses concerned with the general problem of efficient communication of technical information.

## INDUSTRIAL RESEARCH ASSOCIATIONS

DSIR has long been active in promoting the development of industrial research associations in the United Kingdom. As a result, over half of Britain's manufactures is produced by industries that are members of research associations. While the information services operated by the more than fifty research associations for their members are beyond the scope of this report, the operations of one of these associations, the Production Engineering Research Association (PERA), will be described briefly.

One of PERA's functions (15) is to provide industry with technical and management advisory services designed to make factory production as technically up to date as possible. As a consultant to its member firms, PERA will supply skilled technical investigation teams who will examine in detail the design and manufacturing methods in use. Where applicable, detailed recommendations for improved production (more suitable materials, better layout, etc.) are made, and practical assistance in implementing the recommendations is supplied. Practical gains have been achieved in almost every type of factory studied.

PERA maintains close personal contacts through regular visits to all of its members by regional liaison engineers who advise each member of the latest developments at PERA and at other research centres. Members may also benefit from studies of new and improved production techniques and of new materials and methods. Specific work studies or advice on management economics can be supplied on request, the PERA team being careful to avoid disruptions when assisting in introducing changes into member's plants. PERA also operates extensive testing and research laboratories, organizes training and refresher courses, and produces technical films on such subjects as automation, metal cutting, and work study.

### RECOMMENDATIONS FOR IMPROVED COMMUNICATIONS

In 1961 DSIR sponsored a conference (16) at Swansea, Wales, whose objective was to discover better ways and means of speeding up the industrial application of new scientific and technical developments. One of the main conclusions of the conference was that active cooperation by industry is as important as communication between science and industry since any firm, large or small, must investigate technical information sources in addition to its own in order to make the optimum use of new discoveries.

The conference recommended more frequent meetings between scientists and industrialists both in laboratories and manufacturing plants. There should be a national liaison service with an experienced technical staff who would be available to advise industry on problems concerning innovations. It was important that such a national technical liaison service should work very closely with other specialist liaison services in government departments, research associations, and industry. Good personal contact was considered to be the major factor in the success of such a service.

The conference also stressed the importance of investigating better methods of communication among science, industry, and the general public. This problem might best be studied by a small group including industrialists, scientists and engineers, editors, and professional publicity consultants. A great deal of filtering and selection of information is essential and, at the same time, the material must be in a form that management can digest. DSIR is currently supporting a research project on the potential value of teaching machines for industry, particularly for training and re-training on a new method, a new product, or a new machine. It was also pointed out that television and radio have a great potential for speeding up the exploitation of new ideas by industry. One way of using these media to better advantage would be to establish a scientific film centre for the production and distribution of short films on specific technical subjects, including films from other countries.

## TECHNICAL INFORMATION FOR INDUSTRY IN CANADA FROM FEDERAL AGENCIES

### INTRODUCTION

A survey of public information services of the federal government was reported in the Glassco Report (The Royal Commission on Government Organization, Vol. 3, Sect. 13, December, 1962). Some of the findings of this survey are of particular interest in this report. Thus, in discussing relations with the public the report states (page 86):

"Public servants should appreciate that often a real problem of a citizen seeking information or service is to ascertain to whom his inquiry or request should be directed".

On the matter of coordination of information services, the report continues (page 110):

"The picture that emerges of public information services in the government is one of a general blur of diffuse activity, with growing clusters of organization. Central planning, direction and coordination are lacking".

And again, :

"Your Commissioners do not believe in compulsion to achieve cooperation because this may seriously undermine departmental initiative. But coordination can be facilitated and promoted by central encouragement and guidance. Somewhere in government there should be a lookout from which the broad sweep of the information landscape can be viewed with reasonable detachment and the perspective kept in focus".

Since the growth of the Canadian economy has depended to a great extent on the development of primary resources, it is not surprising that the principal centres for disseminating technical information for industry have developed in the federal agencies concerned with natural resource development. These are the Departments of Agriculture, Fisheries, Forestry, and Mines and Technical Surveys, and the National Research Council. Their information services (together with those of the Defence Research Board) will be reviewed in order to indicate what is available to industry and also what additional services should be provided, particularly for secondary industry. Further details may be obtained by consulting the list of references at the end of this report.

