



ESTIMATES

National Research Council Canada

**2000-2001
Estimates**

Part III – Report on Plans and Priorities

Canada

The Estimates Documents

Each year, the government prepares Estimates in support of its request to Parliament for authority to spend public monies. This request is formalized through the tabling of appropriation bills in Parliament. The Estimates, which are tabled in the House of Commons by the President of the Treasury Board, consist of three parts:

Part I – The Government Expenditure Plan provides an overview of federal spending and summarizes both the relationship of the key elements of the Main Estimates to the Expenditure Plan (as set out in the Budget).

Part II – The Main Estimates directly support the *Appropriation Act*. The Main Estimates identify the spending authorities (votes) and amounts to be included in subsequent appropriation bills. Parliament will be asked to approve these votes to enable the government to proceed with its spending plans. Parts I and II of the Estimates are tabled concurrently on or before 1 March.

Part III – Departmental Expenditure Plans which is divided into two components:

- (1) **Reports on Plans and Priorities (RPPs)** are individual expenditure plans for each department and agency (excluding Crown corporations). These reports provide increased levels of detail on a business line basis and contain information on objectives, initiatives and planned results, including links to related resource requirements over a three-year period. The RPPs also provide details on human resource requirements, major capital projects, grants and contributions, and net program costs. They are tabled in Parliament by the President of the Treasury Board on behalf of the ministers who preside over the departments and agencies identified in Schedules I, I.1 and II of the *Financial Administration Act*. These documents are to be tabled on or before 31 March and referred to committees, which then report back to the House of Commons pursuant to Standing Order 81(4).
- (2) **Departmental Performance Reports (DPRs)** are individual department and agency accounts of accomplishments achieved against planned performance expectations as set out in respective RPPs. These Performance Reports, which cover the most recently completed fiscal year, are tabled in Parliament in the fall by the President of the Treasury Board on behalf of the ministers who preside over the departments and agencies identified in Schedules I, I.1 and II of the *Financial Administration Act*.

The Estimates, along with the Minister of Finance's Budget, reflect the government's annual budget planning and resource allocation priorities. In combination with the subsequent reporting of financial results in the Public Accounts and of accomplishments achieved in Departmental Performance Reports, this material helps Parliament hold the government to account for the allocation and management of public funds.

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Report on Plans and Priorities

National Research Council Canada

2000-2001
Estimates

John Manley
Minister of Industry

Canada

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Section I: Messages

A. Minister's Portfolio Message

In the global economy, innovation is an essential determinant of long-term economic growth, improved productivity and, ultimately, our quality of life. Preparing Canadians for the knowledge-based economy remains one of the government's top priorities in the years ahead. My portfolio of government organisations is promoting the growth of a strong, dynamic Canadian economy and helping Canadians take advantage of the opportunities offered by the global knowledge-based economy. We have laid a solid foundation through our continuing investments in knowledge and innovation.

An essential ingredient for our knowledge-based growth, both as an economy and as a society, is Connecting Canadians, an initiative designed to make Canada the most connected country in the world. Leading-edge applications will create jobs and growth, and strengthen productivity performance. Connecting Canadians also allows us to reach out to all citizens, and redefine and enhance how we provide services to, and interact with, Canadians.

I am pleased to present the Report on Plans and Priorities for the National Research Council Canada (NRC) which sets out for Canadians the planned activities, priorities and resources over the course of the next three years. These plans illustrate how NRC is contributing to building a strong and dynamic Canadian economy.

As Canada's principal R&D public sector organization, NRC plays a critical role in building Canada's S&T innovation capacity and the innovation systems and infrastructure essential to Canada's emerging knowledge-based economy and its international competitiveness. NRC's major priorities over the planning period include:

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*

- nurturing the growth of Canada's national, regional, and community-based innovation systems;
- providing a vital link between basic research and the application of that research to the development of products and processes for the marketplace;
- working at the frontiers of science in core areas of importance to Canada through leading-edge research and transferring resultant knowledge, information and technology to foster economic growth, productivity improvement and the competitiveness of Canadian firms;
- increasing collaborations and partnerships with companies, universities and other government laboratories in strategic S&T research;
- developing and disseminating science and technology information, intelligence, and knowledge essential to the development of Canada's knowledge-based economy and global leadership in S&T;
- providing research and technical assistance, advice and support to Canadian SMEs to facilitate their development and growth; and
- fostering and enhancing a Canadian innovation culture, demonstrating to Canadians the importance, relevance and contribution of government research, development and technology transfer.

As we look ahead we must define excellence by global standards. Innovation, science, research and development, and connectedness will profoundly change the world we face in the next decade. To maintain and improve our quality of life, we must be more skilled, more productive, more entrepreneurial and more innovative than any other country in the world and we can be all of these things.

The Honourable John Manley

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

Canada's future success, and comparative advantage in the new Millennium, hinges on two virtually limitless resources, knowledge and skills. Investments in knowledge and skills will be critical to taking advantage of new opportunities in the increasingly connected global economy and in our creative and entrepreneurial communities. These investments will ensure a sound economy and healthy environment for all Canadians.

Science, research and development are all about the quest for knowledge - the discovery of new information and a new understanding of how our world works. The search for knowledge touches all facets of our lives - health and social sciences, education and the environment, business and the economy. The government continues to promote the creation, dissemination and commercialization of knowledge, and to create jobs and wealth. We are reinforcing Canada's competitiveness, improving the well-being of Canadians, and building on Canada's image as a truly innovative society that values the contribution of its knowledge workers. The National Research Council Canada plays an essential part in helping Canadians and businesses innovate through science, research and development.

This Report on Plans and Priorities for 2000-2001 illustrates how the federal government is harnessing the benefits of science and technology for the future of all Canadians. The National Research Council Canada is helping to create stronger partnerships that lead to better jobs for Canadians, to an improved quality of life, and to increases in the world's stock of knowledge. Our emphasis on research and innovation is guided by one vision: the future will belong to countries whose economies are sound, whose populations are healthy, whose children are prepared, and who invest in the knowledge, skills and innovation of their people.

The Honourable Gilbert Normand

MANAGEMENT REPRESENTATION

Report on Plans and Priorities 2000 - 2001

I submit, for tabling in Parliament, the 2000-2001 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. NRC: Contributing to Canada's success in the Knowledge-Based-Economy (KBE)

S&T Plays a Key Role in the KBE...

In the October 12, 1999 Speech from the Throne, the Government of Canada recognized that “knowledge and creativity are now the driving force in a new economy” and that “technology is altering every aspect of our lives”.

Success in the global knowledge-based economy (KBE) is founded upon Canada's ability to generate, exploit and transmit knowledge. As a nation, our ability to compete will depend upon productivity, a skilled

By virtue of its world-class expertise and facilities, its strategic approach to research and development, and its presence in international, national, regional and local networks, NRC is a Canadian and global leader in innovation.

workforce and a capacity to innovate continuously. Canada's national, regional, and firm-level

S&T/innovation capacity is a key pillar, providing a strong basis from which to seize opportunities derived from the strategic management and application of knowledge. These opportunities include, for example: productivity improvement; discovering new products, services and processes, leading to new markets; gaining access to international markets; attracting investment, and facilitating a fair and equitable marketplace.

Furthermore, S&T facilitates an enhanced quality of life for Canadians. The discovery and use of new, emerging technologies and the prudent application of scientific knowledge in the formulation of policies, programs and regulations leads to benefits such as improved health and safety, and the strengthening of our nation's ability to address environmental pressures.

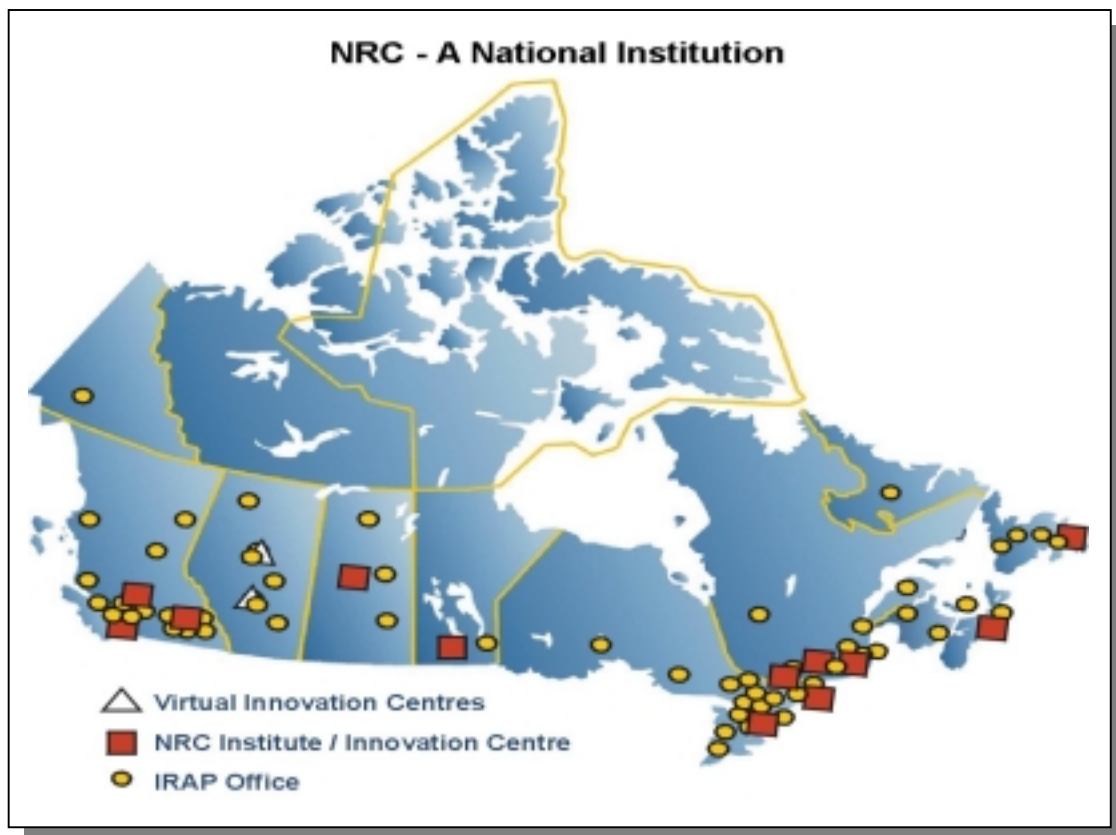
Innovation and S&T are inextricably linked. Nations that invest in strategic research and an innovation culture will be among the leaders in the KBE. To meet this challenge, Canada requires:

- A strong research base;
- Targeted strategic research;
- High quality human resources;
- National research facilities and infrastructure; and national, regional and international networks (i.e. a national system of innovation);
- Effective partnerships;
- Modern knowledge and information infrastructure;
- Innovative support mechanisms for technology-based firms; and
- Effective technology transfer and entrepreneurship.

And NRC is Positioned to Contribute to Canada's Success...

The National Research Council (NRC) is Canada's principal R&D public sector organization. It is a national organization with significant regional and community-based representation. With approximately 3000 full-time employees and 1000 guest workers, an annual budget of \$472 million and income of \$78 million, the NRC creates value to Canadians principally through:

- Undertaking research and development in science and technology, technology transfer activities, and advisory services to government;
- Leading the development of Canada's national, regional and community-based S&T innovation infrastructure and systems of innovation;
- Fostering national and international relationships that support Canada's S&T research, development and innovation efforts, and supporting industry, including SMEs across Canada and globally;
- Developing and disseminating S&T information, intelligence and knowledge essential to the development of Canada's new knowledge-based economy; and
- Fostering and enhancing a Canadian innovation culture --- demonstrating to Canadians the importance, relevance and contributions of government research, development and technology transfer to Canada's prosperity, quality of life and well-being of individual Canadians.



NRC has a Clear Vision to the Future...

NRC's Vision to 2001 indicates that "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." Four broad intended results underpin this vision and reflect NRC's leading role in the strengthening of Canada's innovation capacity, infrastructure and systems of innovation:

Broad Intended Results	Outcomes
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 ▪ Creation and growth of spin-off companies ▪ Introduction of improved management tools and systems

NRC has a long tradition of research excellence that has resulted in a range of technological developments, directly benefiting Canadians. As Canada moves into the knowledge-based economy, NRC has focused its core competencies to continue this tradition of leading-edge research.

**Progress in Research Excellence:
NRC Research Performance Trends 1995-1999**

Growth in Training Program*	+ 47%
Growth in Total Publication Activity	+38%
Growth in Total Reach Activity	+52%
Growth in Total Collaborative Agreements values	+72%

*Includes programs involving guest workers, supervised graduate students, non-graduate co-op students, women in engineering (WES), research associates (RA's) and post-doctoral fellows (PDF's).

Researchers at the Institute for Biological Sciences (IBS) have developed a unique in-vitro model of the blood-brain barrier. IBS' model is unique because it uses human brain endothelial cells isolated from surgical brain biopsies. IBS scientists were able to isolate and combine two different human brain cell types, brain endothelial cells and astrocytes, into an 'artificial' in-vitro model that 'mimics' in-vivo blood-brain barrier. This model is key in studying how to transport pharmaceuticals across the barrier to treat brain injury, stroke, and other neurological conditions. It can also help scientists determine how to repair the barrier when it becomes damaged. Over 50 academic institutions in North America and Europe, including Johns Hopkins Hospital and Harvard Medical School laboratories have obtained cells from IBS for specific research purposes under the Material Transfer Agreement. IBS is negotiating a technology transfer to several local and multinational companies.

The Industrial Research Assistance Program (IRAP) has provided technical and financial assistance to Aqua Health Ltd. in support of numerous fish vaccine research and development projects. Over the last 14 years, Aqua Health Ltd. has brought more licensed fish vaccines to market than any other company in the world. Employment at the Charlottetown facility has grown from 4 in 1984, the company's first year, to 26 in 1999, in addition to which 12 employees staff Aqua Health offices in Europe, the United States and Chile.

NRC has placed a strong emphasis on building partnerships between its people and facilities, and the resources of the regions in which it operates. These activities include the opening of incubation sites and incubation centres. As well, through NRC's Industrial Research Assistance Program, which reaches out to 12,000 firms every year, and other partnership activities, NRC will continue to assist firms develop and exploit technology.

NRC's commitment to assist communities in the development of their technological potential demonstrates NRC's key role at both the national and regional levels of systems of innovation and related infrastructure. NRC has in place various community-based initiatives to enhance the innovative capacity of communities in many regions of this country. It is now well-recognised that technology clusters, whereby innovative, technology intensive firms are encouraged to co-locate, interact and grow in a dynamic, supportive environment, can be very effective drivers of economic growth and international competitiveness.

The new Virtual Environment Technology (VET) Centre at the Integrated Manufacturing Technologies Institute (IMTI), London, Ontario is the largest and most advanced research and development facility of its type in the world. The VET Centre will put Canadian manufacturers at the forefront worldwide by allowing them to bring the design of a given product or part to the ready-for-market stage without prototypes, then run a simulation of the production process before a single hard commitment is made. Exact digital products produced by computer-generated graphics that can be seen and manipulated as if actual are the reason this is possible.

Furthermore, our experience has shown that regional systems of innovation work best when the partners share the same values and a common purpose. Through this teamwork, knowledge is transformed into the shared intellectual capital that fuels innovation. With this model, over the last four years NRC has helped many Canadian firms gain real competitive advantage. We have helped build regional environments or clusters where business thrives. These technology clusters are magnets that attract foreign direct investment to Canada. For example, this attraction has translated into 1000 new jobs around our Biotechnology Research Institute (BRI) in Montreal and our Plant Biotechnology Institute (PBI) in Saskatoon alone. And, NRC's program of technology transfer, including licensing, intellectual property management, and the creation of new start-up companies

continues to move new knowledge to Canadian firms.

In two areas where NRC does not have a physical presence (Calgary and Edmonton), Virtual Innovation Centres have been created to promote communities as good places for innovation-based economic development. The Virtual Innovation Centres are community-led initiatives supported by NRC that promote linkages between sources and users of knowledge and technology, and provide a quick access to the programs and services of NRC across Canada. Regional innovation efforts are complemented through an increased focus on entrepreneurship, designed to identify and implement new opportunities for spin-offs and related mechanisms to move NRC's leading-edge technology closer to the marketplace.

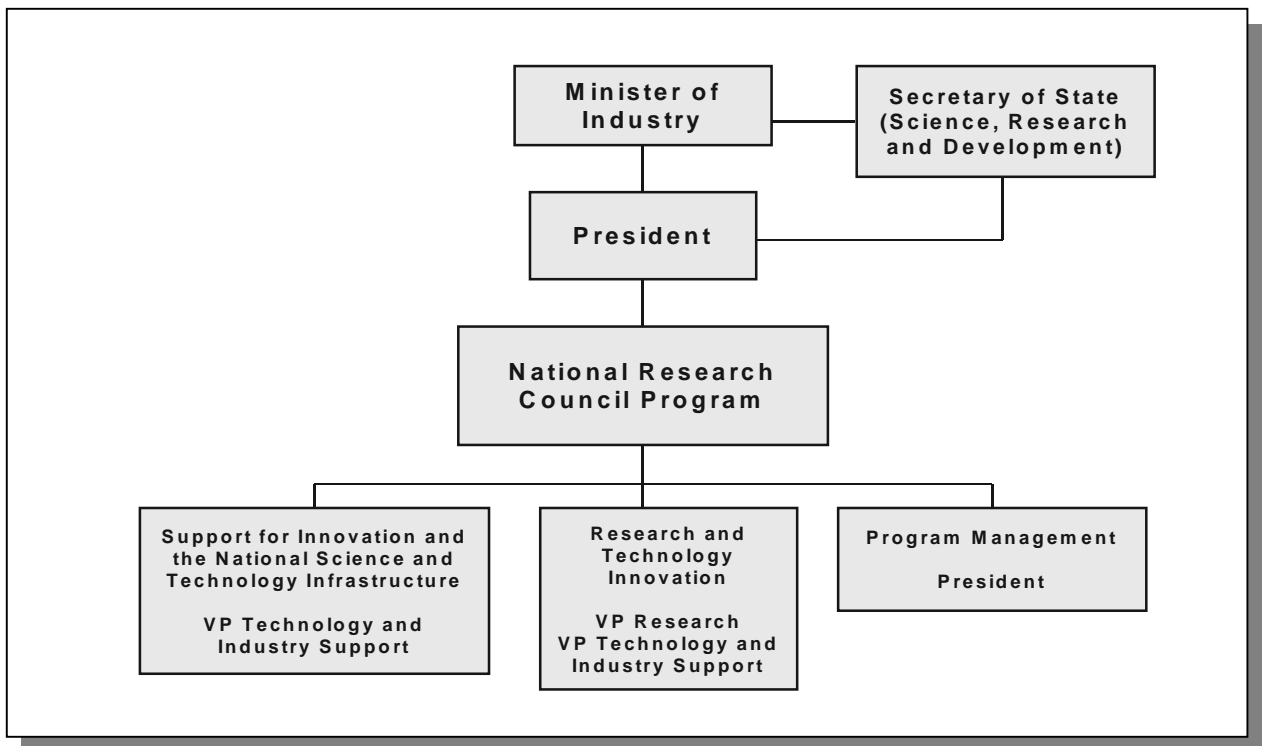
Iridian Spectral Technologies Ltd., a new Canadian company, was launched under the auspices of NRC's Entrepreneurship Program. Drawing on its unmatched in-house expertise, a variety of proprietary design tools licensed from NRC, and an efficient, fully automated production line, the company is building a reputation as a reliable, cost-effective designer and manufacturer of complex thin-film components for the global market. The company has annual sales of over \$1 million which are expected to grow at a rate of 100% a year for the next few years. Employment has grown exponentially, from two full-time staff members a year ago, to 14 today. During the year 2000, the company's staff will grow to 28.

The value of NRC to Canada is also derived from our unique position within the Canadian S&T landscape. NRC is strategically positioned at the centre of the research and development continuum providing a vital link between basic research and the application of that research to the development of products and processes for the marketplace. NRC's strength lies in its ability to

unlock the secrets of science through leading-edge research and to transfer that knowledge to innovative firms for societal benefit. Collaboration and partnership with companies, universities and other government laboratories in strategic research are key to NRC's continuing success.

NRC will pursue its vision and intended results through three business lines over the planning horizon...

NRC's Future Plans and Priorities are developed through three business lines: Research and Technology Innovation; Support for Innovation and the National Science and Technology Infrastructure; and Program Management. These business lines cut across the NRC, as reflected in the organisation chart below.



National Research Council Act

NRC is a federal government departmental corporation. Its mandate, according to the *National Research Council Act*, is to

undertake, assist or promote scientific and industrial research in different fields of importance to Canada; to investigate standards and methods of measurement; and to work on the standardization and

certification of scientific and technical apparatus and instruments and materials used or usable by Canadian industries.

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

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

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

Weights and Measures Act

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

B. Key External Influences

Dynamic change is the order of the day, requiring NRC to become a much more adaptive and anticipatory organization.

As reported in *Globalization of Industrial R&D: Policy Issues* (OECD 1999), “Governments in OECD countries are reacting to the pressures of globalization primarily through policies designed to improve their domestic innovation capacity.” However, in the words of the OECD,

Canada has an “innovation gap”. The innovation gap is the result of both comparatively fewer resources dedicated to innovation and their skewed distribution within the innovation system in Canada with the focus on the generation of knowledge. In short, Canadians are capable of generating new knowledge but we have trouble turning that knowledge into new products and processes.

Closing the innovation gap means turning knowledge into new products, services and processes, and bringing them to market. Progress has been made in recent years, but a challenge remains to keep pace with and surpass our G-7 competitors.

The Government's Innovation Agenda

In the 1999 Speech from the Throne, the government placed emphasis on creating a stronger basis for Canada's youth, and on developing the skills and knowledge for the 21st century that will ensure continued health and quality of life. More specifically, the Speech made reference to the Government's intention to "...ensure Canada has a modern and effective research and science capacity to promote the health, safety and economic well-being of Canadians."

"The future belongs to societies whose economy is sound; who invest in knowledge, education and innovation...Government is determined to do more to support innovation and risk-taking in Canada..."

1997 Speech from the Throne

Dynamic change

NRC is continually being shaped by the changing and sometimes turbulent forces of global science, internationally competitive technology, national government policies, and regional and local innovation opportunities and needs.

This environment is one of constant change and continual learning. Major

developments, summarized below, are forcing NRC to realign its horizons and activities. Primarily, the effect has been to make NRC a more outward-looking and more business-like organization.

In a global context, several key determinants are largely responsible for extending and shaping NRC's traditional orientation from beyond research toward the much broader and strategic context of building Canadian knowledge capacity and innovation. Some of the more pertinent factors include:

- global trade growth and spreading liberalization;
- new infra-info structures of the Internet and electronic commerce;
- globalized financial markets and sourcing for advancing business innovation;
- growth of knowledge-based enterprises to lead technological competition;
- competition for the most qualified people and intellectual capital resources;
- pressures to improve quality of life through advanced education and health; and
- sustainability factors in intergovernmental policies and economic strategies.

NRC's strategic advantage remains its S&T knowledge base, now increasingly supplemented by its experience in managing intellectual relationships that produce innovation through partnerships.

Governmental Focus on S&T

The Government's Agenda has been focussed more on S&T-based innovation in recent years, influenced by the following factors:

- innovation and the knowledge economy have become policy drivers;
- the need for sustained productivity growth;
- federal operational finances have moved from deficit to surplus;
- quality of life and economic growth objectives are now both explicit policy goals for government;
- government on-line, connectedness and electronic commerce are priorities;
- research is now viewed as a necessary investment; and
- there is a renewed focus on attracting, retaining and investing in intellectual capital.

Moving NRC Forward

A distillation of these factors points NRC toward a number of key strategic directions for its forward plans and priorities. These factors are reflected in the general plans and priorities described in Section III:

1. NRC must intensify its national innovation activities and continue to enhance its local and regional focus specifically to take advantage of opportunities around

the development of technology clusters;

2. NRC must become more entrepreneurial and aggressive in competing for talent as an employer of choice, and in developing its strategic equipment and facilities;
3. NRC must continue to develop and expand its partnerships and alliances with key research universities, client firms, other government departments and Networks of Centres of Excellence to more effectively leverage Canada's knowledge capacities;
4. NRC must expand its capacity to deliver information electronically and operate in the new electronic-commerce regime to help Canadian firms be as innovative as their foreign counterparts; and
5. NRC must enhance its international activities and networks to fulfill its aspirations to be a leader in innovation.

In summary, NRC is already a leader in the generation, use and transmission of knowledge in Canada. By re-investing in its research base for the creation of new science and technology and applying its knowledge base nationally and internationally, NRC will play a key role in Canada's successful transition into the global knowledge-based economy of the 21st century.

C. Financial Spending Plan

Departmental Planned Spending

(\$ millions)	Forecast Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002	Planned Spending 2002-2003
Budgetary Main Estimates (gross)	508.4	525.3	506.7	500.0
Non-Budgetary Main Estimates (gross)	-	-	-	-
<i>Less: Respendable revenue</i>	-	-	-	-
Total Main Estimates	508.4	525.3	506.7	500.0
Adjustments**	32.8	24.0	24.0	20.2
Net Planned Spending	541.2 *	549.3	530.7	520.2
Less: Spending of Revenues Pursuant section 5(1)(e) of the NRC Act	57.7	53.4	57.2	57.2
Plus: Cost of services received without charge	10.9	10.7	10.7	10.7
Net cost of Program	494.4	506.6	484.2	473.7

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

** Adjustments are to accommodate approvals obtained since the Annual Reference Level Update (ARLU) exercise.

Full Time Equivalents	3,026	3,084	3,084	3,084
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Section III: Plans, Results and Resources

Business Line I: Research and Technology Innovation

A. Net Planned Spending (\$millions) and Full Time Equivalents (FTE)

(\$ millions)	Forecast Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002	Planned Spending 2002-2003
Net Business Line Spending:	311.9 *	310.8	306.9	298.5
FTEs	2,127	2,168	2,168	2,168

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

B. Business Line Objective

The objective of the Research and Technology Innovation business line is to achieve sustained knowledge-based economic and social growth in

Canada through research, development and the application of technology and innovation.

C. Business Line Description

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

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

- Biotechnologies
- Information and Communications Technologies
- Manufacturing Technologies
- Construction
- Aerospace Technologies
- Ocean Engineering and Marine Industries
- Astrophysics
- Molecular Science
- Measurement Standards

Biotechnologies

NRC's Biotechnology Group, which helps firms bring biotechnology-related products and processes to market for the benefit of Canadians, comprises five research institutes that focus on health care/ pharmaceuticals, agri-food, aquaculture and the environment.

The institutes in this group include:

- Institute for Marine Biosciences (IMB), in Halifax;
- Biotechnology Research Institute (BRI), in Montreal;
- Institute for Biological Sciences (IBS), in Ottawa;
- Institute for Biodiagnostics (IBD), in Winnipeg; and
- Plant Biotechnology Institute (PBI), in Saskatoon.

Information and Communications Technologies

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

The two Ottawa-based institutes in the ICT group, the Institute for Microstructural Sciences (IMS), and the Institute for Information Technology (IIT), 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

Manufacturing in Canada and around the world is undergoing rapid and fundamental change. Production is becoming more automated, global, flexible, customer-driven, environmentally responsible and technology-intensive.

The Manufacturing Technologies Group serves the innovation needs of Canadian industry in manufacturing technologies, and supports longer-term strategic development from its leading-edge facilities and expert teams working on next generation manufacturing systems. It includes the following institutes:

- Industrial Materials Institute (IMI) in Boucherville;
- Institute for Chemical Process and Environmental Technology (ICPET), in Ottawa;
- Integrated Manufacturing Technologies Institute (IMTI), in London, Ontario; and
- NRC Innovation Centre, in Vancouver.

The Research and Technology Innovation Business line also serves several other industrial sectors that are critical to Canada's economy:

Construction

Construction is one of Canada's largest industries and a critical asset underpinning the international competitiveness of the country's economy. NRC, through the Institute for Research in Construction (IRC), is the national technology focus for cost-effective, generic technology solutions. It is a vehicle for effective

linkages to domestic and international research, technical standards and professional organisations, a national co-ordinating mechanism for construction technology, and a link to research that supports the national building and fire codes.

Aerospace Technologies

As Canada's foremost aeronautical research establishment, NRC's Institute for Aerospace Research (IAR) provides R&D support to the operations of the Canadian aerospace industry, which faces exacting design, performance and safety requirements and an increasingly competitive global market. Capabilities include:

- aerodynamics;
- structures;
- materials and propulsion;
- flight dynamics; and
- flight systems integration.

Ocean Engineering and Marine Industries

NRC's Institute for Marine Dynamics (IMD) in St. John's, Newfoundland, through its competencies in the physical and numerical modelling of hydrodynamic processes, is Canada's leader in ocean engineering and offshore structures marine research. The institute provides R&D support to various industrial sectors within the ocean industry: ocean resources, marine manufacturing, and marine transportation. It also ensures that Canada's ocean engineering businesses and operations are competitive, safe and environmentally benign.

Astrophysics

NRC's Herzberg Institute of Astrophysics (HIA) operates the astronomical observatories of the Government of Canada, and ensures that the Canadian scientific community has access to some of the best astronomical facilities in the world. HIA manages Canadian based facilities:

- Dominion Astrophysical Observatory in Victoria, B.C.;
- Dominion Radio Astrophysical Observatory in Penticton, B.C.

As well, HIA provides Canadian researchers with access to several multinational facilities, including:

- the Canada-France-Hawaii Telescope;
- James Clerk Maxwell Telescope; and
- the Gemini Telescopes.

HIA maintains the Canadian Astronomy Data Centre, which provides access to astronomy data from other telescopes (e.g., the Hubble Space Telescope).

Molecular Science

The Steacie Institute for Molecular Sciences (SIMS) undertakes exploratory, long-term research in areas of leading-edge molecular sciences. As such, it plays a key partner role with other NRC institutes in identifying and forging new strategic research programs that will provide the scientific basis for future technological breakthroughs.

Measurement Standards

The Institute for National Measurement Standards (INMS) is a key organization within the Canadian national measurement system. INMS serves as the primary centre of reference for the accuracy, validity and traceability of physical measurements and appropriate chemical measurements.

The Institute plays the leading role in the Canadian national systems of physical and chemical measurements. Through ongoing participation in multilateral initiatives that break down technical barriers to trade, INMS enhances the competitiveness of Canadian products in the global marketplace.

TRIUMF

Located on the campus of the University of British Columbia, the Tri-University Meson facility was established in 1968 and is Canada's national laboratory for research in particle and nuclear physics. An internationally recognized laboratory, TRIUMF is managed as a joint venture by a consortium of four universities (Universities of Alberta, British Columbia, Victoria and Simon Fraser) and operated with contribution funds from the Government of Canada, which are managed by the NRC.

D. Key Plans and Strategies

The Research and Technology Innovation business line will provide Canadians with:

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

1. A Research Program that focuses on excellence and knowledge, and that is relevant to Canadian needs

Key outcomes include:

- ***acceptance and use of NRC's research advances***
- ***recognition of NRC's research excellence***
- ***investment and use of NRC's facilities***
- ***highly qualified personnel***

Genomics and Health-Related Research

NRC's Biotechnology Group will bring the benefits of revolutionary advances in genome science and health-related research to a variety of Canadian industrial sectors and regions. In collaboration with other federal agencies, industries and universities, NRC will make key contributions to national efforts to exploit advances in genome and health-related research. This will be achieved by building upon NRC's expertise in its biotechnology research institutes, as well as the development of local and regional innovation initiatives and strategies in communities across the country. The NRC strategy will promote growth in agriculture, aquaculture, health and bioinformatics industries.

New programs and facilities will be established at NRC locations throughout Canada involving an incremental cost of \$32 million (\$15 million from CIHR and \$17 million from the biotechnology funding allocated to federal laboratories in the 1999 Budget) plus a reinvestment of \$20.4 million from existing NRC institute A-base resources over the first three years. NRC will use the total budget of \$52.4 million as leverage to raise additional investment through collaborative research with industry, universities and other government departments/agencies.

Fuel Cells

The Ministers of Industry and Natural Resources announced the National Fuel Research and Innovation Initiative in 1999. This initiative

includes a \$30 million investment over five years for R&D to strengthen Canada's position in this growing industry. The initiative includes:

- the establishment of a National Fuel Cell Facility at NRC's Innovation Centre in Vancouver;
- a research and technology demonstration and deployment program supported by NRC, NRCan and the Climate Change Action Fund; and
- a targeted university research fund managed by NRC and NSERC.

In 2000-2001, NRC will seek approval for the design and construction of a 500 square metre fuel cells research facility to be housed in NRC's existing Innovation Centre building located on the University of British Columbia campus in Vancouver.

The NRC Fuel Cell R&D Program furthering the development, transfer, and commercialization of fuel cell technologies will be launched at the Innovation Centre. In addition to the Manufacturing Technologies Group, the Steacie Institute for Molecular Sciences will develop a strategy to align its activities with NRC's fuel cell program.

Aerospace Facilities

The Institute for Aerospace Research operates a number of large facilities, many of which are unique in Canada, with a total value estimated to be over half a billion dollars. One of IAR's strategic objectives is to maintain and develop a world-class R&D infrastructure on behalf of the Canadian aerospace community. To accomplish this, NRC would like to

develop a new Gas Turbine Environmental Test Centre. This new Centre would accelerate the development and certification of new aero-engines by the Canadian aerospace industry, and would enable them to develop gas turbines with lower greenhouse gas emissions.

Molecular Electronics

Microelectronics technologies are poised to have a major impact in the area of biotechnology. NRC has recognized that the interface between microelectronics and biotechnology offers a strong opportunity for wealth creation in Canada. New technology such as biochips could bring clinical testing to our physician's office and, likely within 20 years, to our homes - helping us cut our health care costs. SIMS is leading a multi-institute effort to draw on NRC's resources in biology, chemistry, physics and engineering and develop a national presence in this forefront area. Organic materials are also positioned to have a similar impact on traditional information and telecommunication technologies. NRC's Institute for Microstructural Sciences will create a new research group in this area in order to exploit core knowledge and competencies initially developed for telecommunications.

High Performance Computation

This field, growing in importance as a scientific tool, is expected to move from scientific institutions into many areas of application in the next few years. NRC's recent \$5 million investment in High Performance Computation (HPC) represents a

major addition to Canada's research infrastructure that will provide Canadian industry (both SMEs and mega-corporations across the country) with access to the enabling power of HPC for the first time.

The Steacie Institute for Molecular Sciences' participation in CANARIE, which is at the forefront of the HPC national effort, will be a top priority over the next three years. SIMS also plans to establish the conditions needed for transformational HPC applications. Six other NRC institutes will participate in this initiative, including the Integrated Manufacturing Technologies Institute, the Institute for Information Technology, the Institute for Aerospace Research, the Industrial Materials Institute, the Biotechnology Research Institute and the Institute for Chemical Process and Environmental Technology.

NRC's HPC assets will be leveraged through a networked integration with facilities in Canadian universities and corporations, to be known as the Canadian Computational Collaboration (C3.ca). NRC will coordinate the effort as a neutral administrator.

Ocean Engineering Facilities

With the launch of the Institute for Marine Dynamics' Marine Dynamic Test Facility (MDTF) in 1999, researchers are better equipped to study underwater and surface vehicles to predict their stability and the effect of control commands on trajectory. Funded by NRC and the Department of National Defence, this facility will permit testing of full scale underwater vehicles of up to six meters in length,

thereby minimizing problems inherent in model-scale tests. MDTF is particularly cost-efficient since it eliminates the need for model construction.

Astronomical Facilities

The Herzberg Institute of Astrophysics (HIA) has developed a strategic plan for the years 2000-2006 based on a report provided by the NRC-NSERC Long Range Planning Panel on Astronomy and Astrophysics in Canada. The plan focuses on how the Institute will maintain Canada's high world standing in astronomy. The plan addresses:

- participation in current and future multinational ventures;
- resources required to expand archiving and data mining capabilities; and
- ways to improve public outreach.

NRC will examine various options to ensure that Canadian researchers continue to have access to world-class facilities, including participation in the world's future astronomical observatories.

For the next three years, activities will focus on the Atacama Large Millimetre Array (ALMA), identified as a top priority in the Long-Range Plan. Participation in such initiatives will potentially result in substantial economic benefits to the Canadian economy through contracts with Canadian firms and technology transfer.

TRIUMF

TRIUMF's five-year funding is scheduled to sunset in 2000. With input from the findings of a peer review of TRIUMF activities, TRIUMF has prepared and submitted a plan to Government for the next five-year period (2000-2005). Under this plan, TRIUMF would further develop the Isotope Separator and Accelerator, ISAC, into a world-unique facility and ensure continuing Canadian participation at the European Centre for Nuclear Research, CERN, which is at the leading edge of international particle and nuclear physics.

Canadian Light Source (CLS)

NRC has been actively involved in the development of the synchrotron facility in Saskatchewