



National Research Council Canada

Performance Report

For the period ending
March 31, 1998

Canada

Improved Reporting to Parliament Pilot Document

The Estimates of the Government of Canada are structured in several parts. Beginning with an overview of total government spending in Part I, the documents become increasingly more specific. Part II outlines spending according to departments, agencies and programs and contains the proposed wording of the conditions governing spending which Parliament will be asked to approve.

The *Report on Plans and Priorities* provides additional detail on each department and its programs primarily in terms of more strategically oriented planning and results information with a focus on outcomes.

The *Departmental Performance Report* provides a focus on results-based accountability by reporting on accomplishments achieved against the performance expectations and results commitments as set out in the spring *Report on Plans and Priorities*.

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Foreword

On April 24, 1997, the House of Commons passed a motion dividing on a pilot basis what was known as the annual *Part III of the Estimates* document for each department or agency into two documents, a *Report on Plans and Priorities* and a *Departmental Performance Report*.

This initiative is intended to fulfil the government's commitments to improve the expenditure management information provided to Parliament. This involves sharpening the focus on results, increasing the transparency of information and modernizing its preparation.

This year, the Fall Performance Package is comprised of 80 Departmental Performance Reports and the government's "*Managing For Results*" report.

This ***Departmental Performance Report***, covering the period ending March 31, 1998, provides a focus on results-based accountability by reporting on accomplishments achieved against the performance expectations and results commitments as set out in the department's *Part III of the Main Estimates* or pilot *Report on Plans and Priorities* for 1997-98. The key result commitments for all departments and agencies are also included in *Managing for Results*.

Results-based management emphasizes specifying expected program results, developing meaningful indicators to demonstrate performance, perfecting the capacity to generate information and reporting on achievements in a balanced manner. Accounting and managing for results involve sustained work across government

The government continues to refine and develop both managing for and reporting of results. The refinement comes from acquired experience as users make their information needs more precisely known. The performance reports and their use will continue to be monitored to make sure that they respond to Parliament's ongoing and evolving needs.

This report is accessible electronically from the Treasury Board Secretariat Internet site:
<http://www.tbs-sct.gc.ca/tb/key.html>

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Planning, Performance and Reporting Sector
Treasury Board Secretariat
L'Esplanade Laurier
Ottawa, Ontario, Canada
K1A 0R5
Tel: (613) 957-7042
Fax (613) 957-7044



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Performance Report

For the
period ending
March 31, 1998

John Manley
Minister of Industry

Canada

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Chart of Key Results Commitments

NRC has been an early adopter of the new federal approach to performance measurement. This involves a significant shift in corporate culture from the traditional focus on activities, inputs and outputs to a new emphasis on applicable

results and social and economic impacts.

Accordingly, NRC has developed performance indicators which highlight intended impacts and accomplishments, as demonstrated in the following table.

<i>to provide Canadians with:</i>	<i>to be demonstrated by:</i>	<i>achievement reported on pages:</i>
a research program that focuses on excellence and knowledge, and that is relevant to Canadian needs	<ul style="list-style-type: none"> • acceptance and use of NRC's research advances • recognition of NRC's research excellence • investment in and use of NRC's facilities • highly qualified personnel 	9-11 14-15
economic growth by helping Canadian firms develop new, marketable technologies	<ul style="list-style-type: none"> • partner involvement in research projects • technical and commercial successes of firms that work with NRC • client and partner satisfaction with NRC's services and support 	9-11 16-17 21-22 24-25
technology-based economic growth in communities across the country	<ul style="list-style-type: none"> • results of regional initiatives • use and impacts of codes and standards • impacts of collaboration with government and industry • influence of NRC's industrial support and information networks 	9-11 17-18 22-24
transfer of NRC's research successes to Canadian firms	<ul style="list-style-type: none"> • number of technology and information transfers to firms • results of patent and licence sales • introduction of improved management tools and systems 	9-11 18 26-28

Section I: Messages

A. The Minister's Message

Canada is well positioned to be a leader in the new emerging global knowledge-based economy. Our government is working with the private sector to address the challenges in making the transition to this economy. By focussing on the challenges of a competitive 21st century economy, we can turn Canada's potential into reality and create jobs and wealth for our citizens. The Industry Portfolio, bringing together 13 departments and agencies with complementary goals and objectives, plays an important role in helping Canadians achieve this vision.

In 1997-98, the Industry Portfolio focussed on three areas of activity - each crucial for our economic success - now and into the next century:

- promoting innovation through science and technology;
- assisting businesses to grow by providing information, advice and financing support; and
- ensuring a fair, efficient and competitive market place.

The Portfolio members' Performance Reports collectively illustrate how the Portfolio is making a contribution toward the realization of these objectives.

The 13 Industry Portfolio members are:

*Atlantic Canada Opportunities Agency
Business Development Bank of Canada*
Canadian Space Agency
Competition Tribunal
Copyright Board
Canada Economic Development for Quebec Regions
Industry Canada
National Research Council Canada
Natural Sciences and Engineering Research Council of Canada
Social Sciences and Humanities Research Council of Canada
Standards Council of Canada*
Statistics Canada
Western Economic Diversification Canada*

**Not required to submit Performance Reports*

I am pleased to present the Performance Report for the National Research Council (NRC) for the fiscal year ending March 31, 1998. In the 1997-98 Estimates Part III, NRC articulated its strategic objectives and described how its plans for the fiscal year would contribute to their realization. This report sets out NRC's accomplishments against those plans and shows the contribution it is making to Portfolio and government-wide objectives.

The Honourable John Manley

B. Message from the Secretary of State (Science, Research and Development)

Canada's future is being built on a resource that is virtually limitless: *knowledge*. In a competitive global economy, all Canadians must be able to use knowledge to their best advantage. Competence in science, technology and innovation is an essential ingredient for success in the knowledge-based society.

Almost half of Canada's GDP growth is in the knowledge-intensive sectors of the economy. The fastest growing sectors include information and communications technology, aerospace, and consulting engineering. Canada's science and technology challenges, then, are to ensure that our people have the skills to benefit from the knowledge-based economy, and are able to innovate through science and technology in all aspects of our industrial growth. The National Research Council plays an essential part in doing just that - helping Canadians and businesses meet the challenges.

As Secretary of State for Science, Research and Development, I have taken a personal interest in the government's promotion of a culture where we use innovation and turn it into a competitive advantage in the marketplace.

We need to keep the best and brightest minds in Canada, and we need to attract others from around the world. We need to build support for international partnerships that help build on the foundation of Canada's knowledge-based economy. As we enter the next century, the challenge will be to build on our momentum and ensure that Canada has the science and technology necessary to secure our place in the world for the next generation.

The Honourable Ron J. Duhamel

Section II: NRC Overview

A. Mandate, Roles and Responsibilities

National Research Council Act

NRC is a federal government departmental corporation. Its mandate, according to the *National Research Council Act*, is to undertake, assist or promote scientific and industrial research in different fields of importance to Canada; to investigate standards and methods of measurement; and to work on the standardization and certification of scientific and technical apparatus and instruments and materials used or usable by Canadian industries.

Under the *National Research Council Act*, NRC also has the responsibility for “operating and administering any astronomical observatories established or maintained by the Government of Canada”. NRC’s research and development activities include grants and contributions used to support a number of international activities.

NRC is also mandated to provide vital scientific and technological services to the research and industrial communities. This mandate is discharged to some extent through the operation of the Industrial Research Assistance Program, the Canada Institute for Scientific and Technical Information, (CISTI) and the Canadian Technology Network.

The *National Research Council Act* empowers NRC to “establish, operate and maintain a national science library” and to “publish, sell and otherwise distribute” scientific and technical information. NRC fulfils this mandate through CISTI, providing Canadians with access to worldwide scientific, technical, medical and related information and expertise.

Weights and Measures Act

NRC is responsible for primary standards of physical measurements as formally established by the *Weights and Measures Act* and the *National Research Council Act*. NRC has a specific mandate relating to “the investigation and determination of standards and methods of measurements including length, volume, weight, mass, capacity, time, heat, light, electricity, magnetism, and the investigation and determination of physical constants and the fundamental properties of matter”.

B. Operating Environment

Over the years, NRC’s activities in nuclear energy, defence, space and medical research, and the support of universities have led to the creation of several separate federal agencies such as Atomic Energy of Canada Limited (1952), the Defence Research Board (1947), the Medical Research Council (1969), the Natural Sciences and Engineering Research Council (1978), and the Canadian Space Agency (1990). NRC has maintained close relationships with these agencies and their successors.

As a member of the Industry Portfolio, NRC has extensive and frequent interactions with its portfolio partners at the management, policy and working levels. The organization also has ongoing relationships with many other research-based federal departments and agencies, often as clients and collaborators in NRC-led research activity. For example in 1997-98, NRC’s research institutes worked closely with Fisheries and Oceans, National Defence, Transport Canada, Agriculture Canada, Foreign Affairs and International Trade and Environment Canada. This is in addition to many other partner, client and collaborative interactions last year with

non federal government organizations – for example, provincial and municipal governments, universities, industry associations and individual companies.

C. Vision to 2001

In its Vision to 2001, NRC has taken up the challenge of contributing to Canada's technological development, competitiveness and prosperity. The vision summarizes the organization's approach to fulfilling its mandate in light of the economic and social realities facing the country now and in the coming years.

NRC's Vision:

As Canada's foremost R&D agency, NRC will be a leader in the development of an innovative, knowledge-based economy through science and engineering. This vision will be realized by:

- *being dedicated to excellence in advancing the frontiers of scientific and technological knowledge in areas relevant to Canada;*
- *carrying out focused research, in collaboration with industrial, university, and government partners, to develop and exploit key technologies;*
- *providing strategic advice and national leadership to integrate key players in Canada's system of innovation; and*
- *taking a more aggressive, entrepreneurial approach to ensure the transfer of our knowledge and technological achievements to Canadian-based firms.*

D. Business Lines

NRC is classified as a departmental corporation under Schedule II of the *Financial Administration Act*. Under the *National Research Council Act*, the general orientation and establishment of

NRC's policies and programs are the responsibility of a Council comprised of up to 22 members appointed by the Governor in Council. Representing senior levels of Canadian industry and academic communities, Council members bring a broad range of knowledge and experience to the decision making process. NRC's President acts as both Chairperson of the Council and as the Chief Executive Officer of the organization.

NRC's Program has three business lines, which provide a balance between conducting R&D, offering technical and financial assistance to industry and the scientific community, and supporting the organization with administrative and management services:

- Research and Technology Innovation
- Support for Innovation and the National Science and Technology Infrastructure
- Program Management

1. Research and Technology Innovation

The Research and Technology Innovation business line includes NRC's research programs, technology development initiatives, management of national science and engineering facilities, along with its research and technology collaborations with firms, universities and public institutions. These efforts all focus on key technological and industrial areas of Canada's economy where NRC has specific roles and recognized competencies, and where it has the ability to have an impact.

This business line is organized in terms of a portfolio of programs, facilities and services in strategic technologies, key industries and areas of research which are all critical for Canada's ability to become an innovative society and economy.

The Research and Technology Innovation business line is structured and its performance measured in terms of the following technology areas:

Biotechnologies

Biotechnology research is strategically important to key sectors of Canada's economy. NRC's strengths in biotechnology help it serve and interact with industrial and university partners. Its five biotechnology research institutes focus on health care/pharmaceuticals, agri-food, marine biotechnology and the environment.

Information and Telecommunications Technologies

The convergence of the multibillion dollar information and telecommunications sector with the global marketplace has created an environment where risks and rewards are great.

The two research institutes in NRC's ITT Group bring together a broad range of complementary technical capabilities and equipment to help firms reduce the risks and costs of working on the next generation of communications and information technology hardware and software.

Manufacturing Technologies

Globalization, trade agreements, and other external pressures present challenges and opportunities for this important sector that magnify the importance of new technologies. Three NRC research institutes focus on advanced materials, software systems, intelligent production systems, industrial lasers, process technologies, sensors, and control systems.

The Research and Technology Innovation business line also focuses on key industries which are critical to Canada's economy. They include:

Construction

Construction is one of Canada's largest industries and a critical asset underpinning the international competitiveness of the country's economy. NRC is the national technology focus for cost-effective generic technology solutions, a vehicle for effective linkages to domestic and international research, technical standards and professional organizations, and a national coordinating mechanism for construction technology.

Aerospace

As Canada's foremost aeronautical research establishment, NRC provides R&D support to the operations of the Canadian aerospace industry which faces exacting design, performance and safety requirements and an increasingly competitive global market. Competencies include: aerodynamics; structures, materials and propulsion; flight dynamics and flight systems integration.

Ocean Engineering and Marine Industries

NRC, through its recognized competencies in the physical and numerical modeling of hydrodynamic processes, plays an important niche role for Canada in ocean engineering and marine research. It provides R&D support to various industrial sectors within the ocean industry: ocean resources, marine manufacturing, and marine transportation.

Core Research

Finally, NRC provides critical support to key areas of research and technology development which underpin Canada's innovation systems. These include NRC's responsibilities for research in national measurement standards and supporting Canada's national measurement system, as well as its role in managing national astronomical facilities. As an organization with a

mandate for research, NRC knows the importance of long term strategic investments in leading edge research which is linked to Canada's technological and innovation needs. It recognizes that incremental innovation is often based on transformational research and research methods. While all elements of the business line support these efforts, NRC has established a program with specific responsibilities for integrating NRC's competencies in the area of molecular sciences.

2. Support for Innovation and the National Science and Technology Infrastructure

The second business line encompasses NRC's assistance to industrial research and the dissemination of scientific and technical information. NRC fulfils this mandate by developing and diffusing scientific knowledge and technology in partnership with industry, governments and universities. This activity is carried out nationally via the Industrial Research Assistance Program and the Canada Institute for Scientific and Technical Information networks.

The **Industrial Research Assistance Program (IRAP)** is well known for its successes over the years in helping small- and medium-sized enterprises, (SMEs) develop and exploit technology. Founded on a national network of Industrial Technology Advisors (ITAs), IRAP contributes technical and financial assistance to help companies improve their technical knowledge and expertise to meet the challenges of a changing and competitive economy. IRAP extends the reach of its ITA network by creating extensive linkages with other government departments and agencies, helping deliver their programs in some cases.

IRAP is also responsible, in co-operation with Industry Canada, for implementing a recent government initiative, the **Canadian Technology Network (CTN)**. CTN is a national network of people who provide comprehensive, easily accessed, user friendly advice to SMEs that need technical and related business help.

The mission of the **Canada Institute for Scientific and Technical Information (CISTI)** is to provide worldwide scientific, technical and medical information to Canadian users to help achieve Canada's economic and social goals. CISTI plays an essential role in Canada's S&T infrastructure, supplying more than 25 products and services to over 13,000 clients across the nation. Also, through its Research Press, CISTI is Canada's largest publisher of scientific journals.

3. Program Management

The third business line includes corporate support and direction, and administrative services, with a focus on effective management of NRC's programs and its resources.

The Program Management business line comprises two components:

- the Executive Support function which provides policy, program and executive support for the co-ordination and direction of NRC's operations and its governing Council, and
- the Program Administration function, which supports and enables effective and efficient management of NRC's resources through its specialization in: finance; information management; human resources; administrative services and property management; and corporate services.

Section III: NRC's Performance

A. Performance Accomplishments

1. Progress in Achieving NRC's Vision

In 1996, NRC outlined a new corporate Vision building on an outstanding record of past achievement and future potential as Canada's principal R&D agency. The Vision statement is NRC's commitment to play a leadership role in the development of an innovative knowledge-based economy through science and technology. *Vision to 2001* emphasizes four elements:

- research excellence for the advancement of knowledge
- focused research and partnerships in key technologies
- integration of Canada's system of innovation
- entrepreneurship in knowledge and technology transfer

In implementing this new Vision, NRC has had to face new realities: the pressures of operating with a reduced appropriation base; radical change in the industrial environment with the globalization of markets and increasing competitiveness in knowledge-based economies; the need for workforce renewal in the face of retirements, layoffs and competing market demands for scientific personnel. The impact of NRC's efforts to overcome these challenges, working in collaboration with its partners in the business, academic and government communities, is illustrated in this report.

The following sections describe in more detail some of the specific initiatives NRC has undertaken toward fulfillment of its Vision.

Regional Initiatives for Wealth Creation

One of the core elements of *Vision to 2001* involves NRC's role in fostering economic growth and wealth creation through science and technology.

NRC believes that its greatest impact can be made at the local level, where its unique capability to forge linkages among different stakeholders – researchers, businesses, entrepreneurs, educators, and investors – helps create communities that foster innovation. NRC has placed a strong emphasis on building partnerships between its people and facilities, and the resources of the regions in which it operates. As a truly national organization with an impact on the research and business communities in every province and in the territories, NRC has been able to launch a number of targeted regional initiatives.

In the National Capital Region, for example, NRC has worked with partners in the local community to launch an Action Plan for Innovation to improve the linkages between the region's dynamic information technology, telecommunications, and life sciences industries and the expertise found at NRC.

Re-skilling Highly Qualified Personnel

O-Vitesse stands for Ottawa-Carleton Venture in Training Engineers and Scientists for Software Engineering. The program combines two study terms and alternating work terms, to train candidates with strong science and engineering backgrounds – often at the Ph.D. level – and provide them with skills needed for software engineering. The program has been so successful that most students receive job offers even before completing the course work.

O-Vitesse was launched in November 1996 to respond to the shortage of software engineers in Ottawa-Carleton, and has added seven local high-tech companies to the original group of NRC, Mitel, and two local universities.

In December 1997, 40 candidates were selected to join the original 10 students chosen in the launch of the program.

The Action Plan established a centralized information source on local activities, and has fostered greater collaboration among local business people and researchers at NRC's institutes in Ottawa and elsewhere. As a direct response to the need for human resources in software engineering, NRC helped create the O-Vitesse Program to retrain highly qualified science and engineering graduates for employment as software engineers. This well-received program is a good indication of how NRC's innovation initiative in the National Capital Region is maturing.

Another successful initiative is centered on NRC's Institute for Biodiagnostics (IBD) in Winnipeg. In 1997, in partnership with Western Economic Diversification and the Government of Manitoba, NRC launched a Western Medical Technologies Strategy to bring together IBD's expertise with the talent and resources in the private sector, universities and hospitals of Western Canada. The Strategy has already shown concrete results, with three new spinoff companies, incubation facilities for small businesses at IBD, and three magnetic resonance imaging demonstration sites in western hospitals.

NRC is supporting the growing strength of the manufacturing sector in Southwestern Ontario with the opening, in 1997, of a new facility, the Integrated Manufacturing Technologies Institute (IMTI), established on the campus of the University of Western Ontario.

There are regional initiatives underway in Vancouver, Calgary, Edmonton, Saskatoon and Montreal, and others are in the preliminary planning stages in Nova Scotia, New Brunswick and Newfoundland.

International Interactions

NRC is one of Canada's most effective links to other national research and development bodies around the world. Its international influence creates a receptive climate in other countries for Canadian

technology and Canadian SMEs, encourages a two-way flow of S&T information, and makes the services of these organizations available to clients and partners in Canada. NRC's international efforts have also helped attract foreign investment to Canada.

Making International Connections

NRC participated in the Second APEC Technomart held in Taipei in January 1998. The delegation included representatives of NRC research institutes, the Canada Institute for Scientific and Technical Information (CISTI), the Industrial Research Assistance Program (IRAP), the Canadian Technology Network and 18 SMEs, which are either IRAP clients or NRC spin-offs.

The vast majority of the participating companies saw Technomart and two previous technology missions to South-East Asia as positive experiences, leading to technology-based joint ventures and new business relationships. By their own estimates, six of the companies expect more than \$85 million in sales revenue over the next three years due at least in part to the missions. As well, four companies were successful in attracting \$7.5 million in venture capital and joint venture funding in support of the new technology alliances.

In 1997-98, NRC strengthened ties to its traditional partners in Europe and the United States, including new collaborative agreements with the Centre Nationale de Recherches Scientifiques of France and the British Council in the United Kingdom. NRC also established stronger relationships through new memoranda of understanding with various Asian countries. Among these are:

- an agreement with the National Science Council of Taiwan;
- an agreement with the National Science and Technology Board of Singapore, with which NRC now has five collaborative projects;

- an agreement with RIKEN in Japan to promote collaborative activities;
- participation in various APEC activities including Technomart in Taipei, and the APEC Centre for Technology Foresight in Bangkok, and the APEC Symposium on S&T Information Dissemination to SMEs;
- agreements to establish the Canadian Technology Network in Thailand and Indonesia (with assistance from the Canadian International Development Agency).