## DEPARTMENT OF AGRICULTURE

Because agriculture has been important to Canada since Confederation, the department has been the leader in promoting improvements in production and marketing through scientific research. At the same time it has developed an advanced technical information communications system that might well be a model for a similar system for secondary industry. The organization has two components, the Information Division and the Scientific Information Section (Research Branch).

### Information Division

The division collects information through the libraries (which it administers) and the Research Branch. Information is communicated by direct correspondence, publications, press, radio and TV, and by exhibits.

The division receives a large daily mail from farmers and consumers. Usually requests are for information on a specific subject rather than for a particular report. Inquiries that may be answered by a publication are handled by the division. More difficult inquiries are handled by the library staff or by specialists in the Research Branch. Other sources of information outside the department (such as the U.S. Department of Agriculture) are not used to a great extent since it is considered that most of the inquiries relate to problems that are specific to Canada.

Twice a month the division publishes "Farm News", a one-sheet publication with articles that can be reprinted directly by publishers of weekly and daily newspapers serving rural areas. Every week tape recordings are prepared and distributed to approximately one hundred English and forty French radio stations. During 1962 a total of approximately one thousand news stories was prepared.

Some educational films have been prepared on an experimental basis for television in conjunction with the National Film Board. Visual aids were also used through supplying still pictures and exhibits for agricultural fairs.

The division is responsible for all publications for use by the general public. A total of three to four million copies is distributed each year. About five hundred free publications are available of which about twelve per cent are in French. An average printing run is ten thousand copies, although sometimes fifty thousand are printed. The public are advised of these publications through the Queen's Printer's Daily Check List, through agricultural field representatives, through radio and press releases, and through the department's own annual index of publications (in French and English). However, no mailing list or card service is maintained. Most of the funds for publications are allocated to other divisions of the departments. These

divisions arrange for publication through the Information Division and supply it with the necessary money.

For 1962-63 the division estimates total expenditure of \$743,000 for a staff of 118. Included in this total is an estimated \$250,000-\$275,000 for the main library plus fourteen branch libraries. The library, one of the best in the world in agriculture, is one of the most essential components of the technical information organization.

In connection with extending the present services, it is hoped that the writing staff may be increased by the addition of competent agricultural scientists who will study the research projects in progress and report these current activities to farmers in an understandable manner. However, technical information specialists are difficult to obtain. Another staffing problem exists in the department's libraries, which are the backbone of any information centre. In common with other federal agencies the department has difficulty in recruiting librarians, particularly those with technical training. It is contended that the staffing problem will not be overcome until these positions become more attractive. To accomplish this it is essential that librarians and information officers be considered as professionals and that their pay scales should be on a par with other federal professional workers.

#### Scientific Information Section

This section is a part of the Research Branch, the latter containing a large number of specialists in its ten research institutes, nine regional research stations, six research laboratories, twenty-six experimental farms, and fourteen special libraries.

The section with a staff of fifty is composed of five units. In the Domestic Information Unit there are specialists on insect pests, food research, and liaison in fungicides, herbicides, and insecticides. The emphasis here is in speed in answering inquiries and in issuing bulletins (e.g., 'Cereal News' and 'Canadian Plant Disease Survey'). The Scientific Editing Unit when requested will edit scientific papers written by the staff for publication in a scientific or technical periodical (the department does not issue any scientific periodical at present, but one is contemplated).

The Project Unit serves the branch executive in establishing and checking the research projects. There are about 3,000 projects in progress, both major and minor. Because of deletions and additions that occur all of the time, the projects are recorded by a card system that is available to the department's staff. However, no attempt is made to publish a summary of current projects.

The Public Information Unit was organized four years ago to handle inquiries from the public. It is operated by four technical people with a considerable amount of experience in agricultural science. The unit has operated very satisfactorily, particularly in speeding up replies to inquiries. Many of these may be answered directly by telephone, some by means of previously prepared bulletins or mimeographed reports, and some from the knowledge of the unit's personnel. The remaining specialized inquiries are usually taken care of by oral questioning of the specialist research scientist concerned. The written reply is made by the officer of the Public Information Unit. Research scientists prefer this method to having to make a written reply themselves. This system speeds replies and minimizes interference with the scientist's main work. On the other hand, the work load of the unit has grown rapidly as the research institutes have become more confident of the unit's ability to handle special inquiries.

