National Research Council Canada

1997-98 Estimates

Part III

Expenditure Plan

The Estimates Documents

The Estimates of the Government of Canada are structured in three 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 Part III documents provide additional detail on each department and its programs primarily in terms of the results expected for the money spent.

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National Research Council Canada

1997-98 Estimates

Part III

Expenditure Plan

Approved

Minister of Industry

The Minister's Message

The Industry Portfolio
Building Jobs and Growth through Partnerships and Innovation

The National Research Council (NRC) is a member of the Industry Portfolio. The NRC undertakes, assists and promotes scientific and industrial research in the national interest. NRC's close to 3,000 employees work in research institutes, the Canada Institute for Scientific and Technical Information, and Industrial Research Assistance Program offices across the country. In partnership with large and small firms, universities, federal institutions and agencies, and provincial governments, NRC's acitivities put science and technology to work in the creation of wealth and jobs in the new knowledge-based Canadian economy.

Through the coordinated efforts of its member organizations, the Industry Portfolio is playing a vital role in helping to improve economic growth, and employment and income prospects for Canadians. The Industry Portfolio brings together the key departments and agencies responsible for science and technology, regional development, marketplace services and micro-economic policy. In doing so, the Government of Canada has created a new capacity for partnership and innovation, both within the Portfolio itself and externally, with the private sector and other stakeholders.

As Minister responsible for the Industry Portfolio, I am focussing the Portfolio's activities to help Canadians move confidently into the 21st century. Through the Portfolio, I am working to ensure that our businesses and industries have the best tools and the right conditions to innovate, grow, compete and generate jobs.

The Industry Portfolio Is ...

- Atlantic Canada Opportunities Agency
- Business Development Bank of Canada
- Canadian Space Agency
- Competition Tribunal
- Copyright Board of Canada
- Federal Office of Regional Development (Quebec)
- Industry Canada
- National Research Council of Canada
- Natural Sciences and Engineering Research Council of Canada
- Social Sciences and Humanities Research Council of Canada
- Statistics Canada
- Standards Council of Canada
- Western Economic Diversification

The technology-driven global economy which has emerged in the 1990s holds much promise, as well as many challenges. To maintain traditional strengths and markets while building new ones, Canadians must innovate. We have to develop and use leading edge technologies and skills needed in the knowledge-based economy. We

need to increase the abilities of our firms and industries to export. We must also enlarge Canada's share of international investment. And we must work to ensure all Canadians, especially our youth, are able to participate fully in the new economy. To achieve these goals, business, governments and individual Canadians have to work together, in partnership.

The Industry Portfolio is playing its part by focussing on three areas of activity -- each crucial for our economic success, now and into the next century:

- promoting innovation through science and technology
- assisting business to grow by providing information, advice and financing support
- ensuring a fair, efficient and competitive marketplace.

Innovation is the key to success in the global economy. Creative thinking and adopting new technologies and processes keep traditional industries competitive while launching new industries for emerging and expanding markets. The Industry Portfolio is taking a new, risk-sharing approach to investing in technology through partnerships with the private sector. We are also making strategic investments to expand Canada's intellectual resources and advance knowledge.

The Portfolio assists Canadian businesses to increase their competitive advantage and their capacity to expand. Our actions are particularly directed at strengthening the backbone of Canada's economy -- small and medium-sized enterprises.

The Industry Portfolio has a vital role to ensure an open and efficient marketplace by setting clear and fair "rules of the game." In this way, we are supporting business activity while protecting consumer and investor interests.

Through its wide range of activities, the Industry Portfolio is contributing to economic growth, increased employment and higher living standards for Canadians in every region, both today and into the new century.

John Manley
Minister of Industry

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I. Foreword

As we face the challenges and opportunities of the 21st Century, the National Research Council of Canada (NRC) should be viewed as one of our country's greatest assets.

Over the past 80 years, NRC has built a reputation for excellence in research management expertise and national information networks. These attributes have made it a powerful magnet and the federal government's most effective tool for promoting national collaboration in research and development (R&D) and for attacking many of the major scientific and technical issues in the late 1990s.

Since its inception, NRC has had a tremendous beneficial impact in many areas that affect the overall quality of life of Canadians. Our greatest potential lies in a unique capability to carry out focused, leading edge R&D for the development of new technologies which will form the basis for the growth of innovative existing or future companies. This in turn assists in the creation of skilled job opportunities for young Canadians working in a technology based future. One of our most important and compelling priorities is a commitment to use the inherent power of our communities and regions to stimulate knowledge-based economic growth across Canada.

We have also recognized that to reach our full potential as an engine for technology based growth we will have to become more entrepreneurial in our efforts to ensure that every opportunity is taken to spinoff our technologies and put our knowledge, expertise and facilities to work for the benefit of Canadians. This challenge - to instill a spirit of individual and institutional entrepreneurship throughout NRC - demands a major cultural change which we have embraced as a high priority for the years ahead.

At NRC we are determined to be at the centre of scientific, technological and industrial innovation in Canada as we move towards the millenium. To achieve this, we will apply the clear focus and specific priorities set out in our strategy for the future entitled *Vision to 2001*. The Vision was released publicly in 1996 and was the force that spawned a variety of initiatives listed in this Main Estimates document.

Thoughout its history, NRC has had an appreciation of the necessity to adapt to the changing needs of Canadian society: individuals, institutions and industries. For example, we have recently seen community based innnovation systems grow in importance within the national economy, and we are now focusing on communities and regions as a key element of our plans for the future. NRC has been a leader in promoting this point of view and has already taken action on this and other issues. This drive comes from dealing face to face each year with thousands of industrial clients and research partners across Canada, and from responding to their urgent needs and technological challenges.

Traditionally, science and technology organizations like NRC have struggled when trying to describe the results of their work and the short and long term effects of their plans and initiatives. NRC will measure and report on the impact of our programs and *Vision to 2001* initiatives through a comprehensive, organization-wide performance measurement system which will be up and running in 1997.

NRC will acquire and develop the expertise and tools necessary to measure and quantify the economic returns of its research, programs and services. Attempts will be made over the next few years to estimate the aggregate or spillover rates of return to the economy and society generated by specific projects, based on quantifiable benefits realized by companies. NRC should thus be in a better position to demonstrate its full impact and contribution to the development of an innovative, knowledge-based economy for Canada.

As Parliamentarians consider these Main Estimates, they can be assured that our employees, management, and governing Council are committed to achieving the organization's objectives. While NRC will no doubt continue to face challenges of many kinds in the years ahead, it will stay on course and maintain its fundamental character as an organization that promotes and supports scientific and technological excellence.

II. NRC's Plans
A. Summary of Plans and Priorities

1. Factors Influencing NRC's Plans

Global Trends

Canada's ability to maintain its relatively high standard of living into the 21st century will depend largely on its success in transforming to a more innovative, knowledge-based economy. Globalization, trade liberalization and rapidly changing technology are only a few of the many challenges facing the nation.

Creating and developing innovative products and processes can be a long and expensive process. Sophisticated facilities, staffed by world class researchers, are often a prerequisite in carrying out research and development. It can take several years before investments translate into marketable products. Going it alone in R&D can be too costly and difficult a route for many Canadian firms. To alleviate the risks and as a result, share the rewards, industry is increasingly moving toward inter-firm alliances and partnerships with organizations like NRC. NRC has also forged a vast array of collaborative programs, partnerships and networks with other R&D players to maximize the impact of its resources.

Investment in research activities and their accompanying human resources will promote discoveries essential to Canadian innovation. It will also ensure that Canada has the capability to adopt, adapt and utilize technologies introduced from other parts of the world. The federal government and NRC believe that supporting research is a priority. Accordingly, NRC is pursuing a number of measures to ensure that it will maintain and renew its world class facilities and highly trained staff, a significant force for technological innovation, wealth and job creation.

Information Links

Information networks and products such as the Information Highway will be key elements in connecting Canadians to each other, with implications for government services. Through its science and technology (S&T) activities, government has accumulated a great deal of information. The diffusion and analysis of this information will be important in helping Canadians make informed decisions on many subjects. NRC's Industrial Research Assistance Program (IRAP), through its network of technology advisors and the Canadian Technology Network (CTN), provide such services. They will continue to refine their services and relationships with Canadian firms to offer improved access to technology and related business solutions. The Canada Institute for Scientific and Technical Information (CISTI) will also play a leading national role in diffusing S&T information, and will continue to develop and maintain state of the art document delivery systems to serve Canadian and foreign clients.

The Industry Portfolio

The government's federal science and technology strategy, *Science and Technology for a New Century*, established the beginning of new directions for S&T in Canada. The Industry Portfolio, of which NRC is a key member, comprises eleven departments and agencies that collectively account for about 42% of total federal S&T spending. The Portfolio's response to the S&T strategy outlines a managed approach to intra-Portfolio cooperation. Founded on a common vision, the Portfolio will use its unique tools and capabilities to help Canada become a world leader in the development of a knowledge-based innovation system designed to generate jobs, exports and economic growth and enhance quality of life.

NRC is fully committed to this vision, and will continue to nurture its relationships with Portfolio partners, involving:

- defining plans for future investments in advanced manufacturing and information and telecommunications technologies
- developing new joint program and R&D partnerships
- leading the S&T coordinating activities of the industry Portfolio and completing the S&T Strategy Action Plan

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2. NRC's New Vision

Vision

In its *Vision to 2001*, NRC has taken up the challenge of contributing in a major way 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.

As Canada's foremost R&D agency, NRC's vision is to be a leader in the development of an innovative, knowledge-based economy through science and technology.

Long Term Strategies

Over the next three years, NRC will pursue the following organization-wide strategies:

A. Advance the frontiers of scientific and technological knowledge in areas relevant to Canada

NRC's national and international credibility is founded on its reputation for excellence and relevance. Maintaining these high standards is the cornerstone of the organization's ongoing viability, pointing to the high caliber people it attracts and retains as employees, as well as the maintenance of unique, world class research facilities. By the year 2001, NRC plans to have a better qualified team of scientists and visiting researchers than ever before.

Over the next three years, NRC will:

- use rigorous, scientific and economic criteria to evaluate program merit
- increase collaborations with leading edge laboratories around the world to enhance its knowledge base
- design a better system to reward excellence in research ability, creativity, teamwork, and collaborative activities
- improve existing programs (e.g. summer and co-op students, Women in Engineering and Science, Research Associates, etc.) and create new ones to attract the best and most highly qualified young researchers, including a new Postdoctoral Fellowship program
- increase the number of exchanges of NRC staff with industry, university and other government departments
- continue to invest in the development and maintenance of NRC's research facilities and equipment, as well as CISTI's world class scientific and technical information assets

B. Carry out focused research, in collaboration with industrial, university, and government partners, to develop and exploit key technologies

NRC is dedicated to helping Canadian based firms acquire develop and exploit key technologies. Currently, over half of NRC's research involves companies and other government agencies. This rate will be increased over the planning period and NRC's impact on important economic sectors will be intensified. NRC will also intensify its interactions with universities through its NRC-NSERC University-Industry program, its participation in NCE's and through its community innovation initiative.

Over the next three years, NRC will:

- focus research on key technology areas relevant to Canadian industry
- increase research interactions with strategically chosen industrial, university and government partners
- create more opportunities to transfer NRC generated technology to firms
- attract more R&D investments and revenues from partners, collaborators and clients
- share information services with government and university collaborators

C. Provide strategic advice and national leadership to integrate key players in Canada's system of innovation

Over the planning period, NRC will concentrate more of its efforts on helping to develop community innovation systems and linking them to the national innovation system. NRC will rely on its strong regional laboratory and IRAP presence to help advance local economies through innovative research, and will play an active role in the government's refocused S&T strategy.

Over the next three years, NRC will:

- become an essential element of local economies by linking key players in their marketing, business, finance, government and educational communities
- develop a series of community based innovation strategies built around its institutes and programs
- disseminate scientific and technical data to industrial clients through CISTI, and technological advice, business solutions and other kinds of support through IRAP and the Canadian Technology Network
- participate in national and provincial S&T policy fora, and in key trade and regulatory initiatives
- work actively within the Industry Portfolio to promote more effective program linkages among the various partners

D. Take a more aggressive, entrepreneurial approach to ensure the transfer of NRC's knowledge and technological achievements to Canadian based firms

NRC plans to change its culture to create an environment where individual and institutional entrepreneurship can flourish. The thrust of this initiative is to optimize access to NRC's resources and the transfer of technology and maximize the return on investment for both NRC and the Canadian economy.

This requires an entrepreneurial and businesslike approach in partner/client interactions in managing technology transfer to firms or in spinning off new entreprises. NRC plans to become a model of dynamism for all government S&T organizations through the commercialization of more of its technologies than at any other time.

Over the next three years, NRC will:

- form new alliances with business and financial communities to fund promising innovations
- develop new technology incubators
- provide more opportunities for technology spinoffs and new firm startups, including support systems, training and incentives for interested and qualified employees
- increase the number of licences issued
- develop electronic information tools to facilitate alliances and transfer technologies
- make increased use of IRAP's network and advisors

1. 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 NRC Act, the organization also has the responsibility for "operating and administering any astronomical observatories established or maintained by the Government of Canada". NRC's R&D activities include grants and contributions used to support a number of international activities. These investments, for example, include Canada's contribution to the National Science Foundation of the United States in partial support of the construction of the Gemini twin 8 metre telescopes.

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

The Industrial Research Assistance Program assists Canadian companies in developing and exploiting technologies. IRAP's support stimulates R&D within Canadian firms, allowing them to build technical knowledge and expertise. This support is tailored to helping firms meet the challenge of a changing and competitive economy.