Entrepreneurship

In addition to promoting technology commercialization, NRC has fostered a new spirit of entrepreneurship at NRC. It has established new policies and programs to help NRC technologies move into the economy and to promote the establishment and growth of innovative, knowledge-based business. In 1997-98, NRC signed agreements with the Business Development Bank of

Canada and the Canadian S&T Growth Fund to help finance government spin-offs, and put in place a training program for scientists who want to create their own companies to commercialize NRC technology. In the past fiscal year, NRC built upon the success of this initiative by opening the training program to other government departments and the private sector.

Aligning NRC to its Vision

NRC is ready to take the next steps to achieve its Vision. This involves realigning the organization by increasing collaboration and partnerships within NRC itself, and by aligning staff to the objectives of the corporate Vision. NRC will enhance its synergy among research institutes, IRAP and CISTI, both through program integration and decentralized program delivery.

2. Research and Technology Innovation Business Line

Comparison of Total Planned Spending to Actual Spending

Planned versus Actual Spending by NRC Business Line (millions of dollars)								
Business Line	Operating ¹	Capital	Grants and Contributions	Subtotal: Gross Expenditures	Statutory Items ²	Total Gross Expenditures	Less: Revenue Credited to the Vote	Total Net Expenditures
Research and Technology Innovation ³	176.4	39.4	38.6	254.4	24.8	279.2	-	279.2
	<i>184.0</i>	<i>41.2</i>	<i>41.2</i>	<i>266.4</i>	<i>38.3</i>	<i>304.7</i>	-	<i>304.7</i>
	159.5	33.7	41.2	234.4	23.9	258.3	-	258.3

Note: Due to rounding, figures may not add to totals shown.
Numbers in italic denote Total Authorities for 1997-98 (Main and Supplementary Estimates and other authorities).
Bolded numbers denote actual expenditures/revenues in 1997-98.

- Operating includes contributions to employee benefit plans.
- Spending of revenues pursuant to the NRC Act.
- Total authorities and actuals reflect the transfer of the Technology Centres from the Research and Technology Innovation business line to support for Innovation and the National Science and Technology Infrastructure.
Excludes spending of proceeds from the disposal of surplus crown assets.

This is the first of three business lines, the one which reflects all of the research activity conducted at NRC.

The objective of the Research and Technology Innovation business line is to...

achieve sustained knowledge-based economic and social growth in Canada through research, technology and innovation in key areas.

More than at any other time in its history, NRC's research is strategically focused. This means that choices made about the kinds of research to pursue and which industrial partners to work with are based on important current and emerging Canadian needs.

Research projects typically take several years of development before their results are ready for whatever application they were intended. The time element associated with this research spectrum makes it difficult for NRC, or any other research organization, to quantify the impacts that it has in any given year on Canadians, Canadian firms and the economy. However, indicators of NRC's research quality, involvement with industrial and other partners,

and the transfer and sale of its information, services and technology can be considered as solid measures of its annual performance.

NRC is mandated under its Act to conduct research in many fields. This has led to the evolution over the last 80 years of a highly regionalized organization with a broad spectrum of expertise and capability. Managing such a diverse organization so that it can keep ahead of the rapid pace of modern technological society is a challenge.

The realignment three years ago of 10 of NRC's 16 research institutes under the umbrella of technology groups has helped consolidate the research program through combined planning, pooling of resources and the development of closer working relationships. The technology groups were formed so that NRC can better respond to the changing priorities of three major Canadian industrial sectors, biotechnology, manufacturing, and information and telecommunications. To ensure that all of NRC's program elements participate, representatives from IRAP and CISTI are also involved in technology group activities.

Biotechnology Group:

Biotechnology Research Institute (Montreal)
Institute for Biological Sciences (Ottawa)
Plant Biotechnology Institute (Saskatoon)
Institute for Marine Biosciences (Halifax)
Institute for Biodiagnostics (Winnipeg)

This technology group currently has a combined portfolio of 107 collaborative agreements with partners across Canada, including 73 industry partners, 20 universities and 13 other federal and provincial government departments. Last year, the group created four new spinoff companies, and generated nine licences and 21 patents. Twenty-eight firms used incubation facilities within the group's institutes, and 13 products and processes were commercialized.

Manufacturing Technologies Group:

Industrial Materials Institute (Boucherville)
Institute for Chemical Process and Environmental Technologies (Ottawa)
Integrated Manufacturing Technologies Institute (London, Vancouver)

The Manufacturing Technology Group has a portfolio of 346 research contracts with 255 clients, an increase of 13% from 1996-97. Of this total, 85% are from industry and 68% are SMEs. In 1997-98, the MTG generated 11 patents and 16 Intellectual Property licences. Client surveys demonstrate that over 90% of direct industrial impacts of projects with firms have already occurred or are likely to occur in the future.

Information and Telecommunications Technology Group:

Institute for Microstructural Sciences (Ottawa)
Institute for Information Technology (Ottawa)

This technology group has a portfolio of 66 collaborative agreements with partners, including 37 companies, 40 universities, and 17 government agencies.

In 1997-98, 12 new patents were issued and an additional 13 applications were made for new patents. The group generated 9 licences. Researchers published 150 scientific papers, and made 353 presentations at conferences, seminars and workshops. As well, they represented the group on 162 national and international committees.

NRC provides Canadians with a research program that focuses on excellence and knowledge, and that is relevant to Canadian needs

NRC's research projects are chosen so that they eventually generate tangible benefits to Canadians. There is a fundamental principle at NRC that, in order to accomplish this, research activities must be of high quality and relevant to Canadian needs.

Impacts start to become obvious when researchers receive awards and other forms of recognition from the scientific and engineering communities, and also when companies begin to implement the actual discoveries or technologies developed. Case studies from the two institutes that comprise NRC's Information and Telecommunications Technology Group demonstrate the "pick-up" potential of research work.

At the Institute for Microstructural Sciences, research into thin film technology has yielded an impressive array of industrially relevant applications. For example, one use of thin film technology can be found in the thin-film electroluminescent (TFEL) displays currently being marketed by Luxell Technologies. Because of the unique characteristics of these displays, Luxell has recently been able to secure a market niche and, consequently, lucrative contracts valued at more than \$7.5 million.

Air Canada has committed \$5 million to the first phase implementation of an Integrated Diagnostic System developed by the Institute for Information Technology. The system interprets ground based and in-flight data to determine the most probable faults in an aircraft. When fully deployed, this system could save the airline up to \$10 million annually and over \$1.5 billion for the

airline industry at large. This technology has received an award from the American Association of Artificial Intelligence.

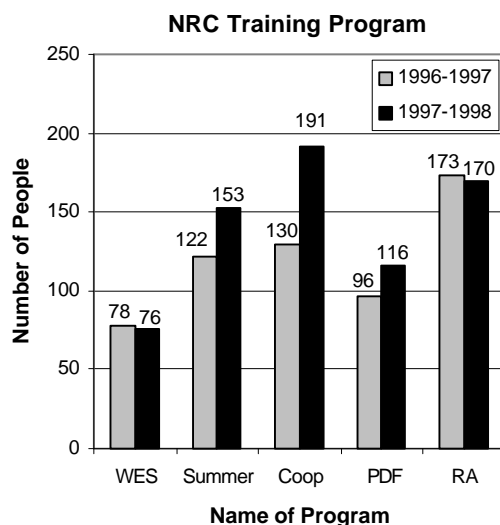
NRC's Herzberg Institute of Astrophysics, traditionally focused on astronomy, is seeking new ways to apply its scientific expertise to industry needs. One project involves providing advice to a firm on the design and calibration of an antenna for cellular phones. The new antenna will direct the radiation from the power supply of the phone away from the person using it.

Both *Nature* and *Science* magazines, as well as several other international publications, have recognized the work of researchers at NRC's Steacie Institute for Molecular Sciences. This visibility will help in the development and ultimate commercialization of a technique that allows the researchers to see, for the first time ever, organic molecules bonding to the surface of a silicon crystal. This technology – using a scanning tunnelling microscope – is expected to significantly expand the capabilities of computer chips (and the companies that manufacture them) by allowing researchers to tailor-make semiconductors using different materials with different properties.

Magnetic Resonance Imaging (MRI) is a relatively new health-related tool that allows clinicians to recognize and pinpoint brain tumours in humans and animals. Its use in the neurosurgical operating theatre has been limited by a number of factors, including a long set-up time prior to the imaging session. NRC's Institute for Biodiagnostics, in collaboration with IMRIS Inc. (an NRC spin-off company) and the Foothills Hospital in Calgary, has developed an innovative automatic matching and tuning RF head coil that reduces set-up time. The coil's unique two-piece design also allows complete access to the surgical field when not in use because the top half of the coil can be removed during surgery.

NRC's Institute for Marine Dynamics has an international reputation for expertise in offshore engineering research. Major oil and gas producers have benefited from the institute's ability to provide fast and accurate data on a range of offshore engineering issues. The experience gained from that work is now being applied to the Canadian petroleum industry, including several studies for Hibernia, Terra Nova and offshore Nova Scotia.

An internationally-acknowledged measure of research quality and relevance is formal recognition by other researchers in Canada and around the world through, for example, awards, acceptance of papers by well-known publications, and speaking invitations to conferences and seminars. Last year, 47 employees received prestigious national and international awards for their work, including the "Canada Gold Medal for Sciences and Engineering" and the induction of a Member of the Order of Canada.



NRC delivers annually on a commitment to give on-the-job training to some of Canada's best young scientists and engineers. These programs are aimed at undergraduate and recent graduates, offering many of them opportunities to train directly with NRC researchers. (WES: Women in Engineering and Science, PDF: Post Doctoral Fellows, RA: Research Associates)

In 1997-98, NRC researchers produced 1,711 documents in conference proceedings and in refereed publications, as well as 918 books, book chapters and technical reports. In 1996-97, there were over 1,650 documents, and 637 books, chapters and reports. Invited presentations at national and international conferences and events demonstrate recognition of research relevance and quality by peer groups. In 1997-98, NRC researchers gave presentations at about 725 conferences.

Investing in equipment and buildings is an essential component of NRC's strategy to stay at the leading edge of changing Canadian science and technology needs. In 1997-98, the organization spent about \$45 million on capital improvements, including the commencement of construction on two Industry Partnership Facilities, one linked to NRC's Biotechnology Research Institute in Montreal, and the other linked to NRC's Information and Telecommunications Technology Group in Ottawa.