The Bio-Graphic Unit provides unusually extensive services not only to the Research Branch, but also to many other government departments and agencies. The unit supplies illustrative, publishing, audio-visual, exhibit, and technological services as related to the recording analysis, and presentation of agricultural research. These services range from the preparation of simple charts and lettering to active collaboration in research projects involving ultraviolet photomicrography, photo-engineering, and instrumentation. The unit operates an extensive equipment loan service including audio-visual equipment, time-lapse assemblies, and still and motion picture cameras. A central file of over 100,000 negatives, photographs, colour transparencies, and drawings is maintained with appropriate technical cross-references.

The Scientific Information Section is overloaded with work because of increasing inquiries and because the research institutes find they can transfer some of their subsidiary functions to the unit. The unit would like to have better communications established among the department's staff, which is widely scattered across Canada. One way of accomplishing this is the publication twice a month of 'Research Highlights', a small bulletin on current research and developments.

## DEPARTMENT OF FISHERIES

### Information and Consumer Service

The Information Branch of this service has a staff of about fifteen, one of whom is on the Pacific coast and two on the Atlantic. The branch has a current budget of about \$250,000 and is actively supplying information to the fisherman, fish processor, and consumer. Its educational program utilizes most of the communications methods available, although communication to fishermen is not complete because they are so dispersed. For specialized information the branch's chief sources of information are the scientists in the Fisheries Research Board and the department's technical library.

Among the branch's publications are the Annual Report (English and French), which reviews the work of the department and progress in commercial fishing; Trade News (English and French), a monthly magazine on commercial technical developments and market conditions; The Canadian Fish Culturist (English and French), a biological journal; and Canadian Fisheries Reports (English and French), which applies the results of scientific research to commercial fishing. Other publications include fact sheets and booklets giving information on specific problems in the fishing industry. The volume of publications ranges from 1500 copies for the technical journals and 4000 for Trade News up to 25,000 copies for some individual booklets ("Canada's Lobster Fishery").

The department uses radio extensively in its Fishermen's Broadcasts on both East and West Coasts. Talks and taped interviews are arranged in cooperation with the Canadian Broadcasting Corporation. Television is also used, mainly by the Consumer Branch.

The department has been active in the use of filmstrips ("Lobsters are a Crop") and films ("Fish Spoilage Control") for educational and training purposes. These are used for instructing its own officers and fishermen in adopting new techniques or in explaining the necessity for fishing regulations.

The Consumer Branch, with a staff of ten, uses the various communications services (within its budget) to encourage the more widespread consumptions of fish in Canada. The excellent reception given the publication of "The Canadian Fish Cook Book" is evidence of the quality of this branch's work.

### Industrial Development Service

The aim of this service is the improvement of all phases of the Canadian fishing industry from catching to retail distribution. It is concerned with the practical application of the research findings of all fisheries research groups. The service includes two sections, Engineering, and Vessel and Gear.

Recent work in the Engineering Section has included improvements in refrigerated road trailers, operation of an experimental salt fish drier, and courses in salt fish processing. Developments in the Vessel and Gear Section dealt with the design of a steel dragger, improved methods and equipment for the herring fishery, better trawling methods for smelts on the Great Lakes, and talks and demonstrations of modern equipment such as electronic fish-finding gear to fishermen both ashore and at sea. The estimated expenditure for this service in 1962-63 is \$790,000.

### Fisheries Research Board

The Fisheries Research Board has three main areas of scientific interest: marine biology, oceanography, and fishery technology. Its findings are published in its Annual Report, a progress review of the Board's scientific activities, and in the Journal of the Fisheries Research Board of Canada. An index of all of the board's publications is also issued periodically.

### General

The department is operating a specialized information centre for the benefit of the fishing industry in Canada and is very alert in using all methods of communication within the limits of its budget. However, the staff is spread very thinly. Face to face communication with the individual fishermen by area information officers could be extended and improved considerably if more trained staff was available.

It is considered that more information on applied technology can be obtained from the work of the Fisheries Research Board's scientific staff. However, the task should be carried out by a competent scientist who can visit the laboratories and discuss the problem with the specialist, and who has also the ability to write up the new information in a form understandable to the industry. This need for a specialist scientific writer is becoming apparent in many areas of applied science. However, finding suitably-qualified scientists is difficult and it appears desirable that some universities should consider establishing courses in communication for scientists to meet this need.

## DEPARTMENT OF FORESTRY

The Forest Products Research Branch is concerned with promoting all of the industrial uses of wood except for pulp and paper. The branch, which has an estimated budget of \$1,116,000 for 1962-63, carries out both fundamental and applied research and plans its program in conjunction with an industrial advisory committee representing sixteen manufacturing associations concerned with forest products. The branch is well aware of the importance of relaying the results of its research to industry and carries out its technical information program (17) as follows:

### Publications and Exhibits

The work of the branch is reported in scientific and technical periodicals and is supplemented by a bimonthly publication, Research News, which describes briefly current research findings of industrial interest. Current research projects are summarized in the annual publication "Program of Work". Special exhibits of research carried out by the branch are arranged, particularly for the benefit of visitors to the Ottawa and Vancouver laboratories.

### Technical Courses

The branch has conducted a number of courses (e.g., on lumber seasoning and on improved sawmilling techniques) that have been effective in disseminating industrial technical information in a very practical manner. These courses have been possible because of close cooperation between the federal and provincial governments, the lumber associations, and industry. Unfortunately, there is not sufficient research staff available to satisfy all the requests for such courses.

### Inquiry and Answer Service

Since the branch has become an important data centre for Canadian woods, the staff can answer most of the large number of inquiries received from information already on file. These inquiries total about 7000 per year.

### Industrial Liaison Service

This service was established recently with four technical field representatives with broad experience in forestry. Through personal contact with industrial firms they can stimulate the application of research results, particularly with medium and small firms who would not otherwise realize that technical assistance is available. At the same time the branch learns at first hand some of the technical problems in industry that require further research and investigation by the branch. A good beginning has been made in convincing industry that the branch is interested in its problems and that it can provide technical assistance of considerable value. However, the activities of the service are limited because of the small staff.

## DEPARTMENT OF MINES AND TECHNICAL SURVEYS

Because the mineral industry is so important in Canada's economy, this department has developed a strong staff of scientists and engineers whose qualifications and experience cover a major part of the physical sciences.

The department has an Editorial and Information Division with five members concerned with departmental information in general. However, specific inquiries on technical subjects are referred to specialists in the six branches of the department. Of the latter, the Geological Survey and the Mines Branch are the ones of major interest to industry as far as relevant technical information is concerned.

### The Geological Survey of Canada

The Geological Survey has the broad responsibility of determining and appraising Canada's mineral resources. Consequently, the scientific and technical information it produces covers a wide range of subjects in the earth sciences. Of particular interest to the mineral industry is information on geology, especially economic geology. Information generated by the Geological Survey is reported in Memoirs describing the geology of a particular area, in Bulletins dealing with specific problems, and in Papers issued shortly after the field season in which the new findings in a particular area are summarized. Other important publications include the Economic Geology Series describing comprehensively particular mineral deposits, Information Circulars giving current data to prospectors, and Preliminary Maps showing the most recent field results in potential areas for mineral discovery. In addition, an annual summary of research projects in progress is issued.

### The Mines Branch

The basic aim of the Mines Branch is the most efficient utilization of Canada's mineral resources. This includes studies of the behaviour of rock in stress environments during mining; research in the recovery of minerals and the extraction of metals by beneficiation and metallurgical treatment of ores; investigations in physical metallurgy of direct interest to the Canadian metallurgical industry; and research in fuels with particular emphasis on coal.

Information on minerals, metals, and fuels and the results of Mines Branch research and investigations are made available through presentation of papers at scientific and technical meetings, through papers published in scientific, technical, and trade journals, and through Mines Branch reports. There are two main series of branch reports, the Mines Branch Series and Investigation Reports. The Mines Branch Series includes Mono-

graphs, Research Reports, Technical Bulletins, and Information Circulars; this series is available to the public and is announced in the Queen's Printers "Daily Checklist of Government Publications". Investigation Reports contain the results of specific projects carried out in the branch at the request of mining companies and are usually confidential. In addition, the Mines Branch publishes "Mines Memo", an annual review of its research investigations.