The NRC Act empowers NRC to "establish, operate and maintain a national science library" and to publish, sell and otherwise distribute" scientific and technical information. NRC fulfills this mandate through CISTI, providing Canadians with access to worldwide scientific, technical, medical and related information and expertise. To do this, CISTI develops and maintains an outstanding collection of information resources in the fields of science, engineering and medicine, and published peer-reviewed scholarly journals with Canadian and international content in scientific disciplines significant to Canada.

The Canadian Technology Network's mission is to provide integrated, accessible pathways to information and services relevant to small and medium sized enterprises that use technology, by better linking providers of industrial support services, existing networks, and sources of 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 NRC 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".

Canadian Commission on Building and Fire Codes

NRC provides technical support to the Canadian Commission on Building and Fire Codes in developing model codes to encourage the efficient construction of safe and durable buildings. Although the regulation of the construction industry is a provincial responsibility, collaborations between NRC, the provinces and the construction industry have resulted in an enviably high level of uniformity in building and fire regulations across the country. This has enhanced the efficiency and competitiveness of Canada's construction industry.

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2. Organization and Program Composition

NRC's Program is divided into three planning elements, or business lines, which provide a balance between conducting R&D, offering technical and financial assistance to industry and the public, and supporting the organization with corporate services.

National Research and Development

The nucleus of the NRC Program is the National Research and Development business line. It encompasses NRC's mandated and core responsibilities for undertaking research and development in strategic areas. National Research and Development supports Canada's S&T infrastructure through its partnerships with industry and other public and private research entities, as well through the support of R&D in the national interest.

The activity focuses on five technology groups that organize and develop programs targeted at sectors vital to Canada's emerging knowledge-based economy. These groups are: biotechnology; information and telecommunications technologies; construction; manufacturing; and infrastructural technologies. Within the groups research activities encompass a full spectrum from fundamental understanding through strategic research to development. As well, NRC has made a formal commitment to nurture and renew its recognized long term, core research capability through the Steacie Institute for Molecular Sciences and through its involvement in international science facilities and research activities.

NRC supports the mandates of other government departments by providing them with services and access to facilities. It also contributes to wealth generation through long term strategic and precompetitive research in collaboration with companies that are competing in global markets.

Support for the National Science and Technology Infrastructure

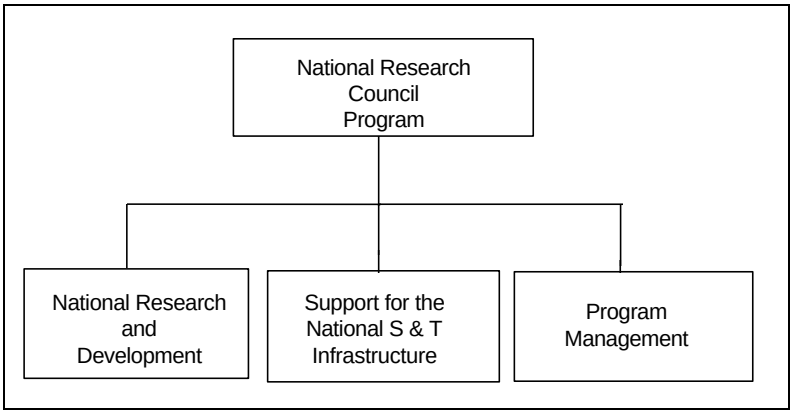
In partnership with industry, governments and universities, NRC enhances its effectiveness by developing and diffusing scientific knowledge and technology. For this reason, the second business line, Support for the National Science and Technology Infrastructure, encompasses the organization's assistance to industrial research and the dissemination of scientific and technical information. This activity is carried out nationally and at regional locations via the Industrial Research Assistance Program and the Canada Institute for Scientific and Technical Information.

Program Management

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

The three activities or business lines are further divided into subactivities, each of them representing major areas of NRC's planning and accountability, as shown in the following diagram.

Activity Structure



3. Resource Plans

Spending Authorities

A. Authorities for 1997-98 - Part II of the Estimates

Figure 1: Financial Requirements by Authority

Vote	(thousands of dollars)	**1997-98 Main Estimates**	1996-97 Main Estimates *
	National Research Council Canada		
70	Operating expenditures	**224,521**	226,975
75	Capital expenditures	**44,816**	45,488
80	Grants and contributions	**127,709**	112,848
(S)	Spending of revenues pursuant to 5.1(e) of the *National Research Council Act*	**40,137**	
(S)	Contributions to employee benefit plans	**25,257**	22,440
	Total Agency	**462,440**	407,751

* 1996-97 Main Estimates reflect vote-netted revenue of $37.834 million

Figure 2: Votes - Wording and Amounts

Vote	(dollars)	**1997-98 Main Estimates**
	National Research Council Canada	
70	National Research Council - Operating expenditures	**224,521,000**
75	National Research Council - Capital expenditures	**44,816,000**
80	National Research Council - The grants listed in the Estimates, and contributions	**127,709,000**

Figure 3: Agency Overview

(thousands of dollars)	Main Estimates 1996-97	**Main Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Net Estimates*	407,751	**422,303**	379,021	379,558
Vote Netted/Statutory Revenue	37,834	**40,137**	40,359	40,359
Total Main Estimates	445,585	**462,440**	419,380	419,917
Revenue Credited to the Consolidated Revenue Fund	(650)	**(650)**	(650)	(650)
Estimated Cost of Services by other Departments	10,086	**9,313**	xxx	xxx
Total Agency	455,021	**471,103**	418,730	419,267

* For purposes of this comparison, Net Estimates display reductions for vote-netted revenue in 1996-97 and Statutory Revenue in 1997-98.

Note: After accounting for NRC's Program Review reductions, the year-over-year comparison between 1996-97 and 1997-98 Main Estimates still reflects an overall increase of some $16 million. This is mainly attributable to approved increases for contibutions to TRIUMF and for the transfer of responsibility from Public Works and Government Services Canada for Payments in Lieu of Taxes.

Figure 4: Net Cost of the Agency by Business Line/Activity

(thousands of dollars)	1997-98 Main Estimates					
	Operating	**Capital**	**Grants and Contributions**	**Total**	**Statutory Payments***	**Total Expenditures**
Business Lines/Activities						
National Research and Development	176,409	39,438	38,560	254,407	24,833	**279,240**
Support for the National Science and Technology Infrastructure	30,351		83,953	114,304	13,159	**127,463**
Program Management	43,018	5,378	5,196	53,592	2,145	**55,737**
	249,778	44,816	127,709	422,303	40,137	**462,440**
Other Revenues and Expenditures						
Revenue credited to the Consolidated Revenue Fund						(650)
Estimated Cost of Services by other Departments						9,313
Net Cost of the Program						**471,103**

* Does not include contributions to employee benefit plans which are allocated in the operating expenditures.

Figure 5: Appropriated Planned Spending

(thousands of dollars)	Main Estimates 1996-97 *	**Main Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Business Lines/Activities				
National Research and Development	241,001	**279,240**	273,136	273,439
Support for the National Science and Technology Infrastructure	115,066	**127,463**	93,055	93,145
Program Management	51,684	**55,737**	53,189	53,333
Total	407,751	**462,440**	419,380	419,917

* 1996-97 Main Estimates reflect vote-netted revenue of $37.834 million.

Note: A technical adjustment in the display of revenue in 1997-98 accounts for the main year-over-year increase. In 1996-97 revenue was vote-netted or reduced from the Main Estimates while in 1997-98 revenue has been added to the Mains.

1. National Research and Development

The National Research and Development business line refers to NRC's physical and life science and engineering research activities, comprising research institutes and technology centres located throughout Canada. Appendix 5 lists the institutes and technology centres, and briefly describes their fields of activity.

In 1995-96, a new program framework was completed for NRC's research and technology program, the culmination of over two years of planning and consultation with NRC's key stakeholders and clients in industry, government and academia. The framework represents the result of an in depth assessment of NRC's core strengths and capabilities in the context of the federal government's Program Review and Science and Technology Review. The framework recognizes that Canada is at an important crossroads as it faces the challenges of the 21st century, and incorporates the elements of NRC's *Vision to 2001*.

Technology Groups

The five Technology Groups in NRC's research and technology program are generally viewed as individual portfolio elements. They are linked in terms of core competencies and shared industrial applications, and differ when responding to specific opportunities and economic imperatives. Each group has developed a strategic planning framework to chart its course into the next century.

Figure 6: Business Lines/Activities by Subactivities

(thousands of dollars)	Main Estimates 1996-97	**Main Estimates 1997-98**	Planned 1998-99	Planned 1999-00
National Research and Development				
Physical and Life Sciences and Engineering	241,001	**279,240**	273,136	273,439

Note: A technical adjustment in the display of revenue in 1997-98 accounts for the main year-over-year increase. In 1996-97 revenue was vote-netted or reduced from the Main Estimates while in 1997-98 revenue has been added to the Mains.

Biotechnology Group

Biotechnology is strategically important to key sectors of Canada's economy. In 1983, NRC was mandated as the lead federal agency in biotechnology, and established its Biotechnology Program under the guiding principles of the National Biotechnology Strategy. This strategy emphasized pioneering biotechnology research in areas of greatest relevance to Canadian industry, and was initiated to ensure that Canada did not miss out on the biotechnology wave.

With NRC's many strengths in biotechnology R&D, it is well positioned to serve and interact with several industrial sectors and with major university players in the field. By maintaining research excellence and strategic relevance, NRC is developing the alliances needed to commercialize its technologies, capitalizing on biotechnology based firms who are aggressively seeking opportunities in line with their own market thrusts.

Construction Technology Group

Construction is one of Canada's largest industries and is a critical asset for enhancing the international competitiveness of the country's economy. In 1993, the scope of construction activities amounted to about 13% of GDP, or $95 billion. The primarily Canadian-owned industry has more than 100,000 firms, most of them small in size and totaling about one million employees. The industry helps to manage Canada's major capital investment of $2 trillion in built assets, with dispersed ownership through thousands of organizations and millions of individuals.

Construction has been more limited in the development and use of innovative technologies than most other Canadian industry sectors. For the last 50 years, NRC has been a well recognized and valuable contributor to research and technology in this area. It will continue to play a major role in developing model codes and new capabilities on behalf of the industry, focusing on reducing the industry's total costs over the life of its built assets, maintaining its already effective building regulatory system, and increasing the productivity and competitiveness of the industry overall.

Information and Telecommunications Technology Group

Historically, NRC's focus in this area had been divided between two primary institutes, one with a mission related to software and systems research geared toward the information technology sector, and the other related to hardware and component R&D geared toward the telecommunications equipment sector.

The restructuring in 1995-96 of NRC's priorities and programs around critical technologies led to the realization that important gains could be realized from a closer affiliation of the two institutes.

In recent years the distinctions between the information and communications sectors of the economy have been disappearing. NRC's studies on the specific requirements of individual community innovation systems across Canada have found a common priority associated with information and telecommunications technologies. This newly formed group will play an important role in NRC's community and regional innovation strategies.

Manufacturing Technologies Group

The manufacturing sector, which accounts for 17% of Canadian GDP and 15% of employment, represents an estimated 52% of total economic activity in Canada. The sector is profoundly affected by the forces of globalization, international trade liberalization, environmental pressures and technological change. A strong, innovative and globally competitive manufacturing sector is critically important to continued wealth creation in Canada. By the next century, the firms that succeed will be those that innovate both technologically and organizationally, and who recognize the global nature of the markets they serve.

Through a process of extensive consultations and analysis of the strategic innovation needs of Canadian industry, NRC has identified, and will focus on through the Manufacturing Technologies Group, three interrelated and interdependent technology innovation areas with the greatest potential for new wealth creating opportunities: design, modeling and simulation technologies; process and development technologies; and monitoring and control technologies.

Infrastructural Technologies Group

The concept of "infratechnologies" refers to a set of tools and methods that enhance the productivity of the R&D, production and market transaction stages of economic activity. These have applications across the scientific and engineering communities, including the resource, manufacturing and service industries. The public or collective consumption of several of those elements gives them an infrastructural character.

NRC's infrastructural technologies capability encompasses: physical and chemical metrology; aerospace technologies; ocean engineering and ocean technology; and astronomical observatories. The Infrastructural Technologies Group represents an area of important, mandated and long standing responsibilities for NRC. During 1995-96, an assessment was made of the common linkages across the group's components. Work on a long term rationale will be completed in 1996-97, including the identification of issues, objectives and implementation strategies for the program areas.

Core Research

Core research is a fundamental activity conducted throughout the National Research and Development business line. NRC's review and realignment of its research program in 1995-96 led to a formal commitment to renew its long term research capacity. The Steacie Institute for Microstructural Sciences (SIMS) was given a special role in this activity, having already established itself as a significant resource for research in the molecular sciences, with an emphasis on cutting across disciplines in the development of new technologies. SIMS is now in the process of shifting from an isolated research institute to a strategic partner for all of NRC's institutes.

In 1997-98, NRC will manage a program of $39.4 million in grants and contributions to major international science facilities, including the Tri-University Meson Facility in Vancouver ($32.9 million), the Canada-France-Hawaii Telescope ($3.3 million), James Clerk Maxwell Telescope ($1.1 million), and the Gemini Telescopes ($1.2 million), as well as other international affiliations ($956K).

NRC's own facilities (listed in Appendix 6) expand the organization's reach, giving its partners in universities access to the tools they need to stay at the forefront of science.

2. Support for the National Science and Technology Infrastructure

Support for the National Science and Technology Infrastructure reinforces NRC's role as a major research and development participant within the larger Canadian science and technology infrastructure. NRC maintains essential parts of this infrastructure making it possible for scientists and engineers in industry government and academia to perform R&D in many important areas.

Figure 7: Business Lines/Activities by Subactivities

(Thousands of dollars)	Main Estimates 1996-97	**Main Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Support for the National Science and Technology Infrastructure				
Industrial Research Assistance Program	96,082	**98,083**	65,834	65,854
Scientific and Technical Information	18,984	**29,380**	27,221	27,291
Total	115,066	**127,463**	93,055	93,145

Note: A technical adjustment in the display of revenue in 1997-98 accounts for the main year-over-year increase in the Scientific and Technical Information component. In 1996-97 revenue was vote-netted or reduced from the Main Estimates while in 1997-98 revenue has been added to the Mains.

Industrial Research Assistance Program

The Industrial Research Assistance Program is mandated to help Canadian companies develop and exploit technologies. IRAP contributions of technical and financial assistance stimulates innovation within Canadian firms and allows them to build their technical knowledge and expertise. This support is tailored to helping firms meet the challenges of a changing and competitive economy.

IRAP is founded on a national network of Industrial Technology Advisors (ITAs). Collectively, these ITAs possess a remarkable range of professional skills and experience, offering assistance in all areas of technology where Canadian industries are active. Each ITA has extensive industrial experience combined with either a general knowledge of technologies, or in depth expertise in a given area. Through the IRAP network, Canadian firms have access to a wide range of scientific and technical expertise. ITAs regularly call upon these resources to solve technical problems when working with clients.

While 30% of IRAP ITAs are NRC employees, the balance work directly for over 140 different private and public organizations. Under contribution arrangements with NRC, these organizations participate as IRAP Network Members to help deliver the program.

These arrangements are in place with such organizations as provincial research organizations, research centres, universities and colleges, industrial associations and other professional groups.

IRAP also extends the reach of its network by creating extensive linkages with other government departments and agencies (federal and provincial) which offer complementary programs or services. In a few cases, IRAP helps deliver programs on behalf of other government organizations. It also has international linkages with Canadian embassies. The ultimate goal of these collaborative arrangements is to better serve Canadian firms.

IRAP Assessment and Strategic Plan

A major assessment of IRAP was completed in 1996-97. It examined the performance and management practices of the Program. Various complementary methodologies were used including client surveys, staff workload analysis, and self assessment workshops. Evidence was gathered on key aspects of the Program, such as service quality, IRAP's impact on Canadian firms, and IRAP's information management strategy. Clients, staff and NRC's governing Council all contributed to the study.

The results of the assessment have been used as input to the development of the next strategic plan, which establishes IRAP's direction to the year 2001. The plan will assist IRAP in responding to the evolving needs of Canadian firms, such as the loss of alternative technology support options, and the possibility of reduced IRAP funding beginning in 1998-99. Input to the plan included environmental analysis and staff workshops, as well as assessment results.

The strategic plan is intended to chart a course for IRAP over the next five years, articulate a set of values and operating principles, and provide a framework for action and ongoing decision making based on program performance. A performance framework will be developed and key performance targets identified, focusing on IRAP's role in the innovativeness of firms and support to Canada's innovation system. Implementation of the strategic plan has already begun.

Implementation of the Canadian Technology Network

The Canadian Technology Network (CTN) is a recent government initiative, announced in June 1994. CTN is a national network of people. It provides a comprehensive, easily accessed, user friendly advisory service available to Canadian small and medium sized enterprises (SMEs). The network links people from organizations that can provide technical and related business assistance to SMEs with technology related business needs.

Considerable progress was made towards CTN's implementation in each region of Canada last year. By March 1996, CTN was operational in all regions, with a membership of over 300

organizations, mainly from the public and non profit sectors. Orientation sessions were held for member organizations to familiarize them with the network and their role in its operation. A directory of member capabilities, searchable by key word and by region, has been installed on a CTN site on the World Wide Web.

In May 1996, CTN's activities formally commenced with a public launch in Toronto.

Plans for 1996-97 include the standardization of management and operating structures in all regions to reinforce a common vision of CTN across the country, built around client service. These plans emphasize the recruitment of additional organizations, particularly industry associations, to act as CTN node members (the contact points for SMEs to access the Network's resources). This strategy is intended to broaden the coverage of industry sectors, areas of expertise and geographic regions provided by CTN members. Personnel within these node member organizations are being provided with training and tools to help them deliver value-added services to client firms. Mechanisms are being implemented to measure client acceptance and the impact of these services. Dedicated CTN Coordinators are being hired in all regions to manage the development and promotion of the Network. CTN is working with CISTI to standardize the design and consolidate the management of its web sites and information products.

Plans also include the development of a strategic partnership with the Canadian Advanced Technology Association. CATA will undertake the recruitment of private sector organizations into the network and, eventually, the merging of the CTN web site with CATA's own on line information product - TechnoGate. This strategy of delivering at least part of CTN through a private sector partnership is intended to address its long term sustainability.

Key international links to CTN will be developed during 1996-97. The first of these occurred with Singapore in September 1996 through NRC activities in this area, and resulted in the sale of the software supporting the CTN web site to Singapore by a Canadian supplier.

Canada Institute for Scientific and Technical Information

Under the NRC Act, NRC is mandated to operate and maintain a national science library and to publish and sell scientific and technical information. This is carried out through the Canada Institute for Scientific and Technical Information, whose mission is to provide worldwide Scientific, Technical and Medical (STM) information to help achieve Canada's economic and social goals. CISTI's program activities are focused on publishing, information dissemination, information management, and information infrastructure.

CISTI plays an essential role in Canada's S&T infrastructure. Over 25 products and services give researchers across the nation ready access to its services. As well, CISTI is Canada's largest publisher of scientific journals. With an award winning innovative electronic system of document delivery, CISTI has become a world leader in all aspects of providing scientific and technical information.

Over the years, CISTI has established a number of partnerships with Canadian universities, international research libraries, and the private sector to contain costs and maintain affordable Canadian access to STM information. Some alliances have also been developed to penetrate new markets and to function as mechanisms for distribution of CISTI products. Over the next five years, CISTI will develop more partnerships as an integral element of doing business, which will reduce the total cost of maintaining an international calibre STM operation, at minimal cost to the taxpayers of Canada.

Scientific publishing will be aggressively expanded, capitalizing on CISTI`s document delivery and Internet infrastructure to move into electronic publishing products. CISTI will offer electronic warehouse and dissemination services to other publishers. Present partnerships with Canadian universities and scientific societies will be the foundation for future alliances.

For this period, growth will continue in the document supply business as libraries rationalize their operations and as STM information costs continue to increase, and CISTI will exploit its expertise in information management to meet this increased demand. CISTI will provide its clients with a reliable and versatile document retrieval and delivery service "on demand". CISTI will meet this requirement by enhancing its STM collection and its investment in the people and systems infrastructure essential to exploit the collection asset to the fullest. Expanded markets will be sought to further improve CISTI's leadership position and its level of revenue, reducing the cost ratio in the process. Document services and related product capabilities will be broadened through strategic linkages and alliances. Beyond 2001, partnership with Canadian universities and other research organizations will support reduced collection costs as STM information sources are shared among partners.

The development of CISTI's and NRC's communications and networks technology will continue to evolve to meet demand, and to give end users broader access to information in a user friendly way. Beginning with NRC researchers, CISTI will develop and adapt technology solutions to contain costs and add functionality to information access by clients. These solutions, and the testbed they offer for other information providers, help position CISTI to play a leadership role in the development of Canada's information infrastructure. With both a local and national presence, CISTI will contribute its international STM information capability to support innovation in Canadian communities.

Global competition in the STM information industry will continue. CISTI will enhance its global competitiveness by being among the lead organizations adopting new technologies to meet the needs of its present and future client base. Meeting the requirements of clients in a timely fashion with a high level of service quality will position CISTI to favourably secure alliances with other world class information providers and creators. Also, it will focus on value added information products for the ultimate user, diversifying the media used for its products and services.

3. Program Management

The objective of NRC's Program Management business line is to ensure the effective management of the organization and its resources. The activity comprises NRC's executive support services and program administration. The focus of the activity is on the overall management of NRC and the provision of financial, administrative and human resource management services.

Several important initiatives are being spearheaded by NRC's corporate services branches, all designed to help the organization become more entrepreneurial and innovative.

Figure 8: Business Line/Activities by Subactivities

(Thousands of dollars)	Main Estimates 1996-97	**Main Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Program Management				
Program Administration	42,554	**46,609**	44,382	44,490
Executive Support	9,130	**9,128**	8,807	8,843
Total	51,684	**55,737**	53,189	53,333

Note: The increase from 1996-97 to 1997-98 Main Estimates represents mainly the transfer of reponsibility from Public Works and Government Services Canada for Payment in Lieu of Taxes.

Administrative Services and Property Management

Over the next few years, the Administrative Services and Property Management branch will be working with the private sector and NRC's research institutes to explore the prospects for future growth and development of "incubator" and "co-locator" facilities. Three strategic initiatives are underway to meet this long term objective:

- a study to assess the feasibly of modifying a single facility at NRC's Ottawa research complex for the purpose of providing an "incubator" zone for new and developing companies interested in making use of NRC's expertise and facilities in the high tech field;
- completion of a Draft Development Plan for the entire NRC Ottawa research complex, which will examine issues related to the possible growth and development of "incubators" and "co-location" facilities; and
- provision of project management, engineering and design services to NRC's Biotechnology Research Institute in Montreal to prepare the site for future collaborators, a process which is also underway at the Industrial Material Institute site in Boucherville.

The branch will continue with consultations towards a national environmental program with greater emphasis on assessing the environmental risks associated with

research institutes outside the Ottawa region. Within the region, attention will focus on environmental baseline studies in support of the complex's long term planning, completion of the Algonquin Radio Observatory environmental audit, and improvements to NRC's handling of hazardous waste.

Finance and Information Management Services

In 1996-97, NRC's Finance and Information Management Services branch initiated the Integrated Enterprise Business System (IEBS) project to address a number of NRC's critical information needs. Notably, the replacement of the current financial system, FINCON, is a high priority, given that Public Works and Government Services Canada will no longer support it after 31 March 1998. As well, the existing Personnel Information System needs to be replaced with a more integrated human resources system.

There are recognized efficiencies and economies of operation to be gained from the acquisition of an integrated enterprise business system, including:

- improved accuracy
- cost containment
- faster reporting and analysis
- meaningful integration of financial and human resource usage with the projects requiring those resources

The implementation of IEBS, using a commercial off the shelf (COTS) software, will commence in 1997-98.

Human Resources

The 1995 federal budget reduced NRC's annual budget by $76.2 million over the period 1994-95 to 1997-98. The Human Resources branch, working in partnership with client managers, unions and employees, has been assisting and supporting the achievement of these reductions as they apply to NRC staff.

Recognizing that NRC's capability to contribute to the economic wealth of Canada resides largely in its current and future work force, over the next few years the Human Resources Branch will work towards building greater integration between the corporate and human resources planning and performance measurement functions. The branch will also develop and implement programs and systems that contribute to the development of a more entrepreneurial and participative management culture, and which enhance the organization's ability to manage change.

Corporate Services

The Corporate Services branch helps NRC's managers position their programs where they will have the greatest impact. With its strengths in collecting and transmitting intelligence about national and international S&T events, economic

- circumstances and market trends, as well as its skills in business relations, intellectual property, licensing and commercialization, the branch will help NRC become a more agile and entrepreneurial organization. For

example, over the next few years the branch will:

- complete work on an NRC wide performance reporting system
- support the implementation of NRC's community innovation strategies
- support NRC's business relations and entrepreneurial development activities
- define NRC's international strategy priorities
- continue to assist in the development of NRC's Technology Groups
- update and refine NRC's *Vision to 2001*

III. NRC's Performance in 1995-96

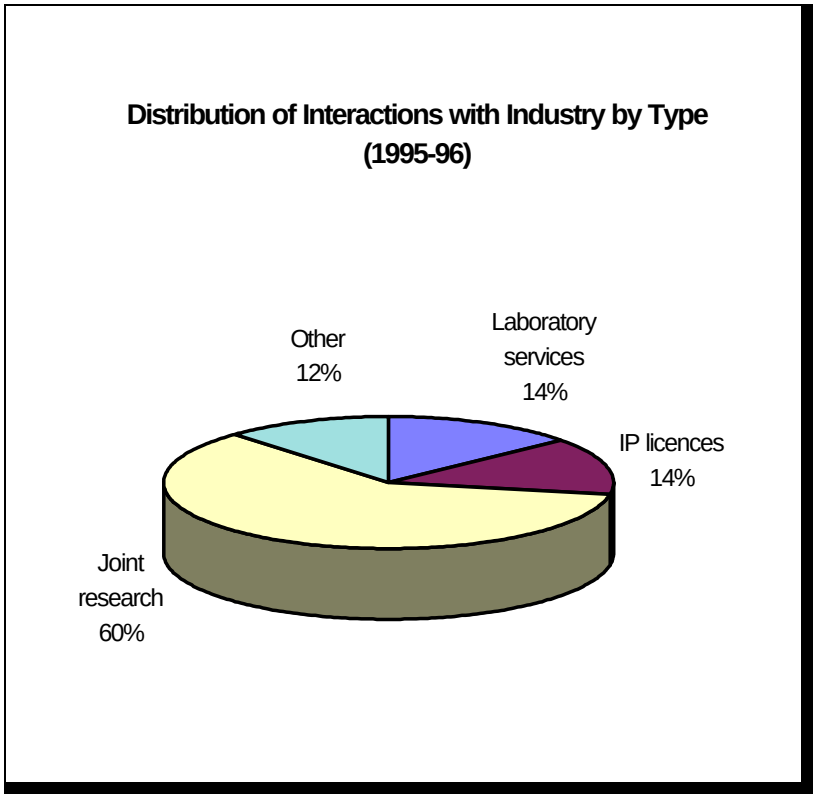
A. Summary of NRC's Performance

NRC promotes economic growth by working with industry to develop and apply technology, codes and standards, and knowledge.

In 1995-96, the organization articulated its long term vision, "... to be a leader in the development of an innovative, knowledge-based economy through science and technology." Success in realizing this vision depends largely on NRC's ability to attract and productively interact with the right clients and partners. Collaborations with Canadian-based firms are the key to NRC's success. Its clientele ranges from small to large companies, from established firms to startups. Partner companies are from all sectors of the nation's economy, from resources to the manufacturing and service sectors.

The following are examples of the extent of NRC's reach with its primary target, Canadian industry:

- NRC's research institutes reported formal interactions with over 375 companies in 1995-96.
- Some 60% of these interactions pertained to joint research projects. The breakdown of interactions by the type of service provided is shown in the accompanying diagram.
- Many of the top 50 firms in terms of R&D spending in Canada participated in or used the services of at least one NRC institute or program in 1995-96.



- NRC works with many of the top 500 companies (in terms of sales) in Canada.

Higher quality products, improved processes, faster product development, new technologies and applications, and better decision making are some of the advantages that Canadian firms realize from their interactions with NRC.

- In 1995-96, NRC entered into 26 licensing agreements and earned royalty revenues of $632,000 for some 130 licences.
- NRC has a portfolio of approximately 1000 active technologies and there are 300 patent applications pending.
- In 1995-96, several hundred Canadian companies directly used NRC's measurement services, codes, and standards information.
- During the year, NRC chaired or participated in 150 national committees and more than 200 international committees.
- The recently established Canadian Technology Network now reaches about 300 members, mainly from the public and non profit sector.
- The number of clients using CISTI's services increased by 21% from 1994-95 to 1995-96, with a total client base of more than 8,000, comprised of approximately 16,000 individual end users. In addition, Research Press boasts 12,000 clients and 20,000 subscriptions.
- IRAP worked with close to 12,000 firms in 1995-96. Its clients are from all industrial sectors of the Canadian economy.

Figure 9: Agency Appropriated and Actual Spending

(thousands of dollars)	Actuals 1993-94	Actuals 1994-95	Main Estimates 1995-96	Actuals 1995-96 **
Business Lines/Activities				
National Research and Development	252,433	264,475	**239,465**	242,589
Support for the National Science and Technology Infrastructure	101,551	110,748	**110,190**	113,005
Program Management	79,427	72,683	**59,513**	68,641
Total	433,411 *	447,906 *	**409,168**	424,235 *

* Excludes spending of proceeds from the disposal of surplus crown assets.
** For comparative purposes, 1995-96 actuals do not include expenditures for vote-netted revenue

III. NRC's Performance in 1995-96
B. Agency Overview

1. Performance Framework

NRC is committed to measuring its performance against its vision. It has developed a performance framework which describes the linkages between objectives, activities and intended impacts in terms of measurable results. It also identifies performance indicators. This approach allows management to focus on three performance areas - resources, reach and results.

The performance framework is intended to clearly define the full range of expected results, and to present related indicators. These will supply the organization with the information needed to manage NRC's activities strategically and to be able to demonstrate results. Over time, the framework will be refined and revised to reflect NRC's changing operational requirements. Within the context of the corporate performance framework, similar exercises were completed during 1996-97 for all NRC institutes and programs, including IRAP, CISTI, the corporate branches, and each of NRC's technology groups.

The next step in implementing the framework and indicators involves revising NRC's performance management process to ensure that it has adequate information for both internal and external reporting purposes. The organization also needs to review its current and future information systems to fully appreciate its information requirements. And, it will acquire and develop the expertise and tools necessary to measure and quantify the economic returns on its research, programs and services.

As illustrated in *Appendix 7, (*NRC - Corporate Performance Framework and Proposed Corporate Performance Indicators) four main categories of activities have been identified: innovation and application of technology; development of knowledge; innovation system support; and management. For each of these categories NRC has also developed long term objectives that it will strive to achieve over the next five years. In addition, to track its progress over the five year period, a balanced set of indicators has been developed to help NRC measure its achievements or results and to adjust its programs accordingly. Examples of the use of these indicators for each of the four categories of activities identified in the Performance Framework are described below.

Innovation and application of technology: NRC's objectives are to invest in technologies and programs which are key to innovation and the development of a knowledge-based economy in Canada. NRC will continue to analyze what those key technologies are and will also monitor its own investments in technologies to ensure they meet Canada's future needs.

NRC will also carry out surveys of its partners and clients to determine the benefits that they have received from working with NRC as well as to determine any ongoing improvements, if any, that are to be made to NRC's advice, products and services.

Development of Knowledge: NRC remains committed to excellence in critical areas of S&T which benefit Canada. One measure of performance in the development of knowledge is the analysis and monitoring of the number of publications which appear in refereed journals. Through this measure, and over a period of time, NRC will be able to benchmark itself against comparable R&D organizations and ensure that it is meeting its established objectives.

Innovation Support System: NRC will continue to provide leadership in the innovation system and will also continue to improve its understanding of innovation systems and role of government in that system. As part of this process NRC will, on an ongoing basis, review and examine products which through its influence and activity have met international standards. By so doing, NRC will be able to ensure that the codes and standards activities for which it is responsible benefit all Canadians.

Management: NRC is taking a more entrepreneurial approach to the management of its programs and activities in order to ensure the effective transfer of NRC knowledge and technology to the marketplace. A number of indicators have been developed which will allow NRC to monitor the extent to which it has met its objectives. For example, NRC will develop client feedback mechanisms which will be used to ensure that its activities and services are properly aligned to client needs. Employee surveys and the results of these surveys will also be used to improve or modify, as required, internal processes, activities and/or services.

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2. Entrepreneurship at NRC

In order to become more entrepreneurial in managing its prorams, NRC recognizes that it will have to be a more businesslike organization. Its culture will need to encourage greater ingenuity, creativity and reasonable risk taking.

In 1995-96, NRC initiated a number of projects with the objective of increasing flexibilities, efficiencies and effectiveness in managing its programs. Initiatives under the Entrepreneurship Program include:

- revising certain internal policies;
- creating training and development tools on entrepreneurship for all levels of staff;
- creating an Entrepreneurship Office;
- an entrepreneurship leave to encourage employees to start new enterprises;
- communicating the entrepreneurship concept to employees; and
- revising staffing, promotion and rewards processes to provide incentives.

Other proposed initiatives involve obtaining seed funding and venture capital investment in NRC technologies, and negotiating flexibilities with Treasury Board to reduce controls and bureaucracy.

NRC has already obtained from Treasury Board agreements on the following flexibities:

- the ability to charge market rates (as opposed to full cost) for NRC goods and services;
- The ability to apply for 50% of the proceeds from the sale of real property to re-invest in real property projects;
- an increase of NRC authority to issue construction contracts to $1M from $400K;
- the ability to transfer funding between Parliamentary Votes to facilitate management of budget; and
- the continuation of NRC's Special Fund.

Ultimately, NRC will measure the success of its Entrepreneurship Program through such indicators as technology transfer, startups, spinoffs, and licence revenues.

All of these indicators should see substantial increases in the next few years, as NRC develops its capabilities in these areas and manages its programs accordingly.

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3. Regional Initiatives

Industrial innovation and the resulting economic growth are increasingly driven by community based systems that have strong intellectual resources, world class research facilities, a leading edge telecommunications infrastructure, and local networks that promote entrepreneurship and strategic alliances.

During 1995-96, NRC worked with S&T regional players to build specialized community based innovation systems and to bring them into a national system of innovation. Examples of NRC's efforts and successes include:

- NRC and the Ottawa-Carleton Economic Development Corporation (OCEDCO) announced a joint strategy to stimulate innovation and entrepreneurship in the National Capital Region.
- In parallel with the OCEDCO initiative, the Societé de diversification économique de l'Outaouais (SDÉO) and NRC established a joint committee.

A number of areas have been targeted for NRC's regional initiatives, including joint projects and marketing technology.

- An action plan framework for an innovation centre has been produced in British Columbia.
- Consultations with local stakeholders began in Toronto, Saskatoon and Halifax to determine the scope, opportunity and timing of potential initiatives.
- The Atlantic Canada Opportunities Agency (ACOA) and NRC have formulated plans to link the latter's research and innovation programs with ACOA's extensive client base to address Atlantic Canada's strategic technology needs.
- NRC began preparation of an action plan to increase its visibility and linkages in the Greater Montreal region. This included the establishment with FORD-Q of an incubator on the site of the Biotechnology Research Institute in Montreal.

1. National Research and Development

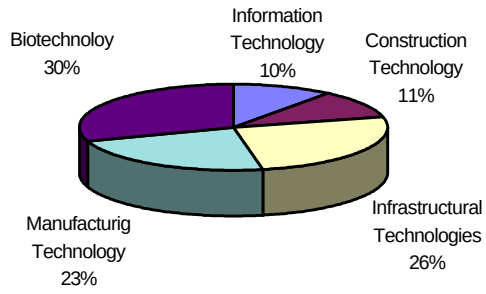
In 1995-96, NRC completed a comprehensive review of its activities, taking into consideration its strengths, available resources, the needs of the country, and areas where the organization can make a major impact.

Key research strengths relevant to industry and Canadian S&T priorities were identified in five areas: biotechnologies; construction technologies; information and telecommunications technologies; manufacturing technologies; and infrastructural technologies. A core science capability was also identified, centering on the Steacie Institute for Molecular Sciences and including involvement in several international science facilities.

During the year, work began to develop program overviews, performance frameworks and goals for the five Technology Groups. Specific programs and projects were consolidated, eliminated and repositioned. NRC's Industrial Research Assistance Program and the Canada Institute for Scientific and Technical Information (part of NRC's Support for the National Science and Technology Infrastructure business line) actively participated in the process, in order that they be better integrated into the evolving research strategies.

Over the next few years, NRC will monitor its investments in each of these technology areas in relation to Canadian needs, and in relation to the overall results obtained.

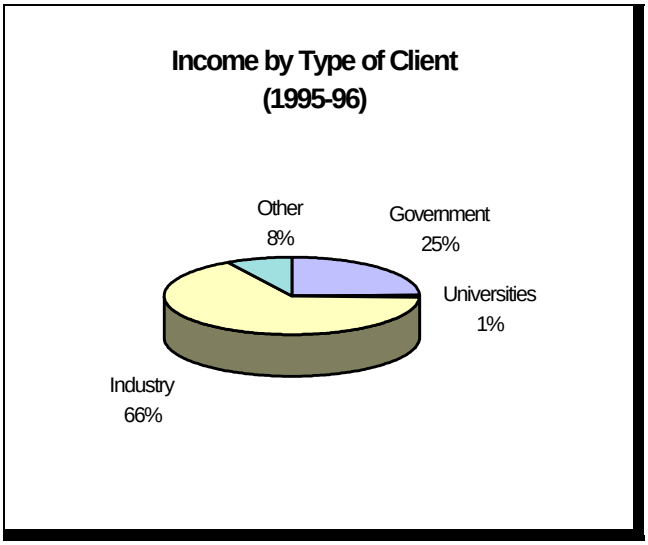
Financial Resources by Technology Group (1995-96)

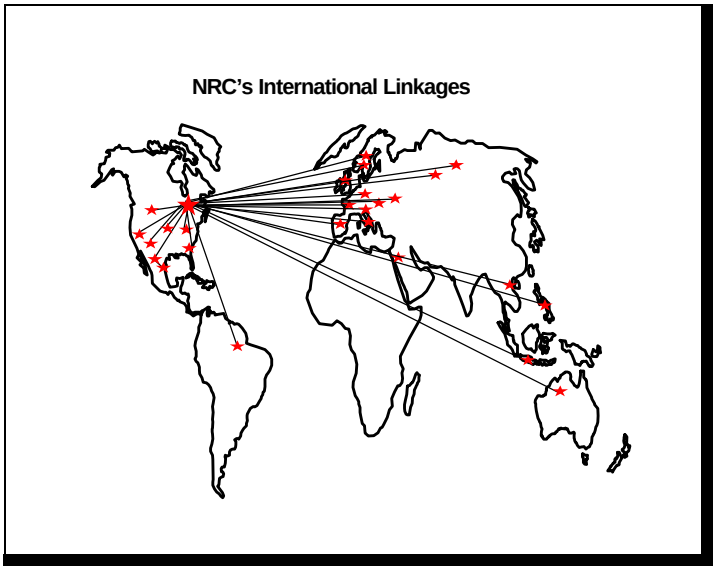


Involvements with Clients and Partners

NRC's ultimate objective is to increase the competitiveness of Canadian firms. The organization measures its economic impact on clients and partners in terms of sales growth, cost reductions, improved market share, increased exports or import substitution, all of which serve to improve a firm's competitiveness in a global market.

Partners' contributions to NRC's research are seen as an indication of their investment in R&D in Canada. In 1995-96, NRC's institutes earned more than $38 million from collaborations in research projects and the provision of services for industry clients.





Participation in International S&T

NRC contributes to the nation's knowledge infrastructure by representing Canadian interests in international S&T activities. In 1995-96, it registered more than 200 interactions with international research organizations, and participated in over 325 international committees.

Performance Highlights

Highlights of NRC's impact on the economic performance of a selection of its clients and partners follow, presented by Technology Group and their member institutes:

Biotechnologies:

- A Dutch manufacturer of biopharmaceuticals is building a new plant adjacent to NRC's Biotechnology Research Institute in Montreal, having chosen this site largely because of the institute's unique facilities and strong capabilities in bioprocess and bioenvironmental research. The $35 million investment is expected to create 70 skilled jobs and generate sales of $50 million a year.

Biotechnologies cont'd:

- Costs for thyroid surgery are estimated at $17 million a year in Canada. NRC's Institute for Biodiagnostics in Winnipeg is developing a non-invasive method of using magnetic resonance spectroscopy to monitor biochemical changes that can signal a malignancy within the human thyroid. This will mitigate the removal of thyroid nodules for diagnosis, an unnecessary operation in 95% of cases.

- NRC's Institute for Biological Sciences in Ottawa and a Canadian firm are working to reduce the use of chlorine in Canada's multimillion dollar pulp and paper industry. Chlorine, which makes paper white, also releases byproducts into rivers, lakes and streams. Canada's only manufacturer of industrial enzymes is now commercializing improved enzymes for use in the pulp bleaching process.

- A Halifax company recently licensed a unique pink form of marine plant from NRC's Institute for Marine Biosciences, and has targeted it at the $1 billion (US) Asian market for seaweed. The company has begun test marketing, and the pink seaweed is now gaining popularity as a sea vegetable in Asia.

- Canadian wheat farmers face increasing global competition. Although exports are steady, net returns are shrinking, and better wheat is needed to give Canadian growers a competitive edge. Researchers at NRC's Plant Biotechnology Institute in Saskatoon have now genetically developed a strain capable of withstanding herbicide and antibiotic use.

Construction Technologies:

- Industries using fixed pipe fire suppression systems will benefit from a project at NRC's Institute for Research in Construction in Ottawa. This work has the potential not only to reduce the costs of fire safety, but also to fight fires more effectively. These Compressed-Air-Foam systems can deliver effective fire suppression at huge cost savings over current technology.

Infrastructural Technologies:

- NRC's Herzberg Institute of Astrophysics in Victoria has an international reputation in both research and optical design. The institute's leadership in the development of the next generation of optical telescopes has helped a BC company become a major player in building observatory domes. It has won contracts worth approximately $36 million for constructing two enclosures for the Gemini Telescopes.

- NRC's Institute for Aerospace Research's unique wind tunnel facilities in Ottawa are being utilized by a large Canadian firm in the development of their world leading business and regional commuter aircraft. The aircraft's first flight occurred in 1996.

Infrastructural Technologies cont'd:

- NRC's Institute for Marine Dynamics in St. John's Nfld. was recently selected to manage a major international research project on navigation in ice covered waters. The project will investigate commercial navigation possibilities along the northern coasts of Norway and Russia, through the Northeast Passage. The results will have a significant impact on northern shipping and transportation, including such economically important sectors as the oil and gas industry.

- A Montreal firm has received a $1.2 million contract to help rehabilitate the transmission system in coastal Peru. Under this contract, NRC's Institute for National Measurement Standards in Ottawa will perform certain measurements. The involvement of the institute is believed to have tipped the scale in favour of the Canadian company, helping it win the contract over foreign firms.

Information and Telecommunications Technologies:

- NRC's Institute for Information Technology in Ottawa has been developing 3D digital imaging since the 1980s. Small and medium sized firms are now licensing this patented technology. A large aerospace company in Toronto has built a radiation hardened version of the advanced and versatile 3D vision technology for nuclear waste site cleanup.

- NRC's Institute for Microstructural Sciences in Ottawa has been working with companies to develop thin film technologies. A Vancouver firm has signed a unique agreement to commercialize the institute's production methods for thin film coatings, which result in precise optical properties.

Manufacturing Technologies:

- A Quebec company is beginning to see success after commercializing an automated vision system for welding, the focus of five years of research at NRC's Industrial Materials Institute in Boucherville. The technology ensures better reliability and productivity, which is expected to give the firm a large share of the international market.

- NRC's Institute for Chemical Process and Environmental Technologies in Ottawa is working with two large oil companies to improve the understanding of how and why fuel composition affects exhaust emissions. This knowledge will ultimately benefit both the environment and Canadian oil producers.

Manufacturing Technologies cont'd:

- In a joint project with a major forest company, NRC's Institute for Sensor and Control Technology in Vancouver has developed image analysis techniques to analyze log cross sections in order to cut around defects in the wood. The log processing industry places great value on maximizing wood recovery through saw cut position.

- Work by NRC's Integrated Manufacturing Technologies Institute, which is being established in London, Ontario, has led to a space vision system that allows the Canadarm to manipulate payloads in space with pinpoint accuracy. The system will be critical to the assembly of the future space station. It can also be applied to precision guidance in industrial robotics.

Core Research

Excellence in research is necessary in developing effective partnerships and consortia. World class facilities and core research underpin all research programs in the business line. NRC allocates close to 25% of its resources to the development of knowledge as well as the enhancement of its core competencies and long term capabilities. With the reformulation of its research activities in 1995-96, NRC created a core science program at the Steacie Institute for Molecular Sciences, which will complement the core research activities undertaken throughout the National Research and Development business line.

Steacie Institute for Molecular Sciences

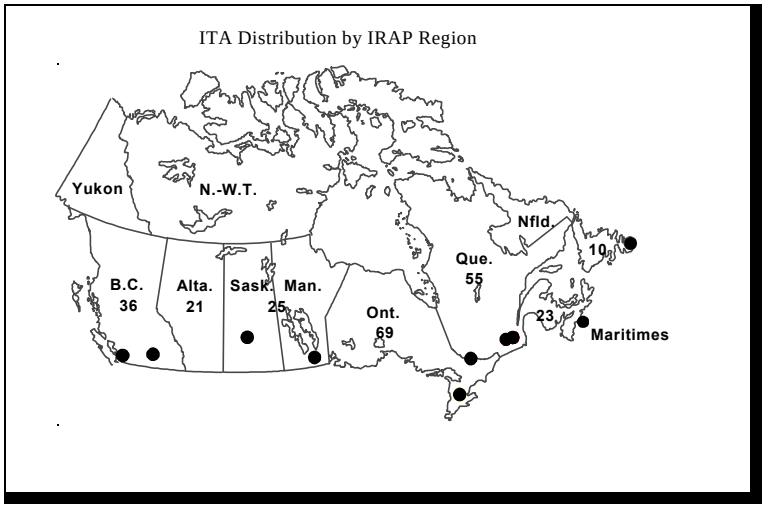
The Institute's research in sub-femtosecond pulse generation, high harmonic generation, and strong field physics, received numerous mentions during 1995-96 in scientific, engineering and the popular press.

The Institute had 43 research collaborations with international organizations representing such countries as Japan, the USA, Britain, Denmark, France and Germany.

2. Support for the National Science and Technology Infrastructure

Industrial Research Assistance Program

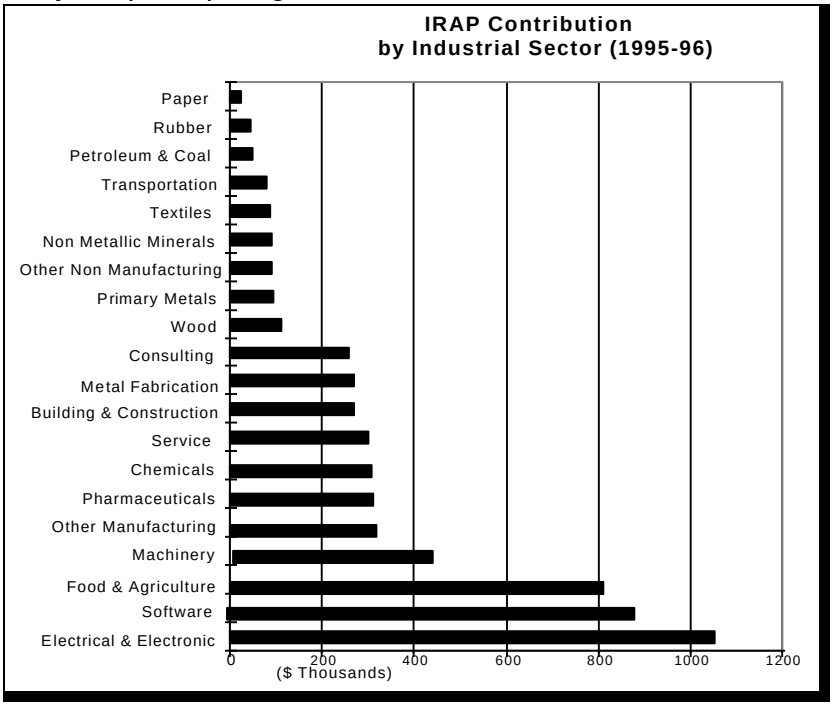
IRAP's Industrial Technology Advisors, the foundation of the program, provide technical advice and assistance to Canadian firms. In 1995-96 there were some 245 ITAs situated in more than 166 office locations in almost 90 different cities across Canada. The following diagram illustrates the ITA distribution by region, excluding seven in Ottawa who provide a national coordination and assessment service to the field offices.

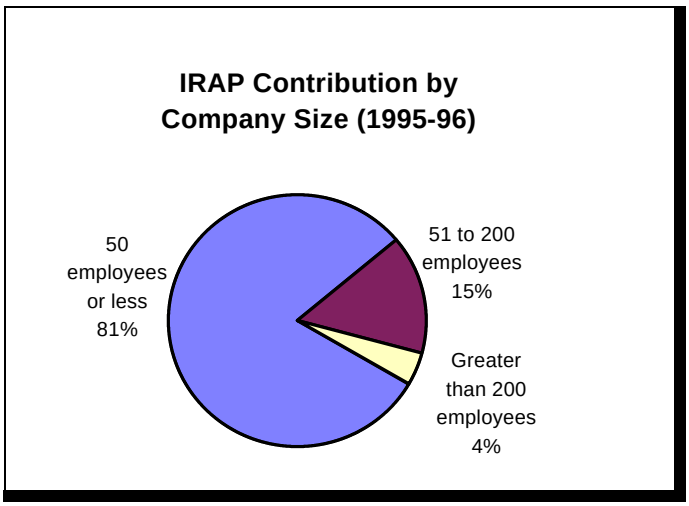


IRAP's clients are from all industrial sectors of the Canadian economy. The figure below presents 1995-96 IRAP financial contributions to firms by industrial sector.

In 1995-96, contributions to firms amounted to approximately $59 million for close to 3,500 projects. IRAP's advice and contributions of about one third of project costs helped to reduce the risks for firms, and resulted in substantial incremental R&D investments by the participating firms.

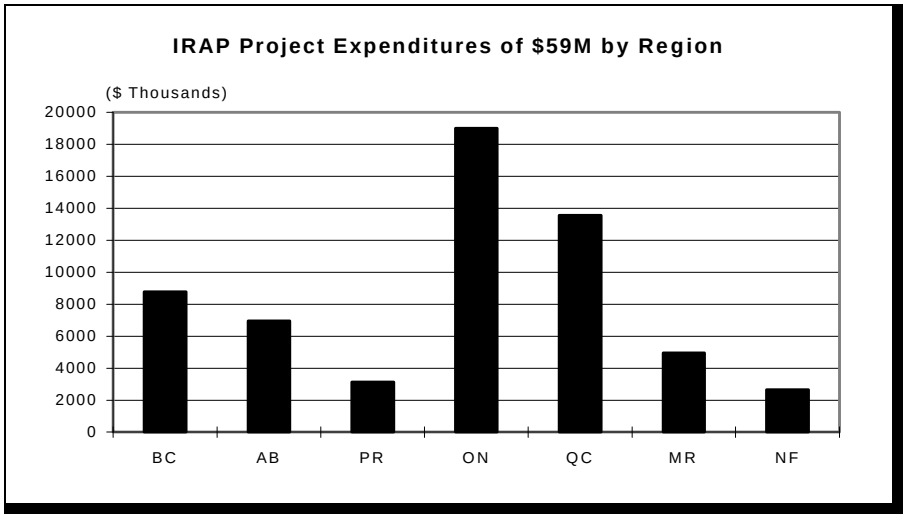
IRAP works primarily with small to medium sized enterprises with fewer than 500 employees. These firms comprise the bulk of Canada's industrial base. The chart on the following page shows that over 80% of project funding in 1995-96 supported firms with fewer than 50 employees.





In 1995-96, IRAP was awarded the Manning Foundation Award of Excellence in recognition of 50 years support to Canada's innovative SMEs.

On a national basis, IRAP's resource allocations and expenditures respond to local industrial demand and generally follow the distribution of IRAP's client base. The table below highlights the amount of funding expended on client projects in 1995-96 by each IRAP region.



Results of the assessment of IRAP show that clients with funded projects maintain a very high level of satisfaction with the Program. Service characteristics such as the expertise of the Program staff and geographic proximity were rated, on average, at over 8 on a scale of 1-10. The complementary nature of IRAP's advice and financial assistance in meeting clients' diverse needs was identified as a key factor in its success. Over 70% of clients with large funded projects were able to identify economic benifits such as export sales and hiring of new employees, and over half stated that IRAP played a large role in achieving those results.

Information from the assessment will be used to improve mechanisms to measure and analyze IRAP's performance, including the identification of potential client groups and client feedback instruments.

Canadian Technology Network

An effective national system of innovation needs strong links between people working at all levels of the S&T infrastructure. In June 1994, the government approved funding for the Canadian Technology Network to address this need. The CTN was designed to strengthen links between Canada's universities, industry associations and government. Its purpose is to gather information on technology and related services from across the country and around the world, and make it easily available to industry. IRAP was given primary responsibility for establishing and implementing the CTN, in close cooperation with Industry Canada.

Early in CTN's development, cross-country workshops were held to determine the network's principal elements. These involved both private and public stakeholders. The main activity in 1995-96 was the building of a "people network" through the recruitment of organizations with technology and related business skills to be CTN members. There are now over 300 CTN network members, mainly from the public and non profit sector. Orientation sessions were provided to member organizations in all regions to ensure that they were familiar with CTN goals and their role in its operation. Members offer SMEs advice, expertise, technology, information and/or specialized facilities to help them solve their problems.

In 1995-96, activities also concentrated on the development of a searchable directory available through the Internet. It lists the capabilities of member organizations. By January 1996, the CTN was operational in all regions of the country, and a national launch was held in May 1996.

Canada Institute for Scientific and Technical Information

In 1995-96, CISTI continued a process to convert its regional branches across Canada into NRC Information Centres, designed to serve the research communities in which they are located, as well as the staff of the host NRC research institutes. Reference services were augmented with leading business and marketing databases to provide a complete service to clients in the technology field.

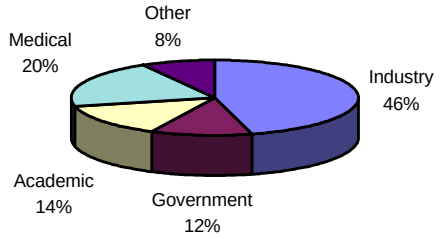
With the advancements in Internet services, especially the use of the World Wide Web, CISTI has focused on the Web as an access and delivery tool for products and services. A new catalogue was launched in January 1996, providing both Web based and Telnet access to CISTI's collection. A Web interface to the SwetScan tables of contents service was introduced in September 1996, and registration and order forms were made available on CISTI's Web site, along with many other interactive features. Use of the World Wide Web as a document ordering mechanism grew substantially with the introduction of a Web based document order form and Web access to the catalogue.

NRC Research Press, which became part of CISTI in 1994, has embarked on an aggressive program of electronic publishing, with the full text of two journals becoming available in 1996 as a pilot project, and six more planned for 1997.

The World Wide Web is the medium for access to the journals, and to the tables of contents for all journals published by NRC Research Press. The number of subscriptions stands at 20,000 and revenues continue to increase, with a projected increase approaching 100% over the next five years as a result of the acquisition of new titles.

Document delivery business increased substantially in 1995-96, exceeding revenue targets and experiencing a 26% growth in sales over the previous year. For example, the number of orders from the U.S. increased 56% in 1995-96 from the same time the previous year, or 233% if the longstanding broker clients are excluded.

CISTI Client Distribution by Type (1995-96)



CISTI Revenues for 1995-96 reached over $12 million, an increase of 9.8% over the previous year, and are expected to increase a further 5%-8% for 1996-97.

3. Program Management

NRC's Program Management business line comprises two subactivities. The Executive Support function provides policy, program and executive support for the coordination and direction of NRC's operations and its governing Council.

The Finance and Information Management Services, Human Resources, Administrative Services and Property Management and Corporate Services branches constitute the second function, Program Administration.

Administrative Services and Property Management

With the promulgation of the *Canadian Environmental Assessment Act* and new regulations under the *Canadian Environmental Protection Act*, NRC is compelled to implement an environmental management system across the organization. The system would ensure regulatory compliance, enumerate environmental liabilities, and set priorities, all within the current resources levels. Some material gains in this direction have already been made. For example, in 1995-96 NRC:

- eliminated its 10 year inventory of PCBs
- incorporated major safeguards into its trichloroethylene distribution system
- completed three petroleum storage projects
- made substantial advances in energy and water conservation, which were primarily motivated by the need to reduce operating costs
- continued to remove asbestos insulation and reduce CFCs in its facilities

The Administrative Services and Property Management branch continued its initiatives in materiel management by completing a major software upgrade to NRC's Integrated Materiel Management System for its purchasing, assets, accounts payable and inventory modules.

Finance and Information Management Services

In order to re-engineer NRC's approach to financial reporting, improve services and reduce costs, the Finance and Information Management Services branch undertook the development and implementation of a Financial Data Warehouse in 1995-96.

This integrates information from all existing financial legacy systems and has been implemented in all NRC institutes across Canada. Developed with leading edge software, the Financial Data Warehouse will continue to serve as NRC's primary electronic repor-ting tool once the new Integrated Enterprise Business System is implemented.

Human Resources

During 1995-96, NRC's Human Resources branch assisted the organization in adjusting its programs to accommodate a reduced resource base. The services provided included reviews of organizational structures, programs and individual positions, as well as the introduction of various assistance programs to minimize the hardship on employees. By 1997-98, approximately 300 employees will have been affected by these changes.

In support of NRC's vision as a world leader in research and the requirement for a dynamic, flexible, responsive and entrepreneurial organization, the Human Resources Branch continued to enhance and optimize the recruitment of highly qualified university graduates and undergraduate students in science and engineering through the Women in Engineering and Science Program, Research Associates Program and Postdoctoral Programs. Approximately 330 recruits were selected in these programs to work with NRC researchers across a wide range of research initiatives and programs.

Corporate Services

During 1995-96, the Corporate Services branch was extensively involved in the realignment of NRC's programs under its new management framework and corporate vision. For example, the branch:

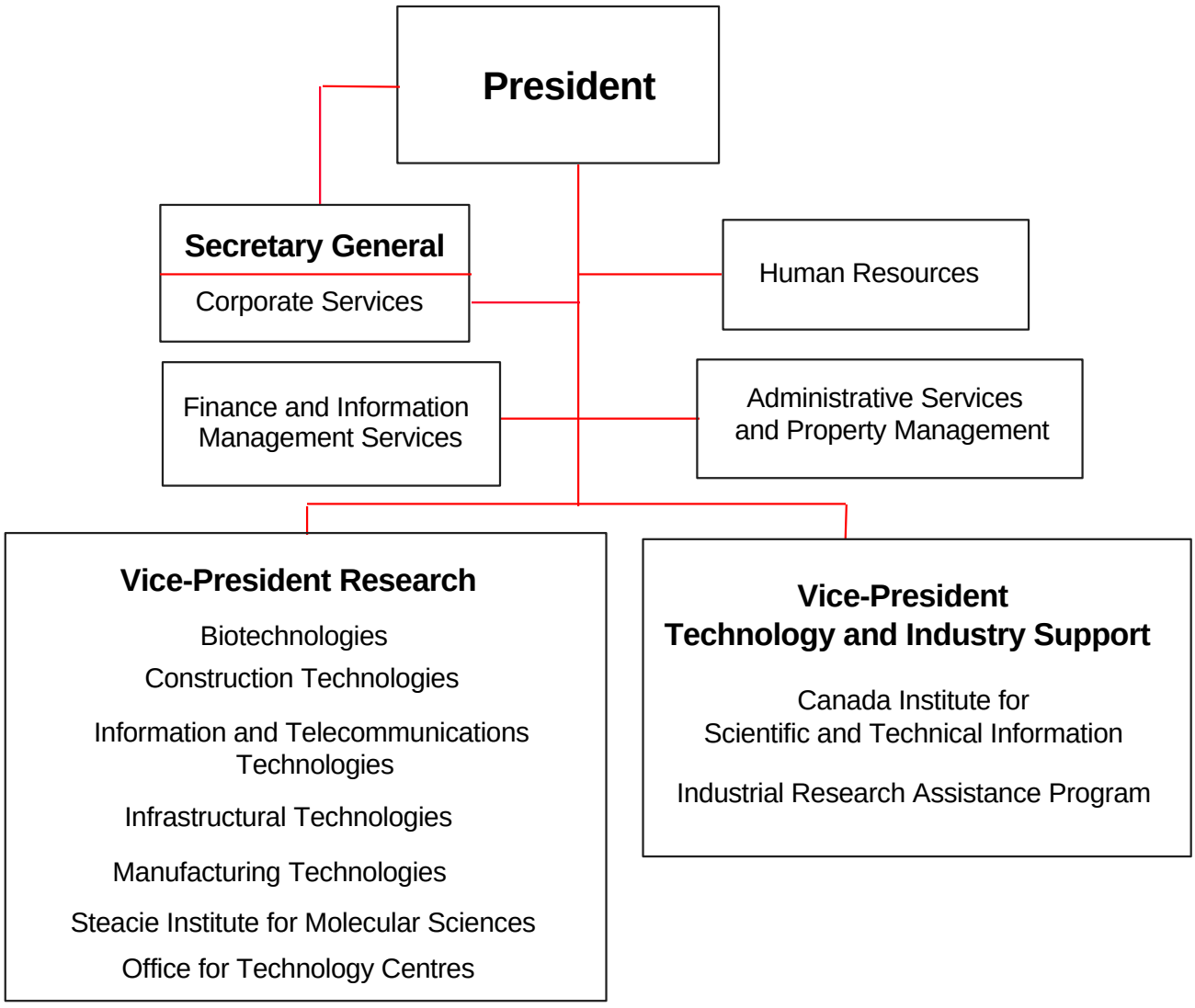
- supported the formation of the Technology Groups, helping them prepare program overviews and performance frameworks
- coordinated the preparation of NRC's *Vision to 2001*, a document which will guide the organization into the next century
- prepared and received senior management approval for a corporate performance framework
- developed several strategies to support NRC's entrepreneurship initiative
- assisted in the launching of NRC's regional and community innovation strategies across Canada

During the year as well, the branch adopted and put in place an integrated approach to its service delivery, realigning its competencies according to specific client needs.

IV. Supplementary Information

Appendix 1 - *Organization*

1.1 NRC Organization Chart



Appendix 1 - *Organization*

1.2 Resource Requirements by Subactivity and Business Line/Activity ($000)

(thousands of dollars)	Business Lines/Activities			**Total**
	National Research and Development	Support for the National and Technology Infrastructure	Program Management	
Organization				
Research Institutes	279,240			**279,240**
Industrial Research Assistance Program		98,083		**98,083**
Canada Institute for Scientific and Technical Information		29,380		**29,380**
Corporate Branches			46,609	**46,609**
Executive Offices			9,128	**9,128**
Total	**279,240**	**127,463**	**55,737**	**462,440**

Appendix 2 - *Personnel Requirements*

2.1 Details of Personnel Requirements by Business Line/Activity (FTEs)

	Actuals 1994-95	Actuals 1995-96	Estimates 1996-97	**Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Business Lines/Activities						
National Research and Development	2,317	2,170	2,137	**2,079**	2,018	2,018
Support for the National Science and Technology Infrastructure	371	370	370	**377**	367	367
Program Management	619	559	565	**554**	538	538
Total	3,307	3,099	3,072	**3,010**	2,923	2,923

Appendix 2 - *Personnel Requirements*

2.2 Summary by Professional Category (FTEs)

	Actuals 1994-95	Actuals 1995-96	Estimates 1996-97	**Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Executive and Senior Management	19	21	20	**24**	23	23
Scientific and Professional	1,251	1,171	1,231	**1,199**	1,163	1,163
Administrative and Foreign	363	351	328	**364**	353	353
Technical	856	812	730	**729**	707	707
Administrative Support	546	501	516	**469**	455	455
Operational	118	107	111	**93**	90	90
Students	131	114	113	**110**	110	110
Women in Engineering and Science	23	22	23	**22**	22	22
Total	3,307	3,099	3,072	**3,010**	2,923	2,923

Appendix 3 - *Capital Projects*

3.1 Capital Expenditures by Business Line / Activity ($000)

	Actuals 1994-95	Actuals 1995-96	Estimates 1996-97	**Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Business Lines/Activities						
National Research and Development	34,249	21,809	39,240	**39,438**	39,438	39,438
Support for the National Science and Technology Infrastructure	1,068	1,490				
Program Management	14,323	13,590	6,248	**5,378**	5,378	5,378
Total	49,640	36,889	45,488	**44,816**	44,816	44,816

Appendix 3 - *Capital Projects*

3.2 List of Capital Projects by Business Line / Activity ($000)

	Currently Estimated Total Cost	Forecast Expenditures to March 31, 1997	**Planned Expenditures 1997-98**	Future Years' Requirements
National Research and Development				
IMR Building Project (S - EPA)	13,525	13,525		
Advanced Systems Research Aircraft (S - EPA)	7,218	7,218		
Spin Pit Testing of Turbine Engine Components (DA)	1,200	1,200		
Functionally Graded Materials for Aeroframe and Aero-Gas Turbine Engines (DA)	1,100	780	**320**	
Hazardous Materials Facility (DA)	650	650		
Stereolithography Apparatus (DA)	675	675		
CNC Router (DA)	600	200	**400**	
SIMS Relocation (DA)	1,265	1,265		
750 MHz NMR Facility (S - EPA)	2,600	2,600		
Gene Discovery Facility (DA)	1,250	750	**500**	
Canadian Netshape Forming Innovation Centre (DA)	1,900	1,000	**900**	
Mould Making and Material Processing (DA)	500	500		
Marine Dynamic Test Facility (S - EPA)	2,800	1,870	**930**	
Bioinformatics Network Project (DA)	535	535		
NMR Upgrade (DA)	500	500		
Intraoperative MRI (DA)	891	891		
Multiprocessor Computer for Molecule Simulation and Modeling	750	750		
Solids NMR Spectrometer (DA)	1,114	1,114		
Projects under $500K			**36,388**	
Total, National Research and Development			**39,438**	

Appendix 3 - *Capital Projects*

3.2 List of Capital Projects by Business Line / Activity ($000) cont'd

	Currently Estimated Total Cost	Forecast Expenditures to March 31, 1997	**Planned Expenditures 1997-98**	Future Years' Requirements
Program Management				
Health and Safety Upgrades -				
Sussex Drive (S - EPA)	8,500	8,500		
Fire Safety Improvements (DA)	920	920		
Renovate M -14, Exterior and Interior (DA)	1,200	1,200		
Reclad M-36 Exterior (S - EPA)	2,600	2,600		
Chiller Installation for M-2 (DA)	820	820		
Renovate M-27, Exterior and Interior (DA)	650		**650**	
Renovate M-13, Exterior and Interior (DA)	1,000		**1,000**	
Repointing Stonework - Sussex Drive (DA)	600		**600**	
Renovate M-7, Exterior and Interior (DA)	1,450			1,450
Renovate M-10, Exterior and Interior (DA)	1,160			1,160
Renovate M-59, Exterior and Interior (DA)	1,250			1,250
Renovate M-60, Exterior and Interior (DA)	790			790
Projects under $500K			**3,128**	
Total, Program Management			**5,378**	
Total Capital Expenditures			**44,816**	

Appendix 4 - *Additional Financial Information*

4.1 Net Expenditures by Business Line/Activity

	Financial Requirement 1997-98 (thousands of dollars)		
		Spending Authorities	
	Total Department Main Estimates	Statutory * Expenditures	(Voted Appropriations) Non Statutory Expenditures
Business Lines/Activities			
National Research and Development	279,240	44,435	234,805
Support for the National Science and Technology Infrastructure	127,463	15,346	112,117
Program Management	55,737	5,613	50,124
Total Program	462,440	65,394	**397,046**
Other Revenue and Expenditures			
Revenue credited to the Consolidated Revenue Fund	(650)		
Estimated Cost of Services provided without charge by other Government Departments	9,313		
Net Department Expenditures	**471,103**		

* Contribution to Employee Benefit Plans and Spending of Revenue Pursuant to 5.1 (e) of the NRC Act.

Appendix 4 - *Additional Financial Information*

4.2 Revenues and Expenditures

4.2.1. Departmental Expenditures by Business Line/Activity ($000)

	Main Estimates 1996-97	**Main Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Expenditures by Business Lines/Activities				
National Research and Development	263,767	**254,407**	247,681	247,984
Support for the National Science and Technology Infrastructure	127,897	**114,304**	79,396	79,486
Program Management	53,921	**53,592**	51,944	52,088
Total	445,585	**422,303**	379,021	379,558
Revenue credited to the vote (1996-97) Spending of revenues pursuant to the NRC Act (1997-98 to 1999-00) and Revenue credited to the Consolidated Revenue Fund				
National Research and Development	(22,766)	**24,833**	25,455	25,455
	(960)	**(265)**	(265)	(265)
Support for the National Science and Technology Infrastructure	(12,831)	**13,159**	13,659	13,659
	(780)	**(125)**	(125)	(125)
Program Management	(2,237)	**2,145**	1,245	1,245
	(260)	**(260)**	(260)	(260)
Total	(39,834)	**39,487**	39,709	39,709
Total Expenditures by Business Line/Activity				
National Research and Development	240,041	**278,975**	272,871	273,174
Support for the National Science and Technology Infrastructure	114,286	**127,338**	92,930	93,020
Program Management	51,424	**55,477**	52,929	53,073
Total Expenditures	405,751	**461,790**	418,730	419,267

Appendix 4 - *Additional Financial Information*

4.2 Revenues and Expenditures

4.2.1.1. Details of Revenues by Business Line/Activity ($000)

	Actuals 1994-95	Actuals 1995-96	Estimates 1996-97	**Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Revenue credited to the vote and Spending of revenues pursuant to the NRC Act by Business Lines/Activities						
National Research and Development						
Fee for Service	19,225	11,636	15,554	**12,842**	13,863	13,863
Rentals	579	424	347	**439**	421	421
Royalties	563	609	822	**1,124**	1,387	1,387
Contracting In			1,743	**6,328**	6,669	6,669
Publications	610	2,092	4,060	**3,600**	2,850	2,850
Other	94	88	250	**500**	265	265
Support for the National Science and Technology Infrastructure						
Fee for Service	4,724	4,940	5,785	**5,870**	6,115	6,115
Royalties	9	23				
Publications	6,457	7,316	7,036	**7,289**	7,544	7,544
Other	8	22				
Program Management						
Fee for Service	1,593	1,644	300	**375**	375	375
Rentals	195	246	97	**220**	220	220
Publications	5	1				
Other	1,006	759	1,840	**1,550**	650	650
Total	35,068	29,800	37,834	**40,137**	40,359	40,359
Revenue credited to the Consolidated Revenue Fund by Business Lines/Activities						
National Research and Development	137	403	960	**265**	265	265
Support for the National Science and Technology Infrastructure	265	185	780	**125**	125	125
Program Management	3,752	395	260	**260**	260	260
Total credited to the CRF	4,154	983	2,000	**650**	650	650
Total Revenues	39,222	30,783	39,834	**40,787**	41,009	41,009

Appendix 4 - *Additional Financial Information*

4.2 Revenues and Expenditures

4.2.2. Transfer Payments by Business Line/Activity ($000)

	Actuals 1994-95	Actuals 1995-96	Estimates 1996-97	**Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Grants by Business Lines/Activities						
Program Management	5,155	5,205	5,196	**5,196**	5,196	5,196
Total Grants	5,155	5,205	5,196	**5,196**	5,196	5,196
Contributions by Business Lines/Activities						
National Research and Development	50,206	43,598	25,789	**38,560**	40,488	39,806
Support for the National Science and Technology Infrastructure	76,194	79,243	81,863	**83,953**	55,067	55,067
Total Contributions	126,400	122,841	107,652	**122,513**	95,555	94,873
Total Grants and Contributions	131,555	128,046	112,848	**127,709**	100,751	100,069

Appendix 4 - *Additional Financial Information*

4.2 Revenues and Expenditures

4.2.2.1 Details of Transfer Payments by Business Line/Activity

	Actuals 1994-95	Actuals 1995-96	Estimates 1996-97	**Estimates 1997-98**
Grants by Business Lines/Activities				
Program Management				
International Affiliations	915	965	956	**956**
Grants to municipalities in accordance with the Municipal Grants Act	4,240	4,240	4,240	**4,240** [2]
Total Grants	5,155	5,205	5,196	**5,196**
Contributions by Business Lines/Activities				
National Research and Development				
Contributions to extramural performers under the Biotechnology Research Program	2,818	1,900	615	**15**
Particle Physics and Astronomy Research Council of the United Kingdom in support of the James Clerk Maxwell Telescope	3,916	2,566	2,644	**1,138**
Canada's share of the costs of the Canada-France-Hawaii Telescope Corporation	3,722	5,814	3,253	**3,253**
Universities of Alberta, British Columbia, Simon Fraser and Victoria in support of the TRIUMF Project	33,250	33,318	19,277	**32,954**
National Science Foundation of the United States in support of the construction of the Gemini Telescopes	6,500	-	-	**1,200**
Support for the National Science and Technology Infrastructure				
Contributions to Canadian firms to develop, adapt and exploit technology (IRAP) [1]	58,368	60,268	61,978	**64,068**
Contributions to organizations to provide technological and research assistance to Canadian industry (IRAP) [1]	17,748	18,975	19,885	**19,885**
Canadian Film Institute	78	-	-	-
Total Contributions	126,400	122,841	107,652	**122,513**
Total Grants and Contributions	131,555	128,046	112,848	**127,709**

[1] Industrial Research Assistance Program

[2] $6.357M is also included in Operating for Payments in Lieu of Taxes

Appendix 4 - *Additional Financial Information*

4.2 Revenues and Expenditures

4.3 Presentation by Standard Object ($000)

	Actuals 1994-95 *	Actuals 1995-96 *	Estimates 1996-97 *	**Estimates 1997-98**	Planned 1998-99	Planned 1999-00
Personnel						
Salaries and wages	169,017	170,993	154,760	**148,571**	144,341	145,383
Contributions to employee benefit plan	21,324	22,149	22,440	**25,257**	24,538	24,715
	190,341	193,142	177,200	**173,828**	168,879	170,098
Goods and services						
Transportation and Communcations	15,496	13,902	16,493	**12,169**	10,120	10,120
Information	4,762	5,779	5,069	**1,472**	1,224	1,224
Other Professional and special services	21,937	19,617	23,349	**14,486**	12,046	12,046
Rentals	4,944	4,345	5,262	**3,849**	3,201	3,201
Repair and upkeep	12,476	11,343	13,279	**10,197**	8,480	8,480
Utilities, Materials and Supplies	37,852	33,930	40,289	**23,244**	19,329	19,329
Construction and acquisition of machinery and equipment	-	-	2,050	**2,050**	2,050	2,050
Other subsidies and payments	2,036	2,653	2,167	**8,483**	8,125	8,125
	99,503	91,569	107,958	**75,950**	64,575	64,575
Capital	61,575	41,277	47,579	**44,816**	44,816	44,816
***Transfer Payments* - Voted**	131,555	128,047	112,848	**127,709**	100,751	100,069
Total	482,974	454,035	445,585	**422,303**	379,021	379,558
Less:						
Revenue credited to the Vote	(35,068)	(29,800)	(37,834)			
Add:						
Spending of revenues pursuant to the NRC Act				**40,137**	40,359	40,359
Total budgetary expenditure	447,906	424,235	407,751	**462,440**	419,380	419,917

* 1994-95 and 1995-96 Actuals and 1996-97 Main Estimates reflect revenue vote-netted from expenditures/ appropriations (1995-96 Public Accounts reflect revenue spending pursuant to the NRC Act).

Appendix 5 - *Areas and Programs of Research at NRC's Institutes*

WWW This symbol indicates that more information about a specific NRC institute is available on the Internet. Access all institute home pages via **http://www.nrc.ca/**

NRC Biotechnology Research Institute (Montréal) WWW

- Receptors and signal transduction
- Proteases and protease regulation
- Target identification and characterization
- Molecular design and structural biology
- Production and scale-up in cell culture
- Scale-up of fermentation, separation and purification processes; production for pre-clinical trials
- Bioremediation of contaminated soils, industrial waste water and air
- Biopesticides, biosensors, biomonitoring methods
- Environmental microbiology, environmental genetics and applied ecotoxicology

NRC's Herzberg Institute of Astrophysics (Victoria and Penticton) WWW

- Astrophysics: radio, optical, ultraviolet
- Canadian Astronomy Data Centre

NRC Industrial Materials Institute (Boucherville) WWW

- Process modelling and optimization: structural performance, flow, solidification
- Process development: net shape forming, multiphase polymers, surface technology
- Process instrumentation: non-destructive characterization, optical inspection, ultrasound techniques

NRC Institute for Aerospace Research (Ottawa) WWW

- R&D in support of the aerospace community in matters affecting the design, manufacture, performance, use and safety of aerospace vehicles. The following are some of IAR's research programs (supported by major facilities):
- Aerodynamics: eight wind tunnels
- Aeroacoustics: acoustic test chambers
- Structures and materials: structural and materials test facilities
- Airborne research and flight mechanics: six research aircraft
- Aeropropulsion: engine, stage and component testing facilities; compressor-exhauster plant
- Flight Recorder Playback Centre
- Icing research: icing tunnel; instrumented aircraft
- Non-destructive evaluation

Appendix 5 - *Areas and Programs of Research at NRC's Institutes*

NRC Institute for Biodiagnostics (Winnipeg) WWW
- Biomedical diagnostic instruments and techniques
- Magnetic resonance and infrared imaging and spectroscopy
- Computational analysis of biomedical data
- Development of pharmaceuticals and medical techniques
- Research into arthritis, cancer, heart disease, stroke

NRC Institute for Biological Sciences (Ottawa) WWW
- Cell biology of neurodegenerative diseases
- Immunochemistry research into vaccines, therapeutics, and diagnostics

NRC Institute for Chemical Process and Environmental Technology (Ottawa) WWW
- Process technology to improve operational efficiency
- Materials chemistry to achieve best performance or function
- Computer modelling and simulation for product or process design and evaluation

NRC Institute for Information Technology (Ottawa) WWW
- Human-computer interaction
- Software for interactive access to information
- Integrated reasoning systems for decision making
- Photonic systems
- Seamless personal information networking
- Software engineering
- Visual information technology

NRC Institute for Marine Biosciences (Halifax) WWW
- Marine biotechnology
- Finfish, shellfish and seaweed aquaculture
- Marine bioactives, including pharmaceuticals, agrichemicals and marine toxins
- Marine Analytical Chemistry Standards Program
- Advanced mass spectrometry
- Genomics/bioinformatics

NRC Institute for Marine Dynamics (St. John's) WWW
- Offshore engineering
- Marine systems
- Advanced projects

Appendix 5 - *Areas and Programs of Research at NRC's Institutes*

NRC Institute for Microstructural Sciences (Ottawa) WWW

- Microelectronics
- Optoelectronics device technology
- Semiconductor process technologies
- Advanced components
- Thin film technology
- Display technology
- Acoustics technology

NRC Institute for National Measurement Standards (Ottawa) WWW

- Electrical power measurements
- Standards in acoustics, electricity, ionizing radiation, length, mass, time, and frequency
- Photometry and radiometry
- Thermometry
- Chemical metrology
- Calibration Laboratory Assessment Service
- Calibration and testing services
- Optical components research

NRC Institute for Research in Construction (Ottawa) WWW

- Building envelope
- Indoor environment
- Urban infrastructure
- Fire risk management
- Repair technologies and strategies
- Canadian construction codes and guidelines
- Evaluation of construction products and systems

NRC Integrated Manufacturing Technologies Institute (London, Vancouver) WWW

- Enabling software systems
- Intelligent production systems
- Industrial laser processes and systems
- Free-form fabrication processes
- Control technologies
- Sensor and diagnostics
- Mechatronic systems
- Surface technology, tribology

Appendix 5 - *Areas and Programs of Research at NRC's Institutes*

NRC Plant Biotechnology Institute (Saskatoon) WWW

- *Brassica* biotechnology
- Cereal biotechnology
- Legume biotechnology
- Gene expression
- Growth regulation
- Promoter technology
- Seed oil modification

NRC's Steacie Institute for Molecular Sciences (Ottawa) WWW

- Femtosecond science
- Nanoscale materials and processes
- Supramolecular chemistry and biology
- Spectroscopy
- Theoretical modelling of molecules and materials

NRC Technology Centres

NRC Canadian Hydraulics Centre (Ottawa) WWW

- Coastal engineering and environmental hydraulics
- Cold regions technology
- Laboratory technologies

NRC Centre for Fluid Power Technology (Ottawa)

- High-speed fluid jet technology
- High-pressure components and products

NRC Centre for Surface Transportation Technology (Ottawa; Vancouver)

- Road vehicle performance
- Rail vehicle performance
- Railway tribology

NRC Thermal Technology Centre (Ottawa) WWW

- New environmentally acceptable refrigerants
- Refrigeration, air conditioning and heat pumps
- Compact heat exchanger technology
- Ice slurry technology

Appendix 6 - *Description of NRC's Major Facilities*

NRC has historically played a significant role in the maintenance and support of national science and engineering facilities on behalf of the Government of Canada. Some major facilities are maintained and operated by NRC while others are managed by external organizations supported by a financial contribution from NRC.

Pilot-Scale Fermentation Facilities:

With over 2,000 m^2 of floor space and a range of fermenters and purification equipment, the Biotechnology Research Institute's Fermentation Facilities are an excellent resource for the pharmaceutical industry and other industrial users of biotechnology. Services offered include: bioprocess optimization, downstream processing, purification and pilot scale production of recombinant proteins, with bioreactor capabilities ranging from 20 to 1,500 litres. These facilities can be used to produce and purify substantial amounts of recombinant protein products for drug evaluation studies, and can offer scale-up and procurement of bioactive materials with full technology transfer to start up companies.

Transgenic Plant Centre:

The Plant Biotechnology Institute's Transgenic Plant Centre boasts 350 m^2 of laboratories and 550 m^2 of greenhouse space. The greenhouses, specifically designed for safe and secure propagation and assessment of experimental transgenic plants, are highly automated and integrated with on-site growth chambers offering a complete range of plant support systems. The facility was established as a national centre to facilitate routine, large scale evaluation of genetically engineered plants and expedite the flow of selected elite germplasm into commercially valuable strains. Centre users have access to the general expertise and facilities of the NRC staff and laboratories.

Astronomical and Astrophysical Facilities:

Under the NRC Act, the National Research Council is mandated to operate and administer astronomical observatories and other major scientific facilities. To fulfil this mandate, NRC operates and maintains facilities which allow the Canadian scientific community to conduct fundamental research in physics and astrophysics.

The major astrophysical scientific facilities managed by NRC are the observatories of the Herzberg Institute of Astrophysics: the **Dominion Radio Astrophysical Observatory** in Penticton, B.C., and the **Dominion Astrophysical Observatory** in Victoria, B.C. The observatories offer the Canadian and international astronomical community sophisticated facilities for collecting, analyzing and cataloguing astronomical data. The operation of these facilities includes the provision of operating personnel; data reduction services; advice on the design, implementation and interpretation of specialized experiments and tests; and the scheduling of experiments and tests. Maintenance by NRC includes routine servicing and repairs, as well as the introduction of updated electronic and mechanical hardware and occasionally the reconfiguration of major portions of the facilities.

Appendix 6 - *Description of NRC's Major Facilities*

NRC supports the operation of externally managed scientific facilities through annual financial contributions. These facilities are used by scientists from Canada and other countries to carry out fundamental research in physics and astrophysics. Dedicated managing organizations are charged with the operation and maintenance of these facilities. The major externally managed facilities are as follows:

Canada-France-Hawaii Telescope (CFHT):

Management of the 3.6 m diameter optical telescope is the responsibility of the CFHT Corporation. The corporation members share operating expenses and observation time on the telescope. Canada's 42.5% share of this observing time is allocated among astronomers through a peer review process. The annual reports of the CFHT Corporation provide specific details of the scientific activities at the facility.

James Clerk Maxwell Telescope (JCMT):

This 15 m radio telescope is the world's largest for studying sub-millimetre waves. It is located at the summit of Mauna Kea, close to the Canada-France-Hawaii Telescope. In 1987, NRC became involved in the Maxwell telescope operation. Under the terms of the agreement with corresponding agencies in the United Kingdom and the Netherlands, NRC repays 25% of the construction costs in ten annual instalments and pays 25% of the annual operating and development costs. In return, Canada is entitled to 25% of the available observing time, allocated through a peer review process, and nominates 25% of the members to the management board.

Britain's Particle Physics and Astronomy Research Council is responsible for the daily management of the facility through the agency of the Royal Observatories. Each partner maintains laboratories to participate in new technical developments funded through the development fund.

Tri-University Meson Facility (TRIUMF):

TRIUMF is Canada's largest single purpose facility for research in subatomic physics and related disciplines. The facility, located on the campus of the University of British Columbia, is owned and operated as a joint venture by the University of Alberta, Simon Fraser University, the University of Victoria and the University of British Columbia. In addition, the Universities of Manitoba, Montréal, Regina, and Toronto are associate members. TRIUMF is a world-class laboratory for intermediate energy particle physics, used by scientists from across Canada and around the globe. TRIUMF is also the focus of infrastructure support for Canadian activities at the forefront of high energy particle physics conducted at the European Laboratory for Nuclear Physics (CERN) in Geneva. In addition TRIUMF carries out auxiliary programs in materials science, life sciences, and medical therapy. TRIUMF has started a five-year project to construct an Isotope Accelerator called ISAC-1, that will consist of a separator and accelerator for radioactive isotopes allowing experiments with very short-lived atomic nuclei.

Appendix 6 - *Description of NRC's Major Facilities*

Currently, funds for the operation and maintenance of the facilities are provided by means of an annual contribution. NRC's funding has historically made up 80% of the centre's annual budget. Research activities are funded largely by granting agencies such as NSERC and to a lesser extent the Medical Research Council of Canada, and external supporters such as Atomic Energy of Canada Limited and the B.C. Cancer Foundation. Details are available in the TRIUMF annual report.

Wind Tunnels:

Wind tunnels of various sizes and operating speeds are used to study designs of new aircraft and components, carry out wind engineering studies on buildings and bridges and measure the wind drag of surface vehicles such as trucks and cars.

Airborne Facilities:

Several experimental aircraft are used to study and evaluate the performance of new aircraft designs, investigate hazardous aircraft operating conditions, study turbulence and other atmospheric conditions, conduct environmental research, develop aeromagnetic sensing techniques and test navigation systems and aircraft control devices.

Structural Test Facilities:

These facilities include mechanical and hydraulic test systems for static and dynamic testing of specimens, including complete aircraft or space structures. High and low energy impact facilities are used for investigations of impact, damage or tolerance of structures, while intense noise facilities are used to investigate acoustic fatigue or to perform acoustic qualification tests on aerospace equipment. A wide range of non-destructive inspection equipment is used to support this research and testing.

Vehicle Dynamics Facilities:

A number of facilities including a vibration facility, a vehicle squeeze frame, an impact test ramp, a tilt table and a C-Dolly facility are used to improve performance of railroad and highway transportation equipment and to reduce wear, damage to cargo and incidence of accidents.

Marine Dynamics Facilities:

These facilities in St. John's, Newfoundland include an ice tank, an offshore engineering basin with multi-segmented wavemaker, a cavitation tunnel, cold rooms and computer-controlled model making equipment. These facilities are used to conduct applied research to develop the technological basis for economic, effective and safe operations of ships,

offshore structures and associated systems for the Canadian ocean technology and marine industries and clients worldwide.

Appendix 6 - *Description of NRC's Major Facilities*

Gas Dynamics Experimental Facilities:

An air compressor and exhauster plant, combustion facilities and an altitude test chamber are used to study combustion phenomena and the flow of gases in gas turbine engines and other power plants, as well as in industrial processes.

Hydraulics Facilities:

A multidirectional wave basin and a coastal wave basin are two national facilities used to test models of engineering structures in simulated coastal water conditions, to study shoreline erosion and sedimentation, and to determine the effect of waves and currents on breakwaters and other harbour facilities.

Engine Test Facilities:

Two calibrated gas turbine test cells, an engine icing test cell, and an anechoic test cell are used in experiments to simulate flight conditions, to monitor and improve the performance of gas turbine aircraft engines and to measure thrust or torque, fuel consumption, the effect of icing clouds on inflight performance and operating noise levels.

Low Temperature Experimental Facilities:

A climatic engineering chamber and an icing wind tunnel are used to test transportation equipment, including aircraft components, under low temperature conditions and to test de-icing systems.

National Fire Laboratory:

A ten storey experimental tower, instrumented to accommodate smoke and fire studies in tall buildings, and its accompanying open Burn Hall, are used for contract and collaborative investigations that demand the use of realistic scale fires. Fire resistance of glass walls, flammability of exterior walls, room fires, tank car fires, firefighting foams, smoke control in highrise buildings and shipboard fires have all been recently studied with these facilities.

Appendix 7 - *NRC Performance Framework*

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 technology.

We will realize this vision 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;
- taking a more aggressive, entrepreneurial approach to ensure the transfer of our knowledge and technological achievements to Canadian-based firms

Resources		**Reach**	**Results**	
Activities	**Outputs**		**Immediate impacts**	**Long term impacts**
Innovation & application of technology Development of knowledge Innovation system support Management	· Projects · Products/ processes/ technologies · Advice/ assistance · Publications/ reports · Financial contributions · Communications · Core competencies · Management tools & systems	*Primary Target* · Canadian industry *Collaborators / intermediaries* · Provinces, Municipalities · OGDs · Service sector · Universities · Research organizations · Consortia	· Create technology opportunities for firms · Commitment to excellence in critical areas · Support for innovation, trade & regulatory systems · Client focus · Employee commitment · Aligned support & management systems · Entrepreneurship	· Increased competitiveness of Canadian firms · Increased investments in R&D in Canada · Leadership in the national innovation system · Improved trade climate for Canadian industry · Dynamic, entrepreneurial organization
Performance Indicators				
· Identification of key technologies, critical areas · Investments in key technologies, critical areas · Analysis of key firms by economic sector		· Clients & partners · Collaborations with key research organizations · Networks/ alliances in national innovation system × Networks in regions/ communities	· Technology transfer, spin-offs, start-ups, etc. · Income/in-kind contribution · Participation in S&T Fora · Diffusion of STI products & services · Participation in key trade & regulatory initiatives · Adoption/use of codes & measurements · Performance against service standards	· Investments by clients & partners · Economic performance of clients & partners · Acceptability of Canadian products & services · Client feedback · Employee feedback

Appendix 7 - *NRC Performance Framework*

Proposed Corporate Performance Indicators

Vision element	Performance indicator	Performance information
Innovation and application of technology		
Invest in key technologies, programs	Resources allocated to key technologies, programs	$ and py allocation by technology or program; new program areas; identification of key technologies
Attract key industry clients & partners	Clients & partners	Number & type of clients by economic sector; comparison to key firms in sectors; nature and extent of collaborations
Create technology opportunities for firms	Technology transfer to industry	Number & type of products, processes & services used by industry; licenses; spin-offs, start-ups; Client feedback
Increase investments in R&D in Canada	Income & in-kind contributions	Revenues, financial arrangements, partner contributions
	Investments by clients & partners	Client & partner investments in Canada (e.g. capital expenditures, technology acquisition, R&D personnel)
Increase competitiveness of Canadian firms	Economic performance of clients, partners	Industry partner sales, costs, market share, job creation, exports or import substitution, productivity; Client feedback
Development of knowledge		
Remain committed to excellence in critical areas	Investments in core competencies	$ and py allocated by core competency; benchmark of critical areas for investment of competencies; investment in new areas; $ and py allocated to development
	Ability to attract & retain quality people	New appointments, visiting scientists, guest workers, students, exchanges, turnover
Increase recognition of NRC expertise & excellence	Publications in top refereed journals	Number of publications in top refereed journals by research area
	Peer recognition	Number & type of awards & honors; Peer review
	Collaborations with key research organizations	Nature & extent of external research collaborations Partner feedback
Contribute to knowledge infrastructure	Investment in S&T infrastructure	Contributions to national and international S&T facilities
	Participation in international S&T	Nature & extent of international S&T linkages
Innovation system support		
Provide leadership in the innovation system	Networks with key stakeholders in innovation system	Nature & extent of NRC networks, alliances; comparison with key innovation system organizations
	Participation in S&T policy fora	Nature & extent of S&T policy committees or fora Stakeholder feedback
	Community innovation	Nature and extent of regional and community activities, collaborations, investments
Provide support for innovation, trade & regulatory systems	Diffusion of STI products & services	Sales, number & type of clients, products Number of requests for information
	Participation in key trade & regulatory initiatives	Nature & extent of committees or other international fora relating to trade & regulatory initiatives; Adoption & use of codes & guidelines; Stakeholder feedback
Improve trade climate for Canadian industry	Acceptability of Canadian products & services	Nature & extent of products accepted to international standards; of protocols, agreements on standards & measurements; Stakeholder feedback
Management		
Create a dynamic, entrepreneurial organization	Client focus	Client input mechanisms (e.g. advisory boards) Client feedback (repeat business, satisfaction)
	Employee commitment to Vision	Employee feedback
	Align support & management systems to Vision	Performance against service standards Cost & time savings; Stakeholder feedback
	Enrepreneurship initiatives	Number of business cases; spin-offs, start-ups