The Industry Partnership Facilities, sometimes referred to as "incubators", are designed to house industrial partners, small- and medium-sized firms in particular. By working closely with NRC experts, companies can improve their competitive positions through enhanced technical capabilities and marketability. The Montreal facility was fully leased upon its opening in the summer of 1998, proof of its attractiveness to industrial partners.

Of its \$10 million annual budget, in the last couple of years the Aerodynamics Laboratory at NRC's Institute for Aerospace Research has funded over \$6 million of that amount through private and public sector partners and clients. This high level of external support highlights the institute's importance to Canada's aerospace community, and the maturity of the sector itself.

NRC contributes to economic growth by helping Canadian firms develop new, marketable technologies

In order to augment the competitiveness of Canadian firms, NRC must help create technology opportunities for them by working with them. In 1997-98, NRC's research program participated in approximately 653 collaborations, compared with about 563 in 1996-97. Developing new research collaborations and partnerships, as well as making progress in existing ones, is an important indicator of the organization's ability to anticipate and act on emerging trends in science and technology. The activities of two of NRC's Manufacturing Technology Group institutes demonstrate how NRC can supply real solutions for companies:

Finding environmentally safer methods to use, treat and dispose of chemicals is essential to the future competitiveness of Canada's manufacturing industry. Recently NRC's Institute for Chemical Process and Environmental Technologies, the Industrial Materials Institute and Viasystems Group Inc. collaborated to develop a method of electrochemically removing contaminants from circuit board plating solutions. This system eliminates costly shutdowns and removes the environmental problems associated with disposing of the contaminated solution.

When Kautex Textron Inc. needed technical proof that its new plastic gas tank was a viable product for the automotive industry, it approached NRC's Industrial Materials Institute (IMI). IMI had developed a software that can simulate how such a product will be moulded into shapes. With IMI's involvement, Kautex was able to perfect the design of the gas tank and produce a lighter, more cost effective product that has given them a competitive edge over other firms.

If NRC can assist Canadian companies in growing their businesses through the introduction of new technologies to their manufacturing processes or new products to their sales lines, then it can reasonably expect positive downstream impacts on the economy and on Canadians. Consequently, the technical and commercial successes of firms who work with NRC are perhaps the most significant measure of the organization's success. Examples from three institutes associated with NRC's Biotechnology Group show how research results have impacted on companies and Canadians.

In 1997-98, NRC's Institute for Marine Biosciences (IMB) in Halifax joined a multi-partner project lead by a private firm, Connors Bros. Ltd., to develop technology for the commercial production of haddock. Of the 12,200 juveniles produced at IMB, 10,500 were delivered to Connors Bros. for growth performance trials in sea cages. The remaining haddock were retained at IMB for use in nutrition, fish health and broodstock development projects. This is the first significant production of haddock juveniles. The technology will provide the company and the region with new economic opportunities.

NRC's Saskatoon-based Plant Biotechnology Institute has developed, in collaboration with the Saskatchewan Wheat Pool, a new Hard Red Spring Wheat variety – "McKenzie" – which will increase crop yield by as much as 15-25% and offer improved disease resistance. Once it is available for commercial sale in a couple of years, the economic impacts on both seed producers and Canadian farmers are expected to be substantial.

Of the approximately 400 Canadians who catch meningitis each year, about 100 of them die soon after catching the disease. Many of those who survive suffer serious health complications like permanent brain damage, deafness and mental retardation. Two-thirds of the patients are five years old or younger. With the support and partnership of two pharmaceutical firms, BioChem Pharma

and North American Vaccines, a research team at NRC's Institute for Biological Sciences has developed vaccines to fight the bacteria that cause infant meningitis. While other vaccines exist, this team's vaccines are vastly superior in protecting against all seven strains of the disease. Plans involve marketing the vaccines by the year 2000, with world-wide sales.

Direct Impacts of Projects Cited in a Client Feedback Survey

Benefit	Has already occurred	Likely to occur in the future	Not likely to occur
Improved process efficiency	52%	38%	10%
Reduced product development time	59%	31%	10%
Greater manufacturing flexibility	35%	49%	16%
New or improved product or process	35%	61%	4%
Increased technological capability	55%	44%	1%
Gained knowledge	81%	19%	0%
Reduced environmental impact	13%	83%	4%
Total Responses	52%	43%	5%

Over the past two years, 240 clients and partners were surveyed on how their involvement with institutes in NRC's Manufacturing Technologies Program impacted their operations. The 112 responses received so far indicate a high level of client/partner satisfaction.

NRC contributes to technology-based economic growth in communities across the country

With its widespread regional presence, NRC has been working with other federal and provincial government partners to attract more technological activity to Canadian communities. A major event last year was the opening of NRC's Integrated Manufacturing Technologies Institute at the University of Ontario in London. The institute will eventually accommodate up to 140 staff, students and visiting researchers from companies and other organizations for training and incubation purposes.

Two NRC institutes focus on developing and improving national building and fire codes and measurement standards. The application of these codes and standards across the country ensures consistency in important areas of Canadian lives, and gives industry an opportunity to take advantage of new approaches. For example, a collaborative project led by the Institute for Research in Construction has resulted in the development of methods to make indoor atriums a more attractive and cost-effective solution to the environmental concerns of building designers, owners and occupants. These

new methods will provide a safe, healthy and comfortable indoor environment, as well as help reduce building operating costs.

NRC's Institute for National Measurement Standards (INMS) has been taking a lead role at times in a growing international movement to overcome barriers to trade that occur when measurement standards and practices (e.g. the weighing and measuring of products) differ between countries. These barriers close doors to markets that Canadian companies are interested in exploring. Substantial progress was made in 1997-98, much of it due to INMS' involvement. For example, both the North American Free Trade Agreement (NAFTA) and the Asia-Pacific Economic Cooperation (APEC), are now incorporating requirements aimed at achieving compatibility in measurement standards and practices.

NRC transfers its research successes to Canadian firms

Ultimately, the objective behind NRC's research activity is to provide companies with opportunities to benefit from marketable ideas, processes and technologies. At an appropriate stage in knowledge and technology development, NRC's researchers will often apply for patents when it becomes obvious that these products may have market potential at some point for Canadian companies. The organization will also sell licences to firms who want to apply NRC-generated knowledge and technology in their businesses. The number of new patents and licence sales each year and the revenues from them is a measure of the quality and applicability of much of NRC's research activity.

In 1997-98, NRC secured 59 patents on inventions and new technologies. By the end of the year, the total number of patents in effect was 568. Also during the year, the organization entered into 42 new licensing agreements. The royalties

collected from licences in 1997-98 doubled from the previous year, totalling over \$2 million.

NRC's Entrepreneurship Program was introduced a few years ago to maximize the transfer of NRC knowledge, know-how and technology to Canadian firms. Changes in culture, approach and procedure at NRC have resulted in improvements in technology transfer. Where no Canadian receptor exists, the organization encourages its researchers to spin off their own companies in order to commercialize their technologies.

In 1997-98, six new firms were spun off by NRC researchers, bringing the two-year total to ten.

1.1 Key Reviews

During the 1997-98 fiscal year, NRC made several changes to its strategic planning and assessment process. A revised five-year assessment schedule was developed which ensures that assessment results are addressed in the strategic plans of NRC's research institutes, programs and branches. The revised process will also improve NRC's ability to assess performance against established objectives.

The Assessment Process

NRC uses three elements in assessing its programs and activities. The program evaluation and comprehensive audit elements are typical in government organizations. The third element is more specific to an R&D organization in that it studies the quality and relevance of research work. A typical peer review of an NRC institute normally involves an on-site examination by several distinguished individuals from the scientific and industrial communities, followed by a report of their findings and recommendations to NRC's senior management.

NRC has other review mechanisms that complement the assessment function. These include: advisory boards and committees with industrial representation; client feedback; reviews of publications submitted to journals; formal, annual program reviews; and self assessment using performance frameworks.

Assessments

In 1997-98, NRC assessed the Institute for Research in Construction (IRC) and the Institute for Aerospace Research (IAR).

The IRC assessment concluded that the institute is conducting leading edge research with high quality results that are generally translated into practical applications. In its role as a unique 'competent honest broker', IRC's leadership in key consortium projects is leading to substantial downstream economic benefits for Canadian firms applying the technologies developed.

To maximize its relevance, leverage and impacts, the institute should continue to develop public/private sector multi-partner consortia for important research initiatives. It was also noted that IRC has a technology leadership role with the vast majority of less sophisticated construction firms.

In the case of the Institute for Aerospace Research, the assessment included a specific focus on the present and future needs of the Canadian aerospace community and IAR's role in meeting these needs. The assessment concluded that the institute is a critical element in the aerospace industry, and that it provides significant technical and organizational benefits for its major, longstanding clients. The assessment also concluded that IAR should continue to develop proactive strategies to involve more small- and medium-sized firms in its activities.

3. Support for Innovation and the National Science and Technology Infrastructure Business Line

Comparison of Total Planned Spending to Actual Spending

Planned versus Actual Spending by NRC Business Line (millions of dollars)								
Business Line	Operating ¹	Capital	Grants and Contributions	Subtotal: Gross Expenditures	Statutory Items ²	Total Gross Expenditures	Less: Revenue Credited to the Vote	Total Net Expenditures
Support for Innovation and the National Science and Technology Infrastructure ³	30.4	-	84.0	114.3	13.2	127.5	-	127.5
	33.8	0.5	87.7	122.0	19.7	141.7	-	141.7
	37.8	1.2	87.5	126.5	19.9	146.4	-	146.4

Note: Due to rounding, figures may not add to totals shown.
Numbers in italic denote Total Authorities for 1997-98 (Main and Supplementary Estimates and other authorities).
Bolded numbers denote actual expenditures/revenues in 1997-98.

- Operating includes contributions to employee benefit plans.
- Spending of revenues pursuant to the NRC Act.
- Total authorities and actuals reflect the transfer of the Technology Centres from the Research and Technology Innovation business line to support for Innovation and the National Science and Technology Infrastructure.

Excludes spending of proceeds from the disposal of surplus crown assets.

This is the second of NRC's two program-oriented business lines, dedicated to offering different kinds of support to research and development across Canada.

The objective of the Support for Innovation and the National Science and Technology Infrastructure business line is to ...

- *improve the innovative capability of Canadian firms through the provision of integrated and coordinated technological and financial assistance, information and access to other relevant resources; and*
- *stimulate wealth creation for Canada through technological assistance, information and access to other relevant resources.*

Comprised of the Industrial Research Assistance Program, the Canada Institute for Scientific and Technical Information, and the Technology Centres, the business line offers a unique range of services and products that are intended to contribute to the economic viability of knowledge-based companies and to the progress of other research organizations. Because the business line is so client and service oriented, these factors are important when describing its performance.

2.1 The Industrial Research Assistance Program

The Industrial Research Assistance Program, commonly known as IRAP, helps Canadian small- and medium-sized companies develop and exploit technologies. The program offers both financial support and technical advice to firms, tailoring these services to the needs of individual clients.

IRAP is considered to be one of the more successful industrial assistance programs in Canada primarily because:

- it concentrates on helping small- and medium-sized firms,
- it is efficiently delivered through a network of specialists from organizations located across Canada,
- the network's responsive nature ensures that the program's focus is on current regional and industrial priorities;
- while it provides financial assistance, it also links firms to valuable sources of technology advice without charge; and
- the financial assistance provided is based on the premise that firms share the costs and risks with IRAP.

In its February 1997 Budget, the Federal Government stabilized IRAP's financial base in order to compensate for the sunseting of certain funds. NRC considers this to be a strong indication of the general high regard held for the program. In the February 1998 Budget, the program received a further \$34 million increase, part of it to deliver Industry Canada's *Technology Partnership Canada* program to SMEs. The other part will be used to conduct IRAP's regular business of helping SMEs foster strategic innovation while encouraging environmentally sustainable technologies and processes.

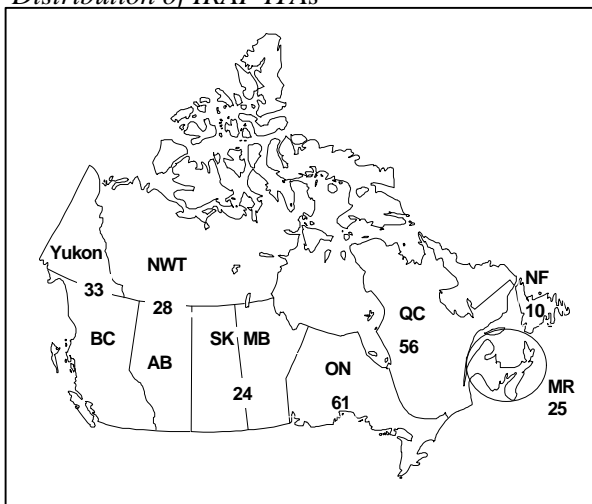
NRC contributes to economic growth by helping Canadian firms develop new, marketable technologies

Of the 245 Industrial Technology Advisors (ITAs) who deliver the program, 70% of them work directly for 130 different public and private organizations, including provincial research organizations, research centres, universities and colleges, industrial associations and other professional groups. All of IRAP's ITAs have industrial

experience combined with either a general knowledge of technologies or an in-depth expertise in specific areas. They represent the best expertise available to SMEs in 80 cities across the country.

Northern Milltech Inc. (NMI) in Prince George, BC, has developed a computerized moisture and density sensor system for lumber that is inexpensive, efficient, and that works on frozen wood. IRAP provided technical expertise and guidance on two of the firm's research projects. "The real value of the IRAP program was the ITA. He pointed out other resources, did a literature and patent search, and helped us get a feel for how we could approach things differently. If the ITA hadn't been there, I don't know how we would have done it." To date, NMI has sold 33 systems worldwide and has generated sales in excess of \$3.4 million in the last 2 years.

Distribution of IRAP ITAs



In 1997-98, IRAP assisted some 12,000 clients, which is similar to the previous year's performance. About 3,300 firms received financial assistance on 4,140 industry-led projects. This represents an increase over 1996-97 performance in which 3,018 firms received support on 3,558 projects. IRAP's total contributions

to these projects amounted to over \$65 million, a 10% increase over the previous year. It is important to note that the program encourages companies to cover as much of their project costs as possible, with firms contributing between 30% to 40% last year. Approximately \$28 million was expended on contribution agreements with ITAs and their associated administration costs.

“True Canadian success story made possible by NRC-IRAP”

The Nack Company of Windsor, Ontario credits IRAP’s \$18,000 contribution with the start-up assistance it needed to develop its technology, and also for finding experts who helped turn the firm’s concept into a reality. In the spring of 1998, the company launched the world’s first all-purpose, ergonomically designed utility knife that changes blades automatically in seconds. The knife has won major trade show awards, and will be one of the first tools to be marketed under a hardware line developed for television star and comedian Tim Allen. The firm directly employs six people, but plans to create many more jobs as demand for its product increases and its foreign market opportunities expand.

In 1997-98, IRAP received authority and resources to deliver two components of the federal *Youth Employment Strategy Initiative in Science and Technology*, a two-year Human Resources Canada program. One program is designed to help SMEs hire recent science, engineering, technology and business graduates, the objective to employ some 980 graduates over the period. The other component of the initiative is to help SMEs hire unemployed graduates of Canadian universities and colleges, with a hiring objective of about 90 graduates.

In the first year, small firms hired nearly 600 youths through the first program component and 18 through the second. This indicates a substantial success rate for the first component. IRAP plans to boost promotion on behalf of the second component pertaining to unemployed youth, and expects an improved company take-up during 1998-99.

Since 1991, Can-Oat Milling Inc. in Manitoba has been conducting research on measuring the properties of milled oats, information that the company needed to process and develop the product. With IRAP’s help over the years, the company was able to hire students to perform research, leading to improvements in its quality control methods and in the ways it processes oats. The work contributed to increased sales for the company, which began with about 45 employees in 1991 and now has 85. The firm has created a permanent new position for one of the students, and has annual sales of over \$30 million. As well, it has set up an R&D department, a good indication of its commitment to remaining competitive in world markets.

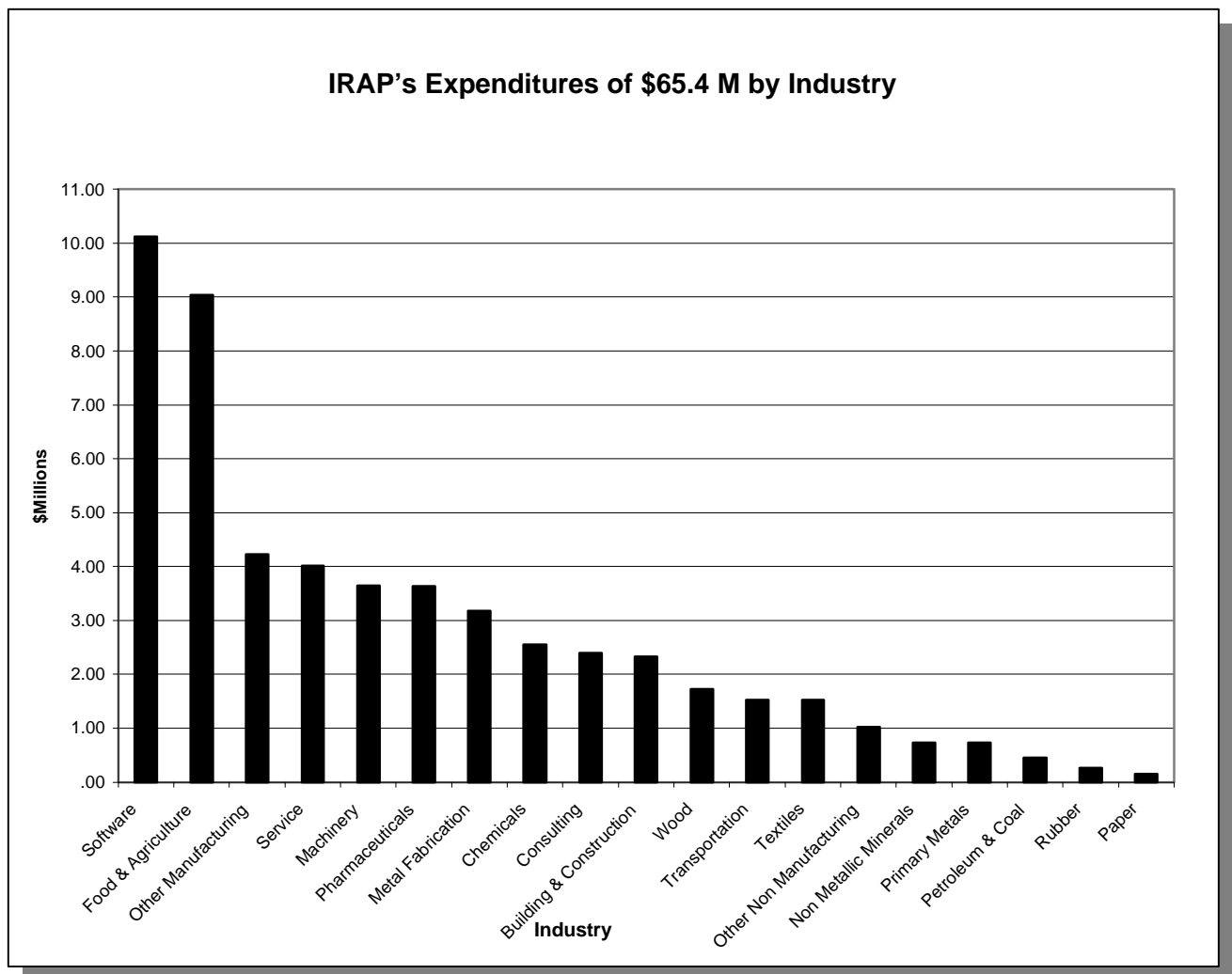
NRC contributes to technology-based economic growth in communities across the country

As part of its strategic plan to offer a fuller range of services to clients across Canada, IRAP is enhancing its linkages with NRC’s research institutes and CISTI. One way the program is doing this is by partnering with them in NRC’s community-based initiatives, contributing to collaborative efforts with other government organizations in British Columbia, Alberta, the Prairies, Ontario and Quebec.

For example in Alberta, in partnership with Western Economic Diversification and other provincial and local organizations, IRAP took a leadership role in the establishment of innovation centres in Calgary and Edmonton, which have now been operating for a year.

In BC, NRC officially opened an Innovation Centre last year on the campus of the University of British Columbia. The Centre has released an action plan that focuses on wood product research, biotechnology and biosciences. The Innovation Centre concept is one way that NRC can offer to companies all of its major program elements - its research expertise and access to IRAP and CISTI - at sites in the regions.

Since its inception in 1994 and with Industry Canada's start-up support, the Canadian Technology Network (CTN) has been delivered by IRAP. CTN is a virtual, national network of volunteer experts from over 850 member organizations who provide advice – at no charge to clients - to technology-oriented small companies looking for help in managing their businesses.



IRAP's clients are from all industrial sectors of the Canadian economy. The figure above shows that the program provides assistance to firms that represent the bulk of Canada's industrial base.

A survey of clients last year confirmed that CTN has been successful in targeting firms with fewer than ten employees. Of the 207 firms surveyed, 80% were very satisfied with CTN's business advice, technical advice or contribution to a direct resolution of their problems. This figure is an improvement over the already high 77% figure reported in a 1996-97 survey.

2.2 The Canada Institute for Technical Information

To support them in their work, all researchers need to have quick and dependable access to the best, most current information available pertaining to their fields of study. The Canada Institute for Technical Information (CISTI) plays an essential role in providing researchers across the country with scientific, technical and medical information (STI). CISTI is a world leader in technical library services, and is also Canada's largest publisher of scientific journals. It holds one of the largest STI collections anywhere and disseminates this information through a state of the art document delivery system.

While its main information storage location is in Ottawa, CISTI has staff in 10 regional offices, situated in NRC's research institutes and Innovation Centres across Canada. These information centres focus on regionally important technology areas, and are accessible to the public.

Modern times demand that CISTI continually adjust the way it delivers information to clients in order to keep pace with changes in information management technology. Over the past few years, CISTI has been positioning itself to become Canada's major STI resource by:

- increasing and improving the range of its publishing and document delivery services; and
- maintaining its world class collection, thereby giving Canadians access to the best and most current scientific, technical and medical information from around the world.

Total CISTI sales reached approximately \$15 million in 1997-98, and its cost recovery ratio increased slightly. However, information management, technology refurbishment, CISTI's commitment to modernizing its operations and maintaining its collection as a valuable Canadian asset require re-investment of its revenues as well as new investment. For example, the inflationary factor in the scientific information industry is very high, and CISTI must spend in the order of \$10 million annually just to maintain its collection at existing levels.

NRC contributes to economic growth by helping Canadian firms develop new, marketable technologies

Like IRAP, the quality and effectiveness of service delivery are critical measures in determining CISTI's performance. There are several indicators that demonstrate how CISTI performed in 1997-98:

- the total number of CISTI clients was 25,974, an increase of 19% over the previous year;
- over 10,700 Canadians were registered as users of CISTI's online Catalogue service during the year, an increase of 44% since 1996-97;
- Canadian users of other CISTI delivery vehicles also increased over the same period— DOCLINE by 33% and SwetScan by 84%;

- over 143,000 document orders were placed through CISTI's Catalogue, an increase of 29% over the previous year;
- Canadians placed close to 440,000 document orders for all of CISTI's services; and
- now a worldwide service, CISTI received a total of 616,000 orders through all of its document services.

In the past several years, CISTI has been developing its capabilities to provide information online. This is clearly the way of the future. For example, there were close to 20,000 different Canadian sites connected to CISTI via the Internet in 1997-98, a 48% increase over 1996-97. The use of CISTI's Virtual Library has grown steadily in the last two years. The number of sites that CISTI served increased 73% in 1996-97 from 1995-96, and 179% in 1997-98.

2.3 Technology Centres

In 1995-96, NRC established four technology centres:

- the Canadian Hydraulics Centre;
- the Centre for Fluid Power Technology;
- the Centre for Surface Transportation Technology; and
- the Thermal Technology Centre.

These centres, each with a small contingent of staff, offer specialized testing and other engineering-oriented services to clients on a cost recovery basis.

While not part of NRC's core activities, the technology centres provide unique engineering facilities and services to Canadian industry. Plans involve reducing the amount of government support so that the centres operate on a cost-neutral basis. The objective is to determine the best arrangement that will allow them to continue to operate within or outside NRC.

One of the four centres, the Centre for Fluid Power Technology, did spin off in late 1997-98. The other three are now operating primarily on the revenues they generate, using those funds to cover salaries, benefits, operating and capital expenditures. NRC provides only a minimal amount of infrastructural support to the centres.

4. Program Management Business Line

Comparison of Total Planned Spending to Actual Spending

Planned versus Actual Spending by NRC Business Line (millions of dollars)								
Business Line	Operating ¹	Capital	Grants and Contributions	Subtotal: Gross Expenditures	Statutory Items ²	Total Gross Expenditures	Less: Revenue Credited to the Vote	Total Net Expenditures
Program Management	43.0	5.4	5.2	53.6	2.1	55.7	-	55.7
	<i>46.3</i>	<i>4.4</i>	<i>5.2</i>	<i>55.9</i>	<i>15.0</i>	<i>70.9</i>	-	<i>70.9</i>
	60.5	9.9	5.2	75.6	15.0	90.6	-	90.6

Note: Due to rounding, figures may not add to totals shown.
Numbers in italic denote Total Authorities for 1997-98 (Main and Supplementary Estimates and other authorities).
Bolded numbers denote actual expenditures/revenues in 1997-98.

1. Operating includes contributions to employee benefit plans.
2. Spending of revenues pursuant to the NRC Act.
Excludes spending of proceeds from the disposal of surplus crown assets.

This business line provides support services to NRC management and the two program-oriented business lines. Its activities include executive services as well as specialized support in finance, information management, human resources, administration, property management and corporate services.

The objective of the Program Management business line is to ...

provide efficient, client-focused services which enhance NRC's effectiveness as an integrated, dynamic science and technology organization.

While generally operational in nature, all areas of the business line – which in 1997-98 comprised four corporate branches – made progress in their commitment to support NRC's more businesslike, entrepreneurial pursuits.

For example, the groundwork of the Entrepreneurship Program has been developed by the business line over the past three years. New awards and incentives to recognize researchers'

successful work with industry were introduced in 1997-98. Also, training programs were developed for research staff considering starting their own businesses, based on NRC technology.

During the year, the financial component of Sigma, NRC's corporate information management system, was readied for implementation. When all stages of its installation are completed in 1999, Sigma will be the most comprehensive, integrated information management system in the federal government. Based on SAP R/3 software, Sigma will include modules on project management, human resources, finance/control, materiel management, and sales and distribution.

This three-year, organization-wide project has necessitated the full-time reassignment of employees to the Sigma team. Over the past year, the loss of staff has been especially difficult for the finance, administration and human resources branches, who transferred many employees to the team, yet were obliged to also manage their ongoing day-to-day operations.

Another major initiative is development of a competency-based approach to managing human resources. This important project has also the participation of many staff from across the organization, putting further pressure on NRC's resources.

One of the most visible demonstrations of NRC's continuing efforts to improve its business processes is in the maintenance of its buildings and facilities located across Canada. Not only must NRC satisfy health, safety and efficiency concerns, but, as a world-class research organization, it must maintain excellent facilities in order to conduct leading-edge science and to attract industrial collaborators.

Over the past year, NRC had several highlights in this area:

- completion of NRC's Integrated Manufacturing Technologies Institute in London, Ontario;
- negotiations and construction of the Biotechnology Research Institute extension in Montreal;

- development of a plan for NRC's Montreal Road complex in Ottawa
- construction of the Industrial Partnership Facility in information technologies in Ottawa;
- receipt of the American Society of Heating, Refrigeration and Air-Conditioning Engineers Technology Award for an energy-efficient ice chiller system to cool one of NRC's wind tunnels in Ottawa.

Finally, staff from the human resources and corporate branches headed up NRC's efforts in co-sponsoring, with the Canadian Aboriginal Science and Engineering Association, the successful national Aboriginal Career Symposium in November 1997 (see box below).

Following the symposium, NRC initiated phase one of the Aboriginal Recruitment Program. The objective of this program is not to act as a training program for future employment, but to recruit, employ and retain participants as Technical Officers within NRC.

NRC and the CASEA Team Up to Promote Careers in S&T

NRC and the Canadian Aboriginal Science and Engineering Association (CASEA) hosted the 1997 National Aboriginal Career Symposium in November 1997 in Ottawa. The symposium introduced Aboriginal students across Canada to potential career opportunities in science, technology and related fields.

The aims of the symposium were to:

- *encourage students to stay in school*
- *introduce potential career opportunities*
- *focus educational choices on prospective science and technology occupations*
- *reinforce the concept that Aboriginal Peoples can maintain their cultural identity within the workplace.*

More than 1,000 students from grade six to the university level had the opportunity to interact with Aboriginal entrepreneurs and experts in science and technology, giving them a basis for understanding the many ways that scientific discovery, technological innovation and contemporary society are linked.

4.1 Key Reviews

Audit of the Management of Workforce Adjustment

As a result of Program Review and general resource reductions over the last several years, NRC has had to reduce its expenditures, with workforce adjustment being an inevitable consequence. To facilitate the achievement of resource reductions, NRC negotiated modifications to its Workforce Adjustment Policy with its unions.

In 1997-98, NRC carried out an audit of its management of workforce adjustment, using methodology developed by the Treasury Board Secretariat. The audit concluded that: the overall design of NRC's planning and infrastructure controls relating to workforce adjustment was appropriate; that workforce reductions were managed in accordance with plans; and that workforce adjustments were carried out in accordance with the NRC Workforce Adjustment Policy.

C. Year 2000 Readiness

NRC has created a Core Group of senior managers to oversee and monitor progress towards readiness for Year 2000. The Group is chaired by a Vice-President. NRC has also established a Year 2000 Project Office, headed by a Director.

The Project Office is currently evaluating Year 2000 readiness in all areas of NRC where there may be potential risk. Mission critical areas in information technology, including administration and financial systems, networks, laboratory research equipment which may contain time-sensitive embedded chips, and real property are being addressed.

Progress on updating organization-wide administration systems is well in hand with the implementation of Sigma, NRC's Year 2000 ready corporate information management system. Sigma is comprised of several SAP modules covering project management, human resources, finance/controlling, materiel management, and sales and distribution. All modules will be on line by the end of 1998-99. NRC is also taking steps to ensure that all interfaces with Sigma will also be Year 2000 compliant.

IRAP will be relying on NRC's new Sigma system for its financial information and is now developing Year 2000 ready complementary information systems to address other information requirements. In addition, IRAP is currently raising awareness with its Network Members and SME clients on the Year 2000 issue and its potential impact on their businesses.