Besides answering technical inquiries and reporting on specific investigations, the branch staff is active on a person-to-person basis in disseminating technical information to industry in many ways. An example of this activity is the Canadian uranium industry. Basic investigations of all of Canada's main uranium ores were carried out in the branch commencing in 1945, including the design of processes and the operation of pilot plants. Information on this development work and training facilities for key company personnel were made available to Canadian uranium mining companies. The branch continues to supply the industry with technical information on plant problems in co-operation with the Canadian Uranium Producers' Committee. Technical information is also given to the industry in connection with the joint research investigation being carried out at the Mines Branch on non-nuclear uses for uranium.

Examples of other co-operating groups currently receiving technical information are: Quebec Asbestos Mining Association (milling of asbestos), Steel Castings Institute of Canada (vacuum degassing), Canadian Zinc Research and Development Committee (galvanizing), and Canadian Gold Metallurgists Committee (milling of gold).

#### Mineral Resources Division

This division collects and analyses statistical and economic data on the production, consumption, and use of minerals, metals, and fuels, and prepares informative reports that are available to the mineral industry. These include annual reviews of the production and marketing of approximately sixty minerals, detailed economic studies of minerals and metals of current interest, and annual lists of mines, mills, metallurgical works, and refineries.

The division is responsible for the department's publication office. In this connection it maintains an extensive mailing list and card service for notifying groups and individuals (in industry, government, universities, etc.) of new publications by the department.

DEPARTMENT OF NATIONAL DEFENCE  
DEFENCE RESEARCH BOARD

Scientific Information Service

This service, which is operated by the Scientific Staff Branch of DRB, is of interest because it operates a practical system of transferring scientific and technical information from the defence report literature to the persons requiring it. The latter include DRB scientists, scientists at universities working on DRB-sponsored projects, and scientists and engineers with companies holding defence contracts who, in the case of classified material, can show a "need-to-know". While the individual scientist or engineer is responsible for keeping abreast of the open literature in his field, the service aims to keep him advised of new developments in the report literature, classified and unclassified, which has grown rapidly in recent years.

A main function of the service is to number, catalogue, and abstract reports as they are received. A catalogue is maintained listing several hundred thousand reports by source, subject and author. Catalogue cards are sent selectively to DRB scientists and to others who need this information. In addition, two Document Digests (one classified and the other unclassified) are prepared monthly by xeroxing selected catalogue cards. A scientist may receive all of the cards in a specialized area and may also read the Digest for survey purposes.

The service has a staff of eighty, about nineteen of whom are professional. The system for handling the large number of reports received each year has been so designed that much of the work is routine and clerical. The key to successful operation of the service is the professional information officer whose ability in selecting documents depends on his personal knowledge of the scientists he serves. Accordingly, information officers pay regular visits to DRB establishments to discuss with individuals their specific information requirements. In this way the scientist is not flooded with a mass of irrelevant material.

## NATIONAL RESEARCH COUNCIL

The National Research Council is a major federal agency whose responsibilities cover a wide area in pure and applied science. It is organized into five science divisions concerned with physics, chemistry, and biology, and four engineering divisions concerned with building research, mechanical engineering, aeronautics, and radio and electrical engineering. For the purposes of this report there are three groups of particular interest: the Division of Building Research, the NRC Library, and the Technical Information Service.

### Division of Building Research (18)

This division is concerned primarily with technical improvements in housing. It carries out research and development on housing design, building materials, and soil studies. DBR publishes a large number of reports of specific investigations of interest to the Canadian construction industry, including many studies on building problems concerned with Canadian winter conditions. In addition, the industry is supplied with information contained in four series of publications: "Canadian Building Digests", a summary (generally of one topic) of technical aspects of building; "Building Research News", a quarterly supplement to the annual report containing notes on current progress; "Canadian Building Abstracts", a semi-annual selection of abstracts of Canadian reports on building research; and "Housing Notes", a series of short articles for home builders on materials and construction methods.

### National Research Council Library (19)

The NRC Library, which was originally established over forty years ago to provide services to NRC scientists and engineers, has developed along with the Council itself and is now the major scientific and technical library in Canada. In addition, it has extended its services to special libraries and scientists in industry, universities, research councils, and government departments and has become the National Science Library for Canada.

The library's present comprehensive holdings of over half a million are being increased at the rate of over five hundred per day, although unnecessary duplication of the holdings of other special libraries in Ottawa is avoided. The library, in order to acquaint scientists with the 10,000 or more journals it receives, issues an annual record, "Serial Publications in the Library". Also published is the "Union List of Scientific Serials in Canadian Libraries" issued in 1957 with a supplement in 1960. These publications form an index of the availability in Canada of the important scientific and technical periodicals. In addition, the NRC Library issues the free publication "Recent Additions to the Library" twice a month. The library's

holdings are available as direct loans, microfilms, or photocopies to scientists, engineers, and science libraries anywhere in Canada.

The NRC Library also maintains a Translation Section, which not only provides a translation service for specific requests by NRC scientists, but also maintains the Canadian Index of Scientific Translations, which lists over 90,000 translations of scientific and technical translations available in the world. Scientists are encouraged to check this list before requesting a specific translation.

As an integral part of its services the library provides a free scientific and technical information service using a staff with science and library training. This service includes compilation of bibliographies, literature searches, answering requests for scientific and technical information, and assisting in the location of lesser known scientific and technical publications.

#### Technical Information Service

This free service (20) for Canadian industry was first organized in 1945 in the Department of Reconstruction and Supply. Its aim is to inform industry of new developments in science and technology that are potentially useful and to assist industry in using such developments to the best advantage. TIS was transferred to the National Research Council in 1947 in order to make the best use of the NRC Library and of NRC's connections with other government agencies both federal and provincial.

At the present time (1963) TIS has a total Ottawa staff of twenty-four of whom fourteen are engineers or scientists with considerable experience in engineering (mechanical, chemical, electrical) or in the physical sciences (physics, chemistry, biochemistry). About three thousand written inquiries are received per year in addition to inquiries by telephone and from field officers.

There are three principal sources of information. First, there is the personal knowledge of TIS staff members, many of whom have technical industrial experience. Second, there are the literature indexes in the National Research Council Library, supplemented by those of other special libraries. (In general, the staff does not have time for extensive scanning of original papers and articles). The third main information source is the specialized knowledge of other scientists and engineers, particularly those in the federal government service.

TIS supports a total of eighteen field officers in seven provinces, many of whom are industrial engineers. Their purpose is to assist industry in solving management problems such as materials handling, plant layout, and cost accounting. Of this total of eighteen field officers, TIS itself has six field officers (two industrial engineers and four technical officers)

two of whom are stationed in Winnipeg, three in Montreal and one in Quebec City. In addition, grants are made to five other provinces to operate TIS field services in conjunction with their own industrial research. These grants provide for the remaining twelve field officers as follows:

	<u>Technical Officer</u>	<u>Industrial Engineer</u>
B. C. Research Council	1	1
Research Council of Alberta	1	1
Research Council of Saskatchewan	1	1
Ontario Research Foundation	1	4
Nova Scotia Research Foundation	1	-

These grants amount to \$15,000 per year for each technical officer and \$12,500 per year for each industrial engineer. TIS feels that it is desirable to extend the industrial engineering service by increasing the number of field officers and also by promoting training courses in industrial engineering.

TIS has issued a number of reports and information notes based mainly on literature surveys of specific subjects where there have been many inquiries. These reports are distributed to libraries and to technical information service organizations in other countries. Some are sent to specific Canadian companies if the subject matter is considered pertinent, but in general there are not many Canadian companies on the mailing list. Because of staff shortages the number of new or revised reports has been declining. At one time TIS issued a news bulletin of new developments, but this was discontinued. Publicity for printed matter is obtained through trade papers, but personal contact by field officers is considered the most useful form of public relations.

An evaluation of the TIS service is not possible because there is no adequate follow-up on specific projects. The service is essentially a question and answer one with a strong engineering flavour. The limitations of the service are recognized by TIS in the following quotation (20):

"However there is no existing organization set up to examine the numerous new ideas and products listed in the technical and trade publications, new and expired patent lists, industrial research reports, etc. These need screening as to their practicability and suitability for Canadian manufacture, examination for potential applications rather than the original one, and presentation to industrial firms likely to be interested in them".

