



National Research
Council Canada

Conseil national
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NRC - CNRC

Report on Plans and Priorities

National Research Council of Canada

1999-2000
Estimates

John Manley
Minister of Industry

Canada

Table of Contents

Section I: Messages

A. Minister's Message.....	1
B. Message from the Secretary of State	3
C. Management Representation Statement.....	4

Section II: NRC Overview

A. Mandate, Roles and Responsibilities.....	5
B. Objective	5
C. Operating Environment	5
D. Financial Spending Plan.....	7
E. Vision to 2001.....	8
F. Business Lines.....	8

Section III: Plans, Priorities, Strategies and Expected Results

A. Summary of Priorities and Expected Results	13
B. Details by Business Line	16
1. Research and Technology Innovation.....	16
2. Support for Innovation and the National Science and Technology Infrastructure	24
3. Program Management	29
C. Consolidated Reporting.....	34
Year 2000 Initiatives	34

Section IV: Supplementary Information

35

Section I: Messages

A. The Minister's Message

Our vision of Canada at the dawn of the new millennium is that of a strong and dynamic country poised to be a global leader in the knowledge-based economy of the 21st century. Canada continues to face the challenges of responding to the rapid pace of global change, and of harnessing the benefits of the knowledge-based economy for all Canadians. The government's goal is to create economic growth and more jobs for Canadians, in order to improve incomes and our standard of living.

Our standard of living depends directly on productivity, and improving productivity growth will be one of Canada's key challenges in the years ahead. The Industry Portfolio has a pivotal role to play in meeting this challenge. With 42 percent of federal science and technology funding and many of the government's micro-economic levers at its disposal, the Industry Portfolio has a unique capacity for innovation, research excellence, and partnership. The 13 Portfolio members bring together a versatile array of complementary programs to help improve Canadian productivity and competitiveness by focusing on such strategic priorities as promoting innovation through science and technology, helping small- and medium-sized enterprises to grow, encouraging trade and investment, and promoting economic growth in Canadian communities.

The Industry Portfolio is:

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

**Not required to submit Reports on Plans and Priorities*

I am pleased to present this Report on Plans and Priorities for the National Research Council Canada (NRC). This Report sets out for Canadians the planned activities, priorities and resources over the course of the next three years. As Canada's principal public sector research and development (R&D) agency, NRC: provides Canadians with underlying R&D infrastructure; performs internationally competitive research in areas of strategic importance; delivers national technological services; and supports knowledge networks that together form the foundation for a strong Canadian system of innovation.

We perform world-class, leading-edge R&D and ensure that our knowledge and technology are moved into the marketplace. In partnership with government, universities and industry, we are working hard to improve the productivity in emerging and established economic sectors through the adoption of new technologies, or the introduction of new products and

services. These plans illustrate how NRC, as a member of the Industry Portfolio, will contribute to improving Canada's competitiveness.

Canada is well equipped to be a leader in the knowledge-based economy of the 21st century. We have the people, the institutions and the research excellence. We have the vision to not only connect all Canadians, but also to connect them to the global marketplace. We know the challenges that we face and the opportunities afforded to us. By mobilising our resources, we can be a leader in the new economy. By working together, we can ensure continuing success as we embark on the new millennium.

The Honourable John Manley

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

Science, research and development are crucial to Canada because our economy - and the global economy - is changing rapidly. Our future success will be built on a virtually limitless resource: knowledge. Our ability to create future wealth will depend on the effective management of knowledge - the ability to create it, acquire it, disseminate it and exploit it. This ability forms the foundation of what is known as a knowledge-based economy.

Science, research and development are all about the search for knowledge - the discovery of new information and new understanding of how our world works. Knowledge is the key to improving the human condition and to improving our quality of life. Search for knowledge must be an ongoing process and a top priority in all sectors because of the potential applications in health and social sciences, education and the environment, business and the economy.

Canadians have worked together to build a society and an economy that are envied around the world. Canada is already a world leader in science, technology, research and development. Our challenge, indeed our opportunity, is to build on our co-operative links and partnerships with all sectors so that we are prepared for the new knowledge-based economy.

The government is committed to maintaining the high levels of success that Canada has attained in the past. We will accomplish this as a nation by continuing our investment in education and the discovery of knowledge and, by sharing, co-operating and working together to improve our economy and quality of life. By continuing to build stronger communities and, thereby, a stronger Canada, we will be able to compete in the new global economy.

Canada has unlimited potential to be a leader in the global knowledge-based economy. I am confident we will remain a strong and prosperous nation with enormous opportunities for all Canadians as we move into the new millennium.

The Honourable Ron J. Duhamel

MANAGEMENT REPRESENTATION

Report on Plans and Priorities 1999-2000

I submit, for tabling in Parliament, the 1999-2000 Report on Plans and Priorities (RPP) for the National Research Council Canada.

This information:

- accurately portrays the mandate, plans, priorities, strategies and expected key results;
- is consistent with the disclosure principles contained in the Guidelines for Preparing a Report on Plans and Priorities;
- is comprehensive and accurate;
- is based on sound underlying departmental information and management systems.

I am satisfied as to the quality assurance processes and procedures used for the RPP's production.

The planning and reporting structure on which this document is based has been approved by Treasury Board Ministers and is the basis for accountability for the results achieved with the resources and authorities provided.

Name: _____

Date: _____

Section II: NRC Overview

A. Mandate, Roles and Responsibilities

National Research Council Act

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

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

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

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

Weights and Measures Act

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

B. Objective

To enhance the national capability and to stimulate investment in research and development for the economic and social benefit of Canada.

C. Operating Environment

NRC’s environment is characterised by change. As the world continues to move into the information age, science, technology, industry and society find themselves increasingly interrelated. A perspective on this complex issue is found in the Organisation for Economic and Co-operative Development (OECD) *Science, Technology and Industry 1998 Outlook* which highlights changes in the economies of leading countries. This report characterises the world as one in which there is increasing globalisation of economies, where:

“Recent developments in science and technology are linked to rapid technological change, globalisation and change in the behaviour of firms.”

“The rapid pace of technological change is due to a productive science base and greater efficiency in the business sector.”

“OECD economies continue to shift towards knowledge-based industries.”

As Canada’s leading government research institution, NRC is becoming an agile organisation which can respond both to the rapid change which increasingly characterises its environment while at the same time retaining the strategic, longer-term perspective required by an institution of science whose forward looking responsibilities are sometimes measured in decades.

NRC has been a key player in the Industry Portfolio of thirteen federal departments and agencies. It chairs the Science and Technology Management Committee of the Industry Portfolio whose first work plan was approved by Portfolio Heads in the fall of 1998. NRC also participates in a broad range of inter-governmental activities, which include the provincial and municipal levels of government. It leads and supports interdepartmental committees and working groups, to provide them with the experience and perspective of Canada’s premier science agency.

Through its role as Canada’s national laboratory, NRC is a major contributor to Canada’s economic agenda. The organisation supports innovation in firms through many of its activities, programs, policies and linkages. As such it will continue to be a key player in the coming

years in helping Canada address one of its major economic challenges, namely, improving Canada’s long term productivity.

Public expectations from science remain high. This must be tempered with the knowledge that most advances in science are translated, slowly, into tangible benefits through private sector exploitation. This process, the commercialisation of science and technology, is fraught with risk. As the Canadian economy becomes increasingly globalised, it becomes vulnerable to impacts from outside its borders. The special problems of this commercialisation process, in the Canadian context, have figured prominently in the government’s policy agenda for well over a decade. Through a wide range of programs, policies, and research, NRC has been and continues to be a key player in addressing this key issue which is central to Canada’s success as a nation in the coming years.

Over the last decade, NRC has reinvented itself, emerging as a leaner, more strategically focused organisation. We are committed to capitalise on past successes and to make strategic investments in areas of science and technology that will expand Canada’s base of knowledge in critical areas. In this way, NRC will serve a multiplicity of constituencies, including the public and private sectors, technologically oriented firms, members of Canada’s scientific community and Canadians in general, as the beneficiaries of advances in science.