CISTI is now involved in a substantial effort to convert and test its program-specific systems re client access, service delivery and client billing systems. Year 2000 conversion is in process and on

schedule, to be completed by the end of 1998-99 to give CISTI time to fully test the system.

During 1997-98, NRC replaced or upgraded 95% of its corporate desktop hardware and software for Year 2000 compatibility. Desktop hardware and software in other areas of the organization will also be addressed, depending on their degree of criticality to the mission of NRC.

In March 1998, NRC completed a full risk assessment of its security and building systems. Work is now underway to address critical areas, with full readiness planned by mid-1999.

In May 1998, NRC conducted an audit of Year 2000 readiness in two of its research institutes, considered to be representative of all of NRC. As a result of this audit, the Core Group decided to put in place a management framework to formalize its approach to addressing Year 2000 issues, and to communicate the importance of the Year 2000 to all institutes and branches.

The auditors have since been retained to work with the remaining institutes to ensure that NRC's mission critical assets are identified by November 1998. These will be evaluated to ensure that they do not pose a risk and problem areas will be addressed as per government directives.

The Year 2000 project is well underway. NRC has targetted March 1999 for compliance. NRC has not set up any contingency plans, but is well aware that until the Year 2000 project is completed, contingency planning remains a consideration.

Section IV: Financial Performance

A. Financial Performance

Like other federal departments and agencies, NRC receives its budget through Main and Supplementary Estimates voted by Parliament. In 1997-98, NRC's Main Estimates budget was approved at \$462 million. Through Supplementary Estimates, NRC received an additional \$22 million for items such as the Youth Employment Initiative, Operating and Capital Budget carry-forwards.

Pursuant to the NRC Act, the organization is able to spend revenues earned through the provision of goods and services. In 1997-98, \$49 million in revenue was earned and was used to

offset the expenditures incurred to provide the goods and services.

Over the years, NRC has found that it is not always possible to spend revenues in the same fiscal year that it earns them. To compensate for this, the organization has been able to accumulate and retain unspent revenue from one year to the next.

In 1997-98, NRC's actual expenditures were 7%, or \$32.9 million higher than planned. This increase was largely financed from the funding received through Supplementary Estimates and the use of NRC's Statutory Revenue Fund.

Table 1
Summary of Voted Appropriations

Financial Requirements by Authority (millions of dollars)				
Vote		1997-98 Planned Spending	1997-98 Total Authorities	1997-98 Actual
National Research Council Program				
70	Operating Expenditures	224.5	238.9	232.6
75	Capital Expenditures	44.8	46.1	44.8
80	Grants and Contributions	127.7	134.1	133.8
(S)	Spending of revenues pursuant to 5.1 (e) of the National Research Council Act	40.1	73.1	58.8
(S)	Contributions to Employee Benefit Plans	25.3	25.3	25.3
Total		462.4	517.4	495.3
Note: Due to rounding, figures may not add to totals shown. Excludes spending of proceeds from the disposal of surplus crown assets. Total Authorities are main estimates plus supplementary estimates plus other authorities.				

Table 2
Comparison of Total Planned Spending to Actual Spending

Planned versus Actual Spending by NRC Business Line (millions of dollars)									
Business Line	FTE's	Operating ¹	Capital	Grants and Contributions	Subtotal: Gross Expenditures	Statutory Items ²	Total Gross Expenditures	Less: Revenue Credited to the Vote	Total Net Expenditures
Research and Technology Innovation ³	2,079	176.4	39.4	38.6	254.4	24.8	279.2	-	279.2
	<i>2,005</i>	<i>184.0</i>	<i>41.2</i>	<i>41.2</i>	<i>266.4</i>	<i>38.3</i>	<i>304.7</i>	-	<i>304.7</i>
	2,163	159.5	33.7	41.2	234.4	23.9	258.2	-	258.2
Support for Innovation and the National Science and Technology Infrastructure ³	377	30.4	-	83.9	114.3	13.2	127.5	-	127.5
	<i>451</i>	<i>33.8</i>	<i>0.5</i>	<i>87.7</i>	<i>122.0</i>	<i>19.7</i>	<i>141.7</i>	-	<i>141.7</i>
	507	37.8	1.2	87.5	126.5	19.9	146.4	-	146.4
Program Management	554	43.0	5.4	5.2	53.6	2.1	55.7	-	55.7
	<i>554</i>	<i>46.3</i>	<i>4.4</i>	<i>5.2</i>	<i>55.9</i>	<i>15.0</i>	<i>70.9</i>	-	<i>70.9</i>
	532	60.5	9.9	5.2	75.6	15.0	90.6	-	90.6
Totals	3,010	249.8	44.8	127.7	422.3	40.1	462.4	-	462.4
	<i>3,010</i>	<i>264.2</i>	<i>46.1</i>	<i>134.1</i>	<i>444.4</i>	<i>73.0</i>	<i>517.4</i>	-	<i>517.4</i>
	3,202	257.8	44.8	133.8	436.5	58.8	495.3	-	495.3
Other Revenues and Expenditures									
Revenue credited to the Consolidated Revenue Fund									(0.7)
									(0.7)
									(0.3)
Estimated Cost of Services by other Departments									9.3
									9.3
									9.3
Net Cost of the Program									471.1
									<i>526.0</i>
									504.3
<p>Note: Due to rounding, figures may not add to totals shown.</p> <p><i>Numbers in italic</i> denote Total Authorities for 1997-98 (main and supplementary estimates and other authorities).</p> <p>Bolded numbers denote 1997-98 actuals</p> <p>1. Operating includes contributions to employee benefit plans.</p> <p>2. Spending of revenues pursuant to the NRC Act.</p> <p>3. Total authorities and actuals reflect the transfer of the Technology Centres from the Research and Technology Innovation business line to Support for Innovation and the National Science and Technology Infrastructure.</p> <p>Excludes spending of proceeds from the disposal of surplus crown assets.</p>									

Table 3
Historical Comparison of Total Planned Spending to Actual Spending

Planned versus Actual Spending by NRC Business Line (millions of dollars)					
Business Lines	Actual 1995-96	Actual 1996-97	Planned Spending 1997-98	Total Authorities 1997-98	Actual 1997-98
Research and Technology Innovation ¹	235.0	226.3	279.2	304.7	258.2
Support for Innovation and the National Science and Technology Infrastructure ¹	120.6	126.4	127.5	141.7	146.4
Program Management	68.6	65.1	55.7	70.9	90.6
Total	424.2	417.8	462.4	517.4	495.3
<p>Note: Increase in actuals compared to planned spending is the result of increased funding through Supplementary Estimates for Operating Budget and Capital Carryforwards, Youth Employment Initiative and Transfer of Condensed Matters Science Program from Atomic Energy Canada Limited to NRC.</p> <p>Due to rounding, figures may not add to totals shown</p> <p>1. Total authorities and actuals reflect the transfer of the Technology Centres from the Research and Technology Innovation business line to Support for Innovation and the National Science and Technology Infrastructure.</p> <p>Excludes spending of proceeds from the disposal of surplus crown assets.</p> <p>Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.</p>					

Table 4
Crosswalk between Old Structure and New Structure
 (does not apply to NRC)

Table 5
Resource Requirements by Organization and Business Line

Comparison of 1997-98 Planned Spending, and Total Authorities to Actual Expenditures by Organization and Business Line (millions of dollars)				
Organization	Business Lines			Totals
	Research and Technology Innovation	Support for Innovation and the National Science and Technology Infrastructure	Program Management	
Research Institutes	271.5 <i>304.7</i> 258.3			271.5 <i>304.7</i> 258.2
Industrial Research Assistance Program		98.1 <i>102.4</i> 102.3		98.1 <i>102.4</i> 102.3
Scientific and Technical Information		29.4 <i>32.2</i> 36.1		29.4 <i>32.2</i> 36.1
Technology Centres ¹	7.7	<i>7.1</i> 7.9		<i>7.1</i> 7.9
Corporate Branches			46.6 <i>61.7</i> 69.7	46.6 <i>61.7</i> 69.7
Executive Offices			9.1 <i>9.2</i> 20.9	9.1 <i>9.2</i> 20.9
TOTALS	279.2 <i>304.7</i> 258.2	127.5 <i>141.7</i> 146.4	55.7 <i>70.9</i> 90.6	462.4 <i>517.4</i> 495.3
% of TOTAL	60.4% <i>58.9%</i> 52.1%	27.6% <i>27.4%</i> 29.6%	12.0% <i>13.7%</i> 18.3%	100.0% <i>100.0%</i> 100.0%
<p>Note: Due to rounding, figures may not add to total shown.</p> <p><i>Numbers in italic</i> denote Total Authorities for 1997-98 (Main and Supplementary Estimates and other authorities).</p> <p>Bolded numbers denote 1997-98 actuals</p> <p>Excludes spending of proceeds from the disposal of surplus crown assets.</p> <p>1. Total authorities and actuals reflect the transfer of the Technology Centres from the Research and Technology Innovation business line to Support for Innovation and the National Science and Technology Infrastructure.</p>				

Table 6
Revenues to the CRF (does not apply to NRC)

Table 7
Revenues by Business Line

Revenues Received (millions of dollars)					
Business Lines	Actual 1995-96	Actual 1996-97	Planned Spending 1997-98	Total Authorities 1997-98	Actual 1997-98
Research and Technology Innovation ¹	18.1	24.4	24.8	19.6	22.8
Support for Innovation and the National Science and Technology Infrastructure ¹	14.3	18.0	13.2	18.4	21.0
Program Management	2.7	2.7	2.1	2.1	4.8
Total Revenues	35.0	45.1	40.1	40.1	48.6
<p>Note: Pursuant to 5.1(e) of the NRC Act, NRC retains and spends all revenue earned through its operations and therefore does not vote-net revenue. See Table 8, Statutory Payments.</p> <p>1. Total authorities and actuals reflect the transfer of the Technology Centres from the Research and Technology Innovation business line to Support for Innovation and the National Science and Technology Infrastructure.</p>					

Table 8
Statutory Payments

Spending of Revenues Pursuant to the NRC Act (millions of dollars)					
Business Lines	Actual 1995-96	Actual 1996-97	Planned Spending 1997-98	Total Authorities 1997-98	Actual 1997-98
Research and Technology Innovation ¹	12.8	21.5	24.8	38.3	23.9
Support for Innovation and the National Science and Technology Infrastructure ¹	14.3	13.3	13.2	19.7	19.9
Program Management	2.7	2.9	2.1	15.0	15.0
Total Revenues	29.8	37.7	40.1	73.1	58.8
<p>Note: Due to rounding, figures may not add to totals shown.</p> <p>Included in Total Authorities of \$73.1M is \$24.5M carried-forward from prior years. \$10.2M of this carryforward was expended in 1997-98 along with 1997-98 earned revenue (see Table 7) of \$48.6M.</p> <p>1. Total authorities and actuals reflect the transfer of the Technology Centres from the Research and Technology Innovation business line to Support for Innovation and the National Science and Technology Infrastructure.</p> <p>Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.</p>					

Table 9
Transfer Payments

Transfer Payments by Business Line (millions of dollars)					
Business Lines	Actual 1995-96	Actual 1996-97	Planned Spending 1997-98	Total Authorities 1997-98	Actual 1997-98
GRANTS					
Program Management	5.2	5.1	5.2	5.2	5.2
Total Grants	5.2	5.1	5.2	5.2	5.2
CONTRIBUTIONS					
Research and Technology Innovation	43.6	41.5	38.6	41.2	41.1
Support for Innovation and the National Science and Technology Infrastructure	79.2	82.8	83.9	87.7	87.5
Total Contributions	122.8	124.3	122.5	128.9	128.6
Total Transfer Payments	128.0	129.4	127.7	134.1	133.8
<p>Note: Increase authorities and actuals for 1997-98, under Support for the National Science and Technology Infrastructure, is the result of additional funding of \$5M for the Youth Employment Initiative.</p> <p>Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.</p>					

Table 10
Capital Spending by Business Line

Capital Spending by Business Line (millions of dollars)					
Business Lines	Actual 1995-96	Actual 1996-97	Planned Spending 1997-98	Total Authorities 1997-98	Actual 1997-98
Research and Technology Innovation ¹	25.9	31.8	39.4	41.2	33.7
Support for Innovation and the National Science and Technology Infrastructure ¹	1.8	1.6	0.0	0.5	1.2
Program Management	13.6	9.8	5.4	4.4	9.9
Total Capital Spending	41.3	43.2	44.8	46.1	44.8
<p>Note: Due to rounding, figures may not add to total shown.</p> <p>The majority of the decrease in 1997-98 actuals compared to the planned spending for Research and Technology Innovation, and the increase in 1997-98 actuals compared to the planned spending for Program Management are the result of capital expenditures incurred by Administrative Services and Property Management Branch (Program Management) on behalf of the Integrated Manufacturing Technologies Institute (Research and Technology Innovation).</p> <p>1. Total authorities and actuals reflect the transfer of the Technology Centres from the Research and Technology Innovation business line to Support for Innovation and the National Science and Technology Infrastructure.</p> <p>Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.</p> <p>Does not include revenues used for capital purchases.</p>					

Table 11
Capital Projects

Capital Projects by Business Line (millions of dollars)						
Business Lines	Current Estimated Total Cost	Actual 1995-96	Actual 1996-97	Planned Spending 1997-98	Total Authorities 1997-98	Actual 1997-98
Research and Technology Innovation						
Industrial Partnership Facility	6.4					3.7
Steacie Institute for Microstructural Sciences						
- Chemical Biology Laboratory	1.7					1.3
Upgrade to Institute for Biological Sciences						
- Sussex Drive Laboratories	1.1					0.5
Biotechnology Research Institute						
- Small Laboratory Extension	1.0					1.0
Marine Dynamics Test Facility	2.8	0.4	0.7	0.9	0.9	0.7
Housing Innovation Facility	0.8					0.2
Spin Pit Testing of Turbine Engine Component	1.4		0.1			1.3
Functionally Graded Materials for Aeroframe and Aero-Gas Turbine Engines	0.9		0.2	0.3	0.3	0.6
Advanced Systems Research Aircraft ⁽¹⁾	4.8	0.2	0.2			0.1
Montreal Centre of Excellence for Site Rehabilitation	1.4					0.7
Gene Discovery Facility	1.2		0.7	0.5	0.5	0.5
Canadian Netshape Forming Innovation Centre	1.9		1.0	0.9	0.9	0.9
CNC Router	0.6		0.1	0.4	0.4	0.4
Link from the Biotechnology Research Institute to the Industry Partnership Facility ⁽²⁾	5.1					2.5
Intraoperative MRI	1.1	0.5	0.4			0.1
Glow Discharge Mass Spectrometer	1.1					1.1
Dry Etching System	0.5					0.5
Current Generator Project	0.7		0.1			0.6
Stereolithography Apparatus	0.9		0.7			0.2
Vacuum Casting Furnace	0.6					0.6
Support for Innovation and the National Science and Technology Infrastructure						
Electronic CISTI	1.8					0.6
Program Management						
Renovate M-13, Exterior and Interior	1.0					1.0
Renovate M-27, Exterior and Interior	0.6					0.6
Sprinkler System in Building U-61	0.6					0.4
Integrated Enterprise Business System	19.0					11.6
Note: Due to rounding, figures may not add to total shown.						
Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.						
⁽¹⁾ NRC funding only; total cost at \$7.2M						
⁽²⁾ NRC funding only; total cost at \$7.8M						

Table 12
Status of Major Crown Projects
 (does not apply to NRC)

Table 13
Loans, Investments and Advances
 (does not apply to NRC)

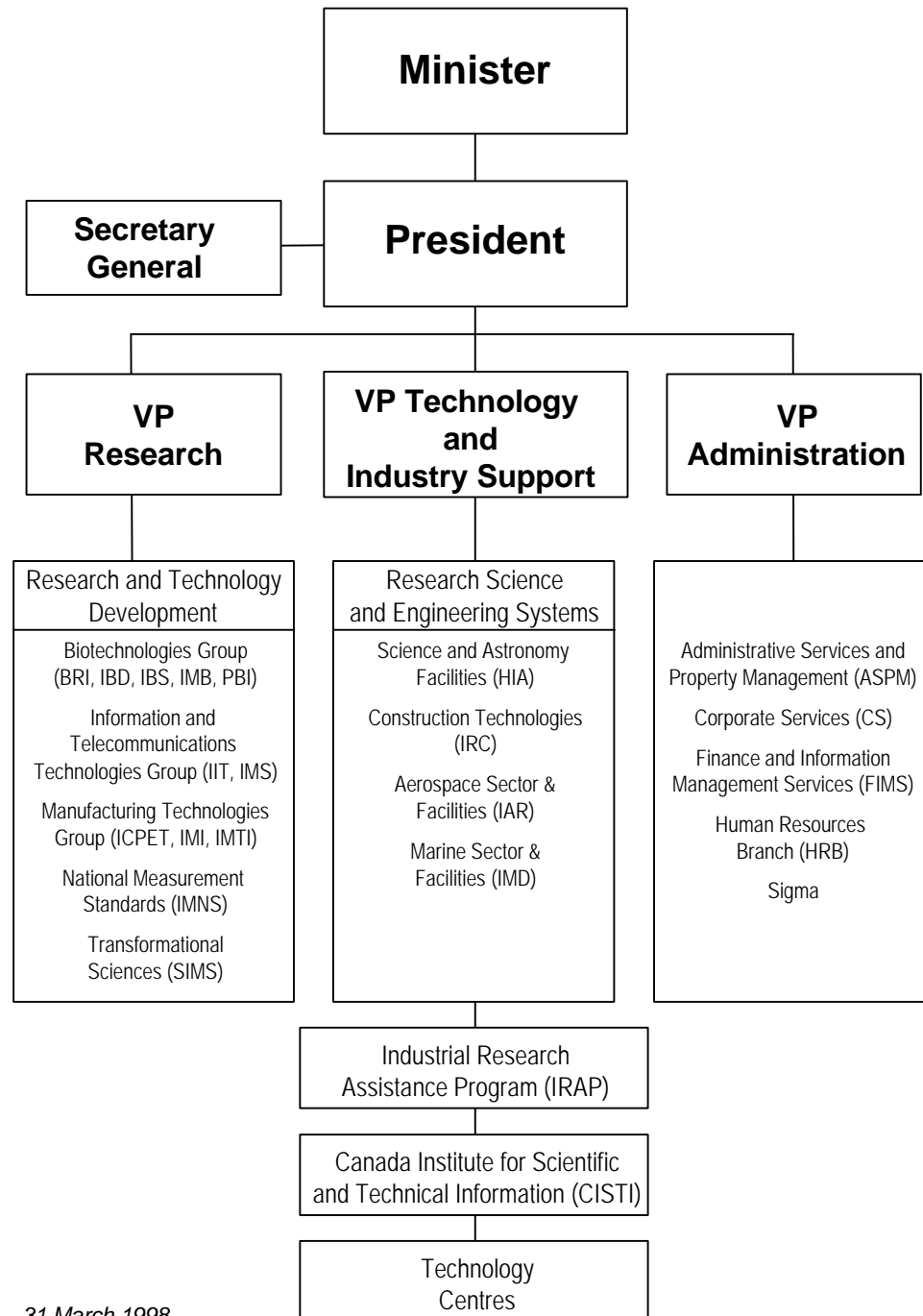
Table 14
Revolving Fund Financial Statements
 (does not apply to NRC)

Table 15
Contingent Liabilities

Contingent Liabilities (millions of dollars)			
List of Contingent Liabilities	Amount of Contingent Liability		
	March 31 1996	March 31 1997	Current as of March 31, 1998
Claims, and Pending and Threatened Litigation			
Litigations	15.5	15.5	15.5
Total	15.5	15.5	15.5
Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.			

Section V: Supplementary Information

A. NRC Organization Chart



31 March 1998

B. Acts Administered in Whole or in part by the National Research Council

The National Research Council is responsible for administering the *National Research Council Act*. The latest revision to the NRC Act is R.S.C. 1985, c. N-15 (never amended)

NRC has responsibility for calibration and certification of standards of measurement under the *Weights and Measures Act*, and also provides technical support to the Canadian Commission on Building and Fire Codes.

The *Atomic Energy Control Act* makes provision for the Atomic Energy Control Board to establish a granting program through NRC, but this possibility is not currently a practice.

C. Listing of Statutory and Council Reports

Annual Report 1997-98

D. Contact for Further Information

Jack Smith
Manager, Planning and Assessment
Corporate Services
National Research Council of Canada
Montreal Road
Ottawa, Ontario
K1A 0R6
Phone: (613) 993-7496
e-mail: jack.smith@nrc.ca