## CONCLUSIONS

Many government information services useful to industry are now in existence, but these have evolved independently of one another with little overall planning or coordination. The greatest development of information services has been for the primary industries, although even here (except in the case of agriculture) the operation of the services tends to be passive, being concerned principally with day-to-day questions and answers. This is due partly to insufficient financial support for a more aggressive policy and partly to a shortage of qualified personnel. As a result, except in the case of the agricultural extension service, industry in general is probably not aware of the considerable information resources of government specialists and libraries that can be utilized.

Most industrial nations recognize that there is a particular problem in applying new technology in secondary industries and that new means must be found to convince management that greater emphasis on technical communication is economically desirable. A number of government agencies including NRC's Technical Information Service and the provincial research councils are working with industry, but the limited amount of resources now allocated results in attention being given only to immediate problems and only to a small fraction of manufacturing firms. In addition, because there is often no follow-up, it is impossible to evaluate the assistance that is being given.

In order to develop an active, overall policy for disseminating technical information, an organization representing industry, labour, governments, and universities should be initiated. Such a small, full-time group would constitute a forum to enable the exchange of views, complaints, and suggestions for improved communications. It should support the coordination of all industrial information services and should actively promote the full use of such services by industry. In addition, it should provide leadership in the application of any new promising developments in the information field through grants for pilot scale studies. If such a group is to be effective, it is essential that it develops the closest liaison with individual firms and trade associations.

One of the important co-ordinating projects requiring attention is the supplying from one source of up-to-date information on the information services currently available from government, industry, universities, professional societies, and trade associations. This information can be made known through bulletins and directories as well as through radio, television, and films.

As a complementary co-ordinating service, it is desirable to have one national clearinghouse as a single referral source for advising questioners where to apply for data on specific technical subjects.

These two services might be sponsored by the representative policy-making group to be set up. In addition, such a group should solicit and distribute up-to-date critical technical progress reviews of specific subjects selected for their particular relevance to Canadian industry.

It is also essential that existing information centres (including the specialized libraries) receive increased financial support. For example, budget restrictions have prevented many government information agencies from performing their tasks properly. As a result, there has not been sufficient qualified staff to carry out a continuing systematic critical evaluation of new scientific and technical knowledge. Such a service is essential for a sound, long-range policy for utilizing new developments in fields selected for their growth potential in Canada.

The main findings of these critical surveys might best be announced in one technical periodical designed to inform industry of significant new processes and equipment (including new patents available for licensing) and of new procedures for assisting firms in locating and developing new products and processes. Immediate additional assistance can be supplied by increasing the number of field officers. This would encourage more industries, particularly smaller ones, to investigate the potential benefits of industrial engineering. Supplementary assistance can be provided by sponsoring regional training courses in industrial engineering as a further means of increasing efficiency.

In North America the agricultural field services have been very effective in making possible the practical application of new developments in farming. However, agriculture and manufacturing differ in many important respects, and it is possible that the necessary person-to-person transfer of information to industry might best be carried out through an organization such as the United Kingdom's Production Engineering Research Association.

In the United States there is currently a great deal of emphasis on obtaining industrial applications ("technological fallout") from the space and military research and development programs. While the results from these programs may not be as important as anticipated, it must be remembered that there is a large reservoir of other technical information available in the world that can be utilized and often at relatively small cost. As is well known, Germany and Japan in recent years have been very adept in using technical information developed by other industrial nations to suit their special needs. In a study by Robert A. Solo (21) it was concluded that, since the main body of knowledge has been available to all nations, the differences in national progress must be due to the receptivity of a nation to

the possibility of using technological advances as well as to its capability of using them. Hence, the useful transmission of information depends as much on how it is received as how it is given. Solo maintains, therefore, that "...in an age of research where the resources of science are poured into the advances of weaponry, this capacity to reach, to absorb systematically, and to exploit complex bodies of knowledge and technological developments remote from the orbit of immediate business experience may be the key to industrial advance". It seems highly probable, therefore, that a moderate increase in investment in technical information services by Canada could yield very satisfactory returns to the economy.

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