D. Financial Spending Plan

(\$ millions)	Forecast Spending 1998-1999 *	Planned Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002
Gross Program Spending	530.1	522.6	509.3	495.7
Less: Revenue Credited to the vote	-	-	-	-
Net Program Spending	530.1	522.6	509.3	495.7
Less: Spending of revenues pursuant to the NRC Act	50.1	51.4	53.4	57.2
Plus: Cost of Services Provided by other Departments	9.3	8.9	8.6	8.6
Net Cost of the Department	489.3	480.1	464.5	447.1

* Reflects best forecast of total planned spending to the end of the fiscal year.

Note: Due to rounding, figures may not add to total shown.

E. Vision to 2001

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

NRC's Vision:

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

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

F. Business Lines

NRC is classified as a departmental corporation under Schedule II of the *Financial Administration Act*. Under the *National Research Council Act*, the general orientation and establishment of NRC's policies and programs are the responsibility of a Council comprised of up to 22 members appointed by the

Governor in Council. Representing senior levels of Canadian industry and academic communities, Council members bring a broad range of knowledge and experience to the decision-making process. NRC's President acts as both Chairperson of the Council and as the Chief Executive Officer of the organisation.

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

1. Research and Technology Innovation

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

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

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

Biotechnologies

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

Information and Telecommunications Technologies

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

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

Manufacturing Technologies

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

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

Construction

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

Aerospace

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

Ocean Engineering and Marine Industries

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

Core Research

Finally, NRC provides critical support to key areas of research and technology development that underpin Canada's innovation systems. These include NRC's responsibilities for research in national measurement standards and supporting Canada's national measurement system, as well as its role in astronomical research and in managing national astronomical facilities. As an organisation with a mandate for research, NRC knows the importance of long-term strategic investments in leading-edge research, which is linked to Canada's technological and innovation needs. It recognises that incremental innovation is often based on transformational research and research methods. While all elements of the business line support these efforts, NRC has established a program with specific responsibilities for integrating its competencies in the area of molecular sciences.

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

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

The **Industrial Research Assistance Program (IRAP)** is well known for its successes over the years in helping

small- and medium-sized enterprises, (SMEs) develop and exploit technology. Founded on a national network of Industrial Technology Advisors (ITAs), IRAP contributes technical and financial assistance to help companies improve their technical knowledge and expertise to meet the challenges of a changing and competitive economy. IRAP extends the reach of its ITA network through collaborations with organisations in Canada's innovation system and by creating extensive linkages with other government departments and agencies, helping deliver their programs in some cases.

IRAP is also responsible for operating the **Canadian Technology Network (CTN)**. CTN is a national network of people who provide comprehensive, easily accessed, user friendly advice to SMEs that need technical and related business help.

The mission of the **Canada Institute for Scientific and Technical Information (CISTI)** is to provide world-wide scientific, technical and medical information to Canadian R&D performers and innovators to help achieve Canada's economic and social goals. CISTI plays an essential role in Canada's S&T infrastructure, supplying more than 25 products and services to over 20,000 clients across the nation, including delivering over 3,500 documents a day to clients. Also, through its Research Press, CISTI is Canada's largest publisher of scientific journals.

Through this business line, NRC also maintains three technology centres offering R&D and testing services to public and private sector organisations on a cost-recovery basis in the areas of hydraulics, surface transportation and thermal technology.

3. Program Management

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

The Program Management business line comprises two components:

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

Section III: Plans, Priorities, Strategies and Expected Results

A. Summary of Priorities and Expected Results

NRC has been an early adopter of the new federal approach to performance measurement, which has involved a significant shift from the traditional focus on activities, inputs and outputs to a new emphasis on applicable results and social and economic impacts.

Accordingly, NRC has developed performance indicators that highlight intended results, as demonstrated in the following table.

This approach is based on the four elements of NRC's Vision statement with each of NRC's business lines contributing in some way to one or more of the Vision elements.

<i>to provide Canadians with:</i>	<i>to be demonstrated by:</i>
A research program that focuses on excellence and knowledge, and that is relevant to Canadian needs	<ul style="list-style-type: none"> • Acceptance and use of NRC's research advances • Recognition of NRC's research excellence • Investment in and use of NRC's facilities • Highly qualified personnel
Economic growth by helping Canadian firms develop new, marketable technologies	<ul style="list-style-type: none"> • Partner involvement in research projects • Technical and commercial successes of firms that work with NRC • Client and partner satisfaction with NRC's services and support
Technology-based economic growth in communities across the country	<ul style="list-style-type: none"> • Results of regional initiatives • Use and impacts of codes and standards • Impacts of collaboration with government and industry • Influence of NRC's industrial support and information networks
Transfer of NRC's research successes to Canadian firms	<ul style="list-style-type: none"> • Number of technology and information transfers to firms • Results of patent and licence sales • Introduction of improved management tools and systems

Planning Overview 1999-2000 to 2001-2002

In 1996, NRC unveiled a five-year strategy, *Vision to 2001*, which recognised the potential to create high quality jobs and economic growth for Canada by promoting innovation and building strong high-tech regions.

Specifically, the *Vision to 2001* committed NRC to:

- strengthening its world-class research base;
- aggressively commercialising technologies and working in partnership with industry to improve productivity in emerging and established economic sectors;
- playing a greater role in innovation at the community and regional level; and
- providing national leadership in S&T.

With support from government, university and industry partners, NRC has taken action to meet these Vision commitments.

- NRC has developed focused, forefront research programs in biotechnology, telecommunications, information technology, manufacturing technologies, aerospace research, and other technologies producing breakthroughs identified as key to Canada's future as a knowledge-based economy.
- NRC's Industrial Research Assistance Program, Canada Institute for Scientific and Technical Information, and other

services have strengthened technology commercialisation and diffusion, built links to industry across the country, and contributed to the Vision of NRC as an innovation leader.

- NRC has become a national advocate for strategic research and regional innovation as illustrated by new facilities, offices, and programs in Vancouver, Edmonton, Calgary, London, Ottawa, and Montreal, and collaborative innovation strategies in these and many other regions.

The solid support of industry leaders and partners for these and other achievements tell NRC that it is on the right track.

Challenges

As NRC prepares to enter the 21st century, it sees exciting opportunities to enhance its contributions to Canada's knowledge economy through: establishing new research and innovation networks and research platforms; adding value to the government's connectedness agenda; stronger agility and partnerships in regional innovation initiatives; renewing critical elements of Canada's science and engineering facility infrastructure.

To move forward, NRC recognises that it must take action to renew its research base. NRC's unique ability to promote technology collaborations, provide the underlying R&D infrastructure to link Canada and its regions to international R&D, and to deliver national technology services rests on its credibility and capacity as a performer of medium- and long-term strategic research. To sustain this capacity, NRC must address key challenges:

- Like many organisations, NRC has operated in an environment of reduced resources in recent years. This has increased the pressure to perform more short-term contract R & D in some program areas, resulting in a shift of resources away from crucial longer-term research.
- It is becoming increasingly challenging to attract and retain high quality staff in the face of growing international competition for top researchers.
- NRC's drive to support Canada's national system of innovation has resource and program implications for virtually all of NRC's institutes, centres and programs.
- In addition to meeting the demands of the many new research partnerships developed under the Vision, NRC must respond to strategic research issues critical to Canada's emerging knowledge-based economy.
- renewing major scientific and engineering facilities and associated equipment in research centres serving industrial sectors and the scientific community across Canada;
- developing strategic initiatives to respond to important national issues such as: the state of Canada's aerospace research infrastructure; long-term opportunities in genomics science; the need for national optoelectronics facilities to serve researchers and enhance the productivity of high tech SMEs; the potential of new environmental technologies such as fuel cells; and the need to enhance the national S&T information infrastructure;
- enhancing efforts to improve the competitive position of traditional resource-based industries through effective integration of innovative technologies;
- providing new services and facilities to promote regional innovation that capitalise on links between NRC's Industrial Research Assistance Program and Canada Institute for Scientific and Technical Information and national R&D resources; and,
- enhancing training activities in support of research programs and regional partnerships.

Planning Priorities

Over the planning period, NRC will complete the second phase of its *Vision to 2001*, building on the accomplishments of the first three years. However, this will ultimately depend on NRC's ability to secure the necessary resources to renew its research program. With resources, NRC will complete phase II of its Vision and contribute to the productivity of Canada by:

- providing a solid research foundation upon which technological advances in strategic R&D can be based;

The coming three-year planning period is a crossroads for NRC. The above noted plans, programs, strategic thrusts and regional partnerships will lay the groundwork for the next five year plan, to be launched in 2001.

B. Business Line Plans

1. Research and Technology Innovation Business Line

(\$ millions)	Forecast Spending 1998-1999	Planned Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002
Net Business Line Spending:				
Research and Technology Innovation	306.0	291.5	277.0	278.1

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

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

Key Plans and Strategies

The Research and Technology Innovation business line contributes to and will be measured against each of the elements of NRC's Key Results Commitments, namely to provide Canadians with:

- *a research program that focuses on excellence and knowledge, and that is relevant to Canadian needs;*
- *economic growth by helping Canadian firms develop new, marketable technologies;*
- *technology-based economic growth in communities across the country; and*
- *transfer of NRC's research successes to Canadian firms.*

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

Biotechnologies

NRC's Biotechnology Group helps to bring biotechnology-related products and processes to the market for the benefit of Canadians. The Group is the steward of Canada's single largest investment in biotechnology with five research institutes located across the country: Institute for Marine Biosciences (Halifax), Biotechnology Research Institute (Montreal), Institute for

Biological Sciences (Ottawa), Institute for Biodiagnostics (Winnipeg) and Plant Biotechnology Institute (Saskatoon).

To maintain research leadership and to ensure that it continues to work productively with the Canadian biotechnology industry, the Group has developed a strategic plan for 1998-2003 that articulates a vision to be an engine for biotechnology development, wealth creation, economic growth and competitiveness, helping Canadian-based firms develop and exploit key technologies.

A critical success factor for the Group will be the extent to which it maintains technological leadership in emerging fields that can be exploited by Canadian firms. The Group has identified bioinformatics and genomics as initial areas of investment.

NRC's capability in bioinformatics – the use of computers to acquire, store, analyse and manipulate vast amounts of genetic and biomedical data – was strengthened with the official launch in February 1999 of the Canadian Bioinformatics Resource (CBR). NRC is making this resource, the largest DNA sequence retrieval system in North America, available to researchers across Canada through an internet-accessible package of biotechnology databases and software tools. In addition to advancing scientists' ability to analyse increasing amounts of genomic and DNA sequence information, the CBR will also help to address the shortage of skilled bioinformatics practitioners by providing the needed infrastructure to support education in this area.

NRC has also been a partner with other government departments in the development of a proposed national initiative in genome sciences which, like

bioinformatics, was identified by the new Canadian Biotechnology Strategy as an area with enormous potential for many fields of life sciences, such as human disease, agriculture and fisheries.

Meeting Canada's Needs for Highly Qualified People

One of the most successful outcomes of NRC's regional innovation efforts has been the creation of the O-Vitesse program in the National Capital Region to re-skill scientists and engineers as software engineers. An intensive, 16-month program involving alternating study and work terms at participating local universities and companies, O-Vitesse has accepted 70 students in two years.

Based on this success, NRC, Carleton University and the University of Ottawa have formed a new, not-for-profit company, Vitesse (Re-Skilling) Canada, to expand the program nationally and to adapt it to other sectors facing human resource shortages, such as bioinformatics. It is expected that enrolment will increase to 150 students within two years.

Manufacturing

NRC's Manufacturing Technologies Group consists of the Industrial Materials Institute in Boucherville, Québec, the Institute for Chemical Process and Environmental Technology in Ottawa and the Integrated Manufacturing Technologies Institute in London, Ontario and Vancouver.

Over the past two years, the Group has made considerable progress toward the objective of responding to the strategic innovation needs of Canadian industry in manufacturing technologies. It has been able to bring NRC's capabilities to bear on collaborative research projects in a wide range of industries with a particular emphasis on highly innovative SMEs.

The Group will complete a review of the strategic plan in 1999-2000. This process will involve widespread consultations with industry on the strategic needs and priorities for Canadian manufacturers in the coming decade. The input from those consultations will be used to outline a research and innovation support agenda for NRC's Manufacturing Technologies Program for the next five to ten years.

Information and Telecommunications Technologies

NRC's Information and Telecommunications Group includes two Ottawa-based institutes: the Institute for Information Technology (IIT), which works in the area of software and selected systems demonstrations, and the Institute for Microstructural Sciences (IMS), which concentrates on the development of hardware components and proof-of-concept demonstrations.

The Group has recently formed an Advisory Board that will comprise members from industry, government and universities to provide guidance on overall strategic directions and program planning.

A major planning initiative under development is a proposal to build an optoelectronics facility to serve the needs of Canadian SMEs. Such a facility, which would allow Canadian firms to create and test prototype devices, does not exist in Canada. IMS is currently investigating the potential to secure the necessary resources and partner commitments to move forward on this project.

The Group has helped develop several NRC regional initiatives in recent years, and has been particularly responsive to the local innovation needs in the

National Capital Region. For example, in late 1998, NRC opened a \$6.4 million Industry Partnership Facility linked to the Group's Ottawa premises. Similar to one attached to NRC's Biotechnology Research Institute in Montreal, the 3,200 m² facility will act as an "incubator" for up to 15 start-up companies by providing them with access to leading-edge equipment, flexible laboratory and office space, as well as access to nearly 350 experts in IIT and IMS. The laboratory and office space will be rented to companies working in collaboration with NRC institutes, and a wide range of NRC services will be available on a cost-recovery basis.

Construction

NRC's Institute for Research in Construction (IRC) is Canada's construction technology centre. As an integral part of its activities, IRC maintains links across the country and internationally with a variety of companies, governments and associations.

In its new strategic plan (1999-2004) IRC has identified key initiatives that will reinforce its role as a technology leader and broker in the construction sector. Among them, IRC will complete construction of the Canadian Centre for Housing Technology, a three-building facility designed to accelerate the development of innovative products and construction techniques and promote Canadian housing technology to the export market.

In addition, IRC is working with municipalities from across the country to develop Canada's first urban infrastructure best practices guide. The goal is to improve the productivity of municipal infrastructures through the development of technologies for the design, construction, operation, and

maintenance of buried services and surface structures.

IRC is also leading the effort to transform Canada's construction codes into objective-based codes, a change that will facilitate the introduction of innovative products and systems as well as enhance the industry's global trading position.

Aerospace

NRC's Institute for Aerospace Research (IAR) is Canada's national centre of excellence in the aeronautical sciences. It maintains and develops major national facilities to support R&D in design, manufacture and performance assessment of aeronautical vehicles.

In 1997-98, IAR underwent an assessment of its activities. In response to the assessment findings, IAR has developed a strategic plan (1999-2004) that will lead to an overall strengthening of basic and strategic research within the institute, while also maintaining a good level of revenue generation and direct support to industry.

IAR's plans include a proposal to develop new facilities for research on gas turbine engines and on advanced manufacturing processes for aerospace components. This proposed initiative would provide significant benefits for operators and manufacturers, as well as create new opportunities for SMEs that act as third tier suppliers of new products and technologies.

IAR is also working with the Aerospace Industries Association of Canada on an initiative to improve the co-ordination of public and private sector aeronautical research in Canada, and to act as a catalyst and facilitator for multi-client, pre-competitive research.

Helping Canadian Firms Meet Their Environmental Responsibilities

There is an increasing emphasis on the management of environmental issues in the innovation process as a result of government regulations and commitments to international agreements such as the Kyoto Protocol. Dealing positively with environmental stewardship is becoming a critical factor for Canadian firms in remaining competitive.

With research expertise in areas such as groundwater cleanup, soil remediation, pollution prevention and building energy efficiency, and technology assistance to SMEs through its Industrial Research Assistance Program, NRC is active on a number of fronts to help industry meet its environmental responsibilities. The following are key activities NRC will pursue over the planning period:

NRC will complete its efforts to establish a cross-cutting environmental research office to facilitate the mobilisation of its research capability to develop technologies relevant to environmental issues. In addition, the office will establish a competency in computer-based tools to aid in the innovation and design of more sustainable or cleaner technologies. Such tools will incorporate the need to characterise the systemic impacts of technologies. These methods are intended to support the ISO-14000 standard (the international standard for environmental management systems), and related voluntary initiatives undertaken by the private sector for environmental and sustainable development stewardship. The office will also provide other departments and agencies with research and technology information and analysis.

NRC will continue to work with other key departments, including Natural Resources Canada and Environment Canada, in the federal government's Climate Change initiative. In addition to participating in several important Climate Change Issues Tables, NRC will undertake these supportive innovation initiatives:

- *A biotechnology initiative intended to respond to the high expectations of the role of biotechnology in meeting Canada's longer-term climate change responsibilities;*
- *A cleaner manufacturing program aimed particularly at developing software tools which combine a reduced "time to market" for product and process innovation with a reduced environmental "foot-print". This will include integrating such concepts as life-cycle assessment into the design and development protocols.*
- *Systems analysis of technological innovation to determine the "climate change" and "sustainability" characteristics of technologies and to aid in identifying those enabling technologies that will have the greatest impact. It will also help to define the innovation framework necessary to provoke greater private sector investment in such technological development.*

As a result of these initiatives and those undertaken by IRAP, NRC expects to be better positioned to respond to the competitive imperatives faced by Canadian industry to the "greening" of market opportunities on a global scale.

Ocean Engineering and Marine Industries

NRC's Institute for Marine Dynamics (IMD), located in St. John's, Newfoundland, is Canada's primary technology centre for ocean technology research and development.

IMD will undergo a full-scale assessment in 1999-2000 that will help the institute complete a five-year plan to build upon its excellent infrastructure and expertise in ocean engineering.

Recently, IMD has been working with industry partners such as Petro-Canada, Mobil Oil Canada Properties, and the Panel on Energy Research and Development to investigate the hydrodynamics of bergy bits (small pieces of sea ice) interacting with vessels. The information gathered during the three-year project will be of considerable benefit to Canadian offshore oil and gas operations.

IMD has formed an alliance with Memorial University and a local SME to build a globally competitive commercial enterprise in marine systems performance evaluation based on the capabilities of the partners and their experience in the marketplace. With a planned growth of business to three times current levels, significant job growth in the region is expected.

Core Research

NRC's Herzberg Institute of Astrophysics (HIA) has the mandate to operate astronomical observatories of the Government of Canada, and to ensure that the Canadian scientific community has access to some of the best astronomical facilities in the world. HIA has achieved this through two domestic facilities (the Dominion Astrophysical Observatory in Victoria, B.C., and the Dominion Radio Astrophysical Observatory in Penticton,

B.C.), and access to several multinational facilities (the Canada-France-Hawaii Telescope, the James Clerk Maxwell Telescope, and the Gemini telescopes under construction in Hawaii and Chile). HIA also maintains the Canadian Astronomy Data Centre, which provides access to astronomy data from other telescopes (e.g., the Hubble Space Telescope).

During 1998-99, HIA underwent a thorough assessment of its facilities, research, and instrumentation development activities. The assessment concluded that HIA's domestic facilities remain useful for training and as test beds for instruments being developed for international facilities. Its international facilities are some of the best in the world, due in part to the excellence of HIA's instrumentation development capabilities. In the areas of adaptive optics and data archiving and management, HIA is recognised as the world leader.

In consultation with the Canadian astronomy community that it serves, HIA is now developing a long-term strategic plan to guide the Institute over the next 10-15 years. This Plan will address recommendations presented in the assessment report, including the identification of appropriate roles for the aging domestic facilities in light of the necessity of continuing HIA's strong international participation, and maintaining HIA's outstanding scientific and engineering expertise. In addition, the Plan will clarify the nature of Canada's participation in the next large international radio telescope project.

The Tri-University Meson Facility (TRIUMF), located on the campus of the University of British Columbia, is Canada's national laboratory for research in particle and nuclear physics. It is managed as a joint venture by a consortium of four universities (Alberta, British Columbia, Victoria and Simon Fraser) and operated under a contribution from the Government of Canada through NRC.

NRC is one of Canada's most effective links to other national research and development bodies around the world. Through its international activities, NRC keeps abreast of S&T developments in other countries, establishes beneficial collaborations with leading research and development organisations, and safeguards Canada's interests in crucial areas such as measurement standards. NRC also introduces Canadian companies to the global marketplace and helps identify opportunities to build industrial linkages and attract foreign investment to Canada.

For the most part, initiatives with the United States and European countries are directly tied to research activities and usually involve researcher-to-researcher interaction. NRC has a long history of international collaboration with these countries and will continue to cultivate its strong S&T networks. NRC has also made a concerted effort in recent years to strengthen linkages with organisations in Asia. As a result, NRC now has an increased profile, strong networks and a variety of collaborative projects in several Asian countries. NRC will continue to build on these initiatives and investigate opportunities that arise as China opens its doors to foreign markets.

Under its current five-year plan (1995-2000), TRIUMF has developed into an internationally recognised laboratory with two high-priority world-class activities: ISAC-1 (isotope separator and accelerator) and collaboration with the European Centre for Nuclear Research (CERN) in Switzerland.

TRIUMF's current five-year funding will end on 31 March 2000. To provide a basis for consideration of a renewal of its funding, TRIUMF has developed a proposed plan for the next five-year period (2000-2005). NRC has completed a peer review of TRIUMF to examine its current activities as well as review its 2000-2005 plan. The intent is to build upon TRIUMF's recent achievements with a program that is realisable, thereby ensuring the best possible future for particle and nuclear physics in Canada.

The Steacie Institute for Molecular Sciences (SIMS) undertakes research in areas of molecular sciences underpinning specific sectors of the Canadian economy. As such, it plays a key partner role with other NRC institutes in identifying and forging new strategic research programs. By employing such tools as technology forecasting to project the intersection of future market needs with new technical capabilities, SIMS, along with other research institutes, CISTI and IRAP have been investigating potential opportunities in areas such as neutron beam research, molecular electronics and high performance computing.

The Institute for National Measurement Standards (INMS) serves as the primary centre of reference for the accuracy, validity and traceability of physical measurements and appropriate chemical measurements. INMS has established a network of national and international linkages in the measurement standard field, which play an important role in ensuring global trade penetration for Canadian industries.

In 1999-2000, NRC will complete an assessment and strategic planning exercise for INMS. The exercise will include: a study of the socio-economic benefits of the institute; a peer review that will look at continued relevance of the research; and the benchmarking of specific processes against similar international organisations.

Ensuring Relevance and Excellence

NRC will continue to evaluate its progress on an ongoing basis as part of its regular assessment schedule. Over the next three years, NRC expects to conduct assessments of its Manufacturing Technologies Group, the Biotechnology Group, the Information and Telecommunications Group, the Steacie Institute for Molecular Sciences and the Institute for Marine Dynamics.

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

(\$ millions)	Forecast Spending 1998-1999	Planned Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002
Net Business Line Spending:				
Support for Innovation and the National Science and Technology Infrastructure	167.2	172.7	174.9	160.1

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

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

Comprised of the Industrial Research Assistance Program, the Canada Institute for Scientific and Technical Information, and the Technology Centres, the business line offers a unique range of services and products that are intended to contribute to the economic viability of knowledge-based companies and to the progress of other research organisations.

Key Plans and Strategies

This business line contributes primarily to NRC's commitment to provide Canadians with:

- *economic growth by helping Canadian firms develop new, marketable technologies*
- *technology-based economic growth in communities across the country*

The Industrial Research Assistance Program

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

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

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

In its Strategic Plan (1996-2001), IRAP pledged to deliver its core services, including providing technical advice, financial assistance and access to relevant resources to stimulate the innovative capabilities of Canadian SMEs. This includes the delivery of the Canadian Technology Network (CTN) in accordance with its original mandate, namely to provide networking support, co-ordination and communication infrastructure to organisations delivering innovation-related information and services to SMEs in Canada.

IRAP has identified information management, program delivery, human resources, and partnerships and collaborations as key areas for action under its Plan.

In addition, in response to new funding received in the February 1998 Budget, IRAP will focus on two new mandate areas: fully implementing its pre-commercialisation assistance initiative and integrating sustainable development.

Pre-commercialisation Assistance

Through IRAP and Technology Partnerships Canada (TPC), pre-commercialisation assistance provides SMEs with access to repayable contributions that can be used to support later-stage development. The total budget for this initiative will be \$30 million per year over the next five years. This new initiative is designed to help SMEs develop new or significantly improved technological products, processes or services from proof-of-concept to first sale. This will result in much needed support to the SME sector in the high-risk undertaking of bringing new concepts to market.

Sustainable Development

Sustainable development is meeting today's environmental, social and economic needs without limiting the ability of future generations to meet their needs. At the level of the SME, sustainable development requires a foresight gained from strategic analysis and planning. In return, it offers the SME a creative perspective of how to innovate and lay the foundations for sustained economic growth over the years. IRAP recognises the important role it can play in fostering the practice of sustainable development within SMEs and has launched an action plan to this effect.

A training session for all IRAP Industrial Technology Advisors in May 1999 will highlight a systematic approach to help SMEs apply Design for Environment — the integration of environmental concerns into the design of products and processes. IRAP will be building on the EcoDesign tool, developed in the Netherlands and now promoted by the United Nations.

IRAP is strengthening the network's access to expertise in sustainable development. New Industrial Technology Advisors are being hired with specialised expertise. Tools are being adapted to allow SMEs to take concrete action in minimising materials and energy use, in preventing pollution, and in developing more functional products.

IRAP is working with the Ontario Centre for Environmental Technology Advancement (OCETA) to pilot a project that starts with a diagnostic audit of an SME's industrial operations. This audit is to identify opportunities to improve energy and materials efficiency (and the cost effectiveness) of the operations. The conversion of the audit information into concrete action will be enhanced by ITAs who will help put the opportunities into a business and innovation framework. They will help assess if IRAP funding for an innovative project would be appropriate or whether a good payback can be achieved through a more straightforward engineering project. In the latter case, an arrangement with an investment firm is to be made to facilitate access to the financing needed. IRAP is working on this initiative with the support of Technology Early Action Measures (TEAM), a part of the government's Climate Change Initiative, as SME efficiency measures should translate into greenhouse gas reductions in Canada.

These initiatives and the others that IRAP will be undertaking will all seek SME buy-in by emphasising the advantages that they can realise from sustainable development practices. Through success stories in applying sustainable development, IRAP will show how the SMEs can achieve lower production costs, improved market access, increased attractiveness to

investors and enhanced strategic planning for sustained economic growth.

The Canada Institute for Scientific and Technical Information

The Canada Institute for Scientific and Technical Information (CISTI) plays an essential role in providing researchers across the country with scientific, technical and medical (STM) information. CISTI is a world leader in technical library services, and is also Canada's largest publisher of scientific journals. It holds one of the largest STM information collections anywhere and disseminates this information through a state of the art document delivery system.

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

Expanded document delivery services

Document Delivery, one of CISTI's two principal business lines, has grown at an exceptional rate in the past several years. This growth is expected to continue over the next three years. In addition to continuing growth in the US, markets in Australia and the Far East are expected to expand as a result of increased marketing activity in those regions.

Clients will have improved means of accessing CISTI's information resources through CISTI Source, the new integrated and enhanced Current Awareness service, that will include full coverage of CISTI's collection, web-based tables of contents, abstracts, and integrated full text with client-initiated subject

profiles, searching, and document delivery. The resources offered to our clients will also expand with the integration of electronic publications into the Document Delivery system.

Information Services to targeted industrial sectors

Building on the success of the "Virtual Library" for NRC staff, CISTI is embarking on a program to develop similar information services to meet the needs of specific industrial sectors. The first BiblioNet, designed to serve the information technology and telecommunications industry, was launched in January 1999. This one-stop web-based research tool brings together world-wide information resources and makes them available to registered users. Future BiblioNets are envisioned as forming part of CISTI's proposed initiative to create a "Scientific Knowledge Network," a national scientific, technical, and medical information network for Canada.

Scientific Publishing

The NRC Research Press continues to enhance its support to scientific publishing. Across Canada, scientific editors, located mainly in universities, oversee the peer review process, which evaluates the scientific value of papers submitted to the NRC Research Press for publication. To facilitate this process, a fully automated, web-based manuscript submission and review system will be developed. This advance will reduce costs and improve efficiency. The prototype will be implemented this year.

As part of the continuing development of its capabilities in electronic publishing, the NRC Research Press will further automate its internal production processes to generate fully Standard Generalised Mark-up Language/Extensible Mark-up Language (SGML/XML) tagged documents. This conversion will facilitate future developments in the areas of electronic linking to related publications and the inclusion of non-text or graphic material, i.e., video clips, sound, or interactive mathematics or graphics, in NRC Research Press documents accessed through the web.

Improved Client Services

CISTI is constantly striving to provide better service to its clients. To reduce delays in providing new clients with access to CISTI's services, an e-commerce application with an online registration function will be developed. Clients will receive their account number and password immediately when they use this improved registration method. Clients who wish to make a one-time order from Document Delivery will also be able to do so through a secure web interface using their credit card.

CISTI will continue to improve its web presence. Implementation of a three-tiered centralised client support service for CISTI products, managed by Help Desk software, will ensure improved standards of consistency, speed, and quality of assistance provided. In response to client requests, CISTI will also provide electronic access to

reporting for clients who wish to review information on their account status and usage of CISTI services.

Expansion of regional presence

As the NRC commitment to regional service delivery in support of the Canadian innovation system expands, the role of CISTI, the premier national STM information provider, is ever more critical. CISTI will continue to expand its regional presence to the limits of its budget ability, adding Vancouver in 1999 and other cities as resources permit.

Technology Forecasting

Working with NRC's research institutes and IRAP, CISTI will establish a technology forecasting capability to further improve NRC's ability to choose promising lines of research, development, and partnership. The same expertise will be developed further to enable small and medium-sized enterprises in Canada to profit from enhanced competitive technical intelligence. The IRAP, CTN, and NRC Information Centre networks across the country will be used to promote and deliver the service.

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

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

Technology Centres

NRC operates three technology centres: the Canadian Hydraulics Centre, the Centre for Surface Transportation Technology and the Thermal Technology Centre. These centres, each with a small contingent of staff, offer specialised testing and other engineering-oriented services to clients on a cost-recovery basis. While not part of NRC's core activities, the technology centres provide unique engineering facilities and services to Canadian industry.

The centres operate primarily on the revenues they generate, using those funds to cover salaries, benefits, operating and capital expenditures. NRC provides infrastructural support to the centres.

The centres have refined their operations and their objectives over the first three years of their existence. NRC will continue to monitor their progress with a view to ensuring they exist within optimal operating arrangements.

3. Program Management Business Line

(\$ millions)	Forecast Spending 1998-1999	Planned Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002
Net Business Line Spending:				
Program Management	56.9	58.3	57.4	57.5

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

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

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

Key Plans and Strategies

By spearheading the introduction of improved management policies, tools and procedures, the Program Management business line supports and will be measured by NRC's success in becoming a more entrepreneurial and business-like organisation.

Human Resources Management

NRC will complete a major review of its people management practices in time for the launch of NRC's next long range plan in 2001. The key objectives will be:

- recruitment of the "best of the best"
- achievement of a highly committed work force

- achievement of a high productivity work force; and,
- achievement of a change-ready work force via the constant growth of intellectual capital.

It is within the context of this new strategy that NRC will address its key human resource management issues, including:

- increased labour market competition for outstanding researchers;
- retention of a highly committed and productive workforce;
- compensation systems that encourage and reward both productivity and personal growth;
- strategic human resource support services for local managers; and
- meeting NRC's Employment Equity and Official Languages targets, especially for the Management Category.

From this major undertaking, NRC expects the following outcomes:

- enhanced managerial accountability for high quality people management, including measurement of

management and leadership behaviour against pre-determined competency profiles and outcomes (360° performance planning and review approach);

- development of a human resources services organisation focused on the provision of strategic as well as transactional assistance to managers at the local level. The benefits will be increased organisational productivity, employee commitment and growth of NRC's intellectual capital;
- greater attention by managers to the softer side of human resources management in terms of what it means to be an "employer of choice" and what it takes to attract and retain a committed work force;
- new or revised human resources management tools and processes, including:
 - a greatly enhanced web-based recruitment program focused on Canadian university and community college students and staff, including related Employment Equity target group programs;
 - implementation of modern career development and leadership/management development policies and programs;
 - implementation of an enhanced manager/leader selection program;
 - revision of compensation policies and programs to link them not only to the work to be performed (universal classification system approach), but also to the development of the employee in the job (competency/state of professional development), and to the employee's performance; and,
 - development of competency profiles, aligned to NRC's Vision and values covering all NRC positions; and, use of these for selection, performance management, career planning, succession planning, and training and development programs;
 - implementation of an accelerated program of language training focused on fully meeting NRC's Official Language targets by the year 2000.

In measuring its progress towards these objectives, NRC will use as an input, Treasury Board's "Framework for Good Human Resources Management in the Public Service".

Entrepreneurship Program

NRC's Corporate Services Branch introduced its Entrepreneurship Program a few years ago to maximise opportunities for the transfer of NRC knowledge to private firms and, in some cases, the creation of spin-off companies based on NRC technologies. Over the planning period, NRC expects an enhanced number of spin-offs – likely almost a dozen a year. This increased number is predicted as a result of the strengthened support measures NRC has put into place. These include existing alliances with the Business Development Bank of Canada and the Canadian Science and Technology Growth Fund, as well as a recently signed agreement with Montreal-based Inno-Centre, an organisation with a proven track record in launching and nurturing technology-based spin-offs. This agreement gives NRC easier access to the management, financial, and operational expertise that are key ingredients for successful start-ups.

Over the same period, NRC will continue with its successful training programs for business development staff aimed at enhancing their understanding of commercialisation issues. One popular program for budding entrepreneurs, *Creating a Technology-based Business*, will be re-offered at least yearly. Because of the strong demand, NRC has opened many of these courses to staff of other government departments.

New training initiatives targeted on the special commercialisation needs of its scientific staff will also be launched across Canada.

NRC's new awards and incentives programs, such as the Industrial Partnership Award and the Inventor and Innovator Award Program, will be promoted even more vigorously as will programs offering industrial secondments and internal NRC assignments. Other tools that enhance successful technology exploitation and the more strategic management of intellectual property, such as technology evaluation and technology valuation, will also be implemented across the organisation.

Information Management Services

NRC has put in place a SAP-based system, known as Sigma that will fully integrate NRC's financial, material management, human resources, and project management systems. Phase 1 of Sigma (finance and material management) has been implemented, with the remaining modules scheduled for 1 April 1999. A Sigma team consisting of 12 NRC personnel and 12 employees of the consulting firm CGI has been created within the recently established Information Management Services Branch (IMSB). This team will provide system administration services, user support, training, and on-going development and enhancement of the system.

In the latter part of 1999-00, the Sigma team will turn its attention to investigating the opportunities for business process re-engineering that are made possible by the introduction of an integrated system such as Sigma. It is expected that capitalising on such

opportunities will allow NRC to improve the productivity of its employees both with respect to the efficiency of administrative processes and in the delivery of services to NRC's external clients.

Over the past several years, NRC has invested heavily in a structured data network infrastructure which is necessary for the rapid movement of large data sets normally associated with scientific and engineering research activities. With the bulk of this infrastructure now in place, IMSB will turn its attention to the evaluation and acquisition of network management tools which will allow for proactive monitoring of network performance, analysis of network traffic patterns, and fine-tuning of the overall network architecture. These measures will improve NRC's ability to move and share large volumes of data within the organisation and with its clients and collaborators, and to acquire data more effectively from external sources around the world.

In 1998-99, IMSB created an IT Security Office with responsibility for overall security architecture planning, and the development and compliance monitoring of IT security policies and standards. An IT security vulnerability assessment has been undertaken and, during 1999-00, additional IT security positions will be staffed. The Branch will also evaluate and deploy IT security measures such as firewalls, data encryption, and network intrusion devices. These steps will protect the ever-increasing use of networked computers by NRC's researchers.

Administrative Services and Property Management

The Administrative Services and Property Management (ASPM) Branch will continue to aggressively pursue opportunities to reduce water, electricity and fuel costs through conservation measures, exploitation of off-peak pricing structures, and more efficient use of energy. Innovations to reduce utility costs for Ottawa-area facilities have already resulted in substantial savings in the past few years. These innovations are now being implemented at research institutes outside the National Capital Region, with the expectation that, by the year 2002, NRC will realise a total reduction in utility costs of \$1.5 million.

NRC has initiated a program requiring all of its research institutes to conduct risk assessments of their facilities and a revision of their contingency plans in order to ensure that adequate precautions are in place to protect personnel and property. The increase in the number and diversity of NRC clients and partners and the associated security issues requires a fresh look at this issue. ASPM has launched an implementation plan that anticipates completion of the assessments and contemporary contingency arrangements for all facilities by 2002.

Although not subject to the Sustainable Development Strategy provisions of the Auditor General Act, NRC has implemented an environmental management program for its facilities that are located in 10 urban centres and in seven different provincial jurisdictions. ASPM has initiated a series of compliance audits conducted by independent contractors to ensure that the related disciplines of energy conservation, emergency preparedness, workplace safety, and environmental compliance are practised. It is anticipated that the audits for all research institutes will be completed by 2002.

ASPM's Conference Services (CSO) provides professional services to NRC researchers in organising national and international scientific conferences and business meetings. CSO manages an average of 10 to 15 conferences annually, on a cost recovery basis. To capitalise on this specialised expertise, CSO has begun to provide services to outside scientific groups holding conferences in Canada, and has recently secured the 12th International Congress of Immunology, to be held in Montreal in 2004. CSO's support of such national and international meetings provides positive exposure to the NRC.

Celebrating the Millennium

NRC sees the arrival of the new millennium to be an opportune time to celebrate Canadian history and to look to the future. As an organisation with an important role in the achievements of the past and the vision for Canada's future, NRC intends to work with its partners to highlight science and technology within the millennium celebrations.

In particular, there are two special opportunities NRC will be pursuing:

The Millennium Conference on Creativity

In June 2000, at the first gathering of its kind, NRC, and its partners, including the National Arts Centre (NAC), will explore the elements of creativity and their interrelationships through a set of targeted conferences, symposia, and artistic performances with special emphasis on features of the creative process shared by the arts and sciences. The symposia will include a look at the future of science and technology and developments in brain research.

Time Science and the Atomic Clock

In the countdown to the year 2000, NRC will exploit every appropriate opportunity to highlight Canada's role in developing international time standards and precision measurements as a public awareness and science promotion focus for the 1999-2000 period. Specific initiatives will include the development of a special countdown clock and communications materials.

C. Consolidated Reporting

Year 2000 Initiatives

NRC is well on its way to Year 2000 readiness. To date, NRC has created a Core Group of senior managers, chaired by the Vice President, Technology and Industry Support, to oversee and monitor progress towards readiness for Year 2000.

NRC has also established a Project Office to prepare NRC for Year 2000 readiness by September 1999. Its primary role is monitoring and reporting, and generally increasing awareness of the Year 2000 issue.

Mission critical research inventory in institutes and branches has been identified. During the months of March and April 1999, compliance will be confirmed by a formal reporting process recently established to track, on a monthly basis, progress being made with respect to ensuring NRC's research assets are Year 2000 ready by June 1999. In addition to confirming compliance, these monthly reports will also highlight the cost of the remediation efforts planned for the period ending 30 June 1999. The documentation will be used to support a NRC Year 2000 Readiness Review to be conducted in late May and early June 1999. The purpose of the review is to allow NRC senior managers to formally confirm the Year 2000 readiness of each institute and branch.

With respect to the building infrastructure, NRC has accepted an offer made by Public Works and Government Services Canada to use their services in verifying Year 2000 compliance of buildings and building control systems. NRC is also identifying special facilities that may have health and safety ramifications should these

not be compliant. Compliance assessments should be completed by the end of March 1999, and NRC should be Year 2000 ready in this area by September 1999.

Business initiatives are being addressed through NRC's new corporate information system, Sigma, based on SAP software, which is currently being implemented. Sigma incorporates financial, human resources, and materiel and project management modules. Although the vendor claims that the system is Year 2000 compliant, it will be necessary to update the basic operating system and test all interfaces to external systems. This work should be completed by September 1999.

Year 2000 clauses must now be included in all contracts, and NRC's Legal Services will perform a "legal audit" of contracts, agreements, and licences. This work should be completed by June 1999.

All of NRC's institutes and branches are expected to complete their own risk assessments and contingency plans. A report of the organisation's total readiness risk will be completed by the Project Office in the May-June 1999 timeframe. NRC-wide contingency plans will be prepared shortly thereafter.

IRAP is also raising awareness with its network members and SME clients on the Year 2000 issue and its potential impact on their business. IRAP will be assisting firms to identify resources that can help them address their Year 2000 situation. In particular, it will link SMEs to other companies that can share best practices, as well as to provide technical and financial assistance to develop new products or services to address Year 2000 issues.

Section IV: Supplementary Information

Table 1: Spending Authorities – Agency Summary Part II of the Estimates

Personnel Information

Table 2.1: Organisation Chart

Table 2.2: Planned Full Time Equivalents (FTEs) by Business Line

Capital Projects Information

Table 3.1: Capital Spending by Business Line

Table 3.2: Capital Projects by Business Line

Additional Financial Information

Table 4: Agency Summary of Standard Objects of Expenditure

Table 5: Program Resources by Business Line for the Estimates Year

Table 6: Details of Transfer Payments by Business Line

Table 7: Details of Revenue by Business Line

Table 8: Net Cost of Program for 1999-2000

Other Information

Table 9: Acts Administered in Whole or in Part by the National Research Council

Table 10: References

Table 1: Spending Authorities – Agency Summary Part II of the Estimates

Vote	(\$ millions)	1999-2000 Main Estimates	1998-1999 Main Estimates
National Research Council Canada			
70	Operating expenditures	238.9	219.9
75	Capital expenditures	34.8	34.8
80	Grants and contributions	152.6	136.4
(S)	Spending of Revenues Pursuant to the NRC Act	51.4	50.0
(S)	Contributions to employee benefit plans	30.7	31.0
Total Agency		508.4	472.1

Personnel Information

Table 2.1: Organisation Chart

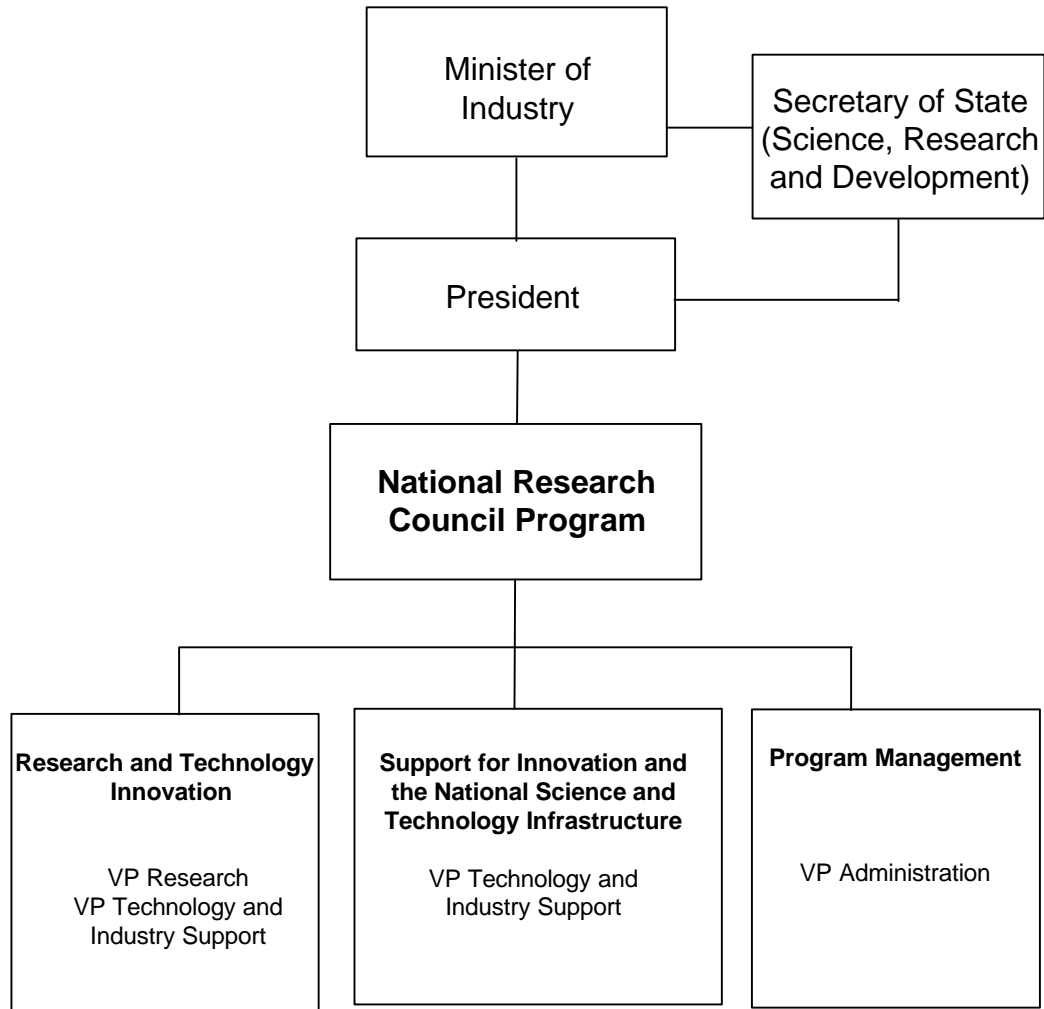


Table 2.2: Planned Full Time Equivalent (FTEs) by Business Line

	Forecast 1998-1999	Planned 1999-2000	Planned 2000-2001	Planned 2001-2002
Business Lines/Activities				
Research and Technology Innovation	2,002	2,085	2,085	2,085
Support for Innovation and the National Science and Technology Infrastructure	387	348	348	348
Program Management	543	533	533	533
Total	2,932	2,966	2,966	2,966

Capital Projects Information

Table 3.1: Capital Spending by Business Line

(\$ millions)	Forecast Spending 1998-1999	Planned Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002
Research and Technology Innovation	42.7	29.4	29.4	29.4
Support for Innovation and the National Science and Technology Infrastructure	1.5	0.0	0.0	0.0
Program Management	7.2	5.4	5.4	5.4
Total	51.4	34.8	34.8	34.8

Table 3.2: Capital Projects by Business Line

(\$ millions)	Currently Estimated Total Cost	Forecast Spending to March 31, 1999	Planned Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002	Future Years' Requirements
Research and Technology Innovation						
Industrial Partnership Facility (S-EPA)	6.4	6.4				
High Resolution NMR Facility (DA)	1.2	1.2				
Montreal Centre of Excellence for Site Rehabilitation (DA)	1.4	0.8	0.6			
Housing Innovation Facility (DA)	0.8	0.8				
Upgrade to Institute of Biological Sciences - Sussex Drive Laboratories (DA)	1.4	1.1	0.3			
Steacie Institute for Molecular Sciences - Chemical Biology Laboratory (DA)	1.7	1.7				
Link from the Biotechnology Research Institute to the Industry Partnership Facility (S - EPA) ⁽¹⁾	7.8	7.7	0.1			
Herzberg Institute of Astrophysics Victoria Building Addition - Planning & Design (DA)	0.6	0.6				
Replacement Program for Obsolete Magnetic Resonance Equipment (DA)	0.7	0.3	0.4			
Innovation Program in the Manufacture of Plastic Film (DA)	1.9	0.3	1.6			
Biosafety Level 2 Pilot Plant for Production & Purification of Gene Therapy (DA)	0.7	0.7				
Canadian Bioinformatics Resource Network (DA)	0.5	0.5				
Area CCD Detector for Synchrotron Beamline (DA)	0.6	0.6				
High Resolution Inductively Coupled Plasma Mass Spectrometer (DA)	0.7		0.7			
Energetic Process Multilayer Deposition System (DA)	1.4		1.3	0.1		
Upgrade Silicon Graphics Equipment (DA)	1.9	1.9				
Virtual Environment Technologies Centre of Excellence (DA)	1.9	1.9				
Support for Innovation and the National Science and Technology Infrastructure						
Electronic CISTI (DA)	1.8	1.8				
Program Management						
Integrated Enterprise Business System (S - EPA)	26.4	22.3	4.1			
Sprinkler System in Building U-61 (DA)	0.6	0.6				
MS Exchange Deployment (DA)	2.1	1.8	0.3			
Year 2000 Wide Area Network Upgrade (DA)	0.9	0.9				
Acquisition of Additional Oracle Licences for Sigma Phase 2 Deployment (DA)	0.9	0.9				

⁽¹⁾ Includes \$2.7M from Canada Economic Development for Quebec Regions

Additional Financial Information

Table 4: Agency Summary of Standard Objects of Expenditure

(\$ millions)	Planned Spending 1998-1999	Planned Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002
Personnel				
Salaries and wages	152.5	153.5	153.5	153.5
Contributions to employee benefit plan	31.0	30.7	30.7	30.7
	183.5	184.2	184.2	184.2
Goods and services				
Transportation and Communications	13.4	11.0	11.0	10.9
Information	1.8	2.1	2.1	2.1
Other Professional and special services	23.5	20.4	20.4	20.4
Rentals	3.9	3.2	3.2	3.2
Repair and upkeep	12.6	12.0	12.0	12.0
Utilities, Materials and Supplies	28.0	39.3	39.3	39.2
Other subsidies and payments	6.6	10.6	10.6	10.6
Construction and Acquisition of machinery	2.1	2.1	2.1	2.1
Total operating	91.9	100.7	100.7	100.5
Capital	51.4	34.8	34.8	34.8
Transfer Payments - Voted	153.2	151.5	136.2	119.1
Gross budgetary expenditures	480.0	471.2	455.9	438.6
Add:				
Spending of revenues pursuant to the NRC Act	50.1	51.4	53.4	57.1
Total budgetary expenditures	530.1	522.6	509.3	495.7

Note: Due to rounding, figures may not add to total shown.

Table 5: Program Resources by Business Line for the Estimates Year

(\$ millions)	Budgetary						Gross Planned Spending	Less: Revenue Credited to the Vote	Net Planned Spending
	FTE	Operating	Capital	Grants and Contributions	Gross Voted	Statutory Items *			
Research and Technology Innovation	2,085	199.4	29.4	40.0	268.8	22.6	291.4	0.0	291.4
Support for Innovation and the National Science and Technology Infrastructure	348	35.9	0.0	110.4	146.3	26.4	172.7	0.0	172.7
Program Management	533	49.6	5.4	1.0	56.0	2.4	58.4	0.0	58.4
Total	2,966	284.9	34.8	151.4	471.1	51.4	522.6	0.0	522.6

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

Note: Due to rounding, figures may not add to total shown.

Table 6: Details of Transfer Payments by Business Line

(\$ dollars)	Forecast Spending 1998-1999	Planned Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002
Grants				
Program Management				
International Affiliations	1,003,000	956,000	956,000	956,000
Grants to municipalities in accordance with the Municipal Grants Act	4,240,000	-	-	-
Total Grants	5,243,000	956,000	956,000	956,000
Contributions				
Research and Technology Innovation				
Contributions to extramural performers under the Biotechnology Research Program	15,000	15,000	15,000	15,000
Particle Physics and Astronomy Research Council of the United Kingdom in support of the James Clerk Maxwell Telescope	1,151,000	1,257,000	1,020,000	1,020,000
Canada's share of the costs of the Canada-France-Hawaii Telescope Corporation	3,253,000	3,253,000	3,253,000	3,253,000
Universities of Alberta, British Columbia, Simon Fraser and Victoria in support of the TRIUMF Project	35,000,000	34,318,000	19,277,000	19,277,000
National Science Foundation of the United States in support of the Gemini Telescopes	1,200,000	1,200,000	1,200,000	1,200,000
Support for Innovation and the National Science and Technology Infrastructure				
Contributions to Canadian firms to develop, adapt and exploit technology (IRAP) ¹	91,358,517	94,448,000	94,448,000	77,407,000
Contributions to organizations to provide technological and research assistance to Canadian industry (IRAP) ¹	16,000,000	16,000,000	16,000,000	16,000,000
Total Contributions	147,977,517	150,491,000	135,213,000	118,172,000
Total Grants and Contributions	153,220,517	151,447,000	136,169,000	119,128,000

¹ Industrial Research Assistance Program

Table 7: Details of Revenue by Business Line

Spending of revenues pursuant to the NRC Act (\$ millions)	Forecast Revenue 1998-1999	Planned Revenue 1999-2000	Planned Revenue 2000-2001	Planned Revenue 2001-2002
Research and Technology Innovation				
Fee for Service	12.1	16.0	16.5	17.4
Rentals	0.4	0.9	0.9	0.9
Royalties	2.6	3.5	4.0	4.4
Contracting In	4.7			
Publications	4.0	1.9	1.9	1.7
Other	0.3	0.3		
Support for Innovation and the National Science and Technology Infrastructure				
Fee for Service	12.1	16.9	18.5	20.3
Contracting In	2.7			
Publications	9.8	9.5	10.1	10.8
Other				
Program Management				
Fee for Service	0.5			
Rentals	0.3	0.2	0.2	0.2
Publications		0.4	0.4	0.4
Other	0.6	1.8	0.9	1.0
Total	50.1	51.4	53.4	57.1

Note: Due to rounding, figures may not add to total shown.

Table 8: Net Cost of Program for 1999-2000

(\$ millions)	Total
Planned Spending	522.6
Plus:	
<i>Services Received without Charge</i>	
Employer's share of health and unemployment insurance premiums paid by Treasury Board	8.4
Employee compensation under Workers Compensation Acts paid by Human Resources Development Canada	0.3
Accommodation - PWGSC	0.1
Cost of Legal services provided by the Department of Justice Canada	0.1
	8.9
Total Cost of Program	531.5
Less:	
Spending of revenues pursuant to the NRC Act	51.4
1999-2000 Estimated Net Cost of Program	480.1

Table 9: Acts Administered in Whole or in part by the National Research Council

The National Research Council is responsible for administering the *National Research Council Act*. The latest revision to the NRC Act is R.S.C. 1985, c. N-15.

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

Table 10: References

Listing of Statutory and Council Reports:

Annual Report 1997-98
Departmental Performance Report 1997-98
Vision to 2001 – Phase II

Contact for further information:

Manager, Planning and Assessment
Corporate Services
National Research Council Canada
Montreal Road
Ottawa, Ontario
K1A 0R6
Telephone: (613) 993-7496

Internet: <http://www.nrc.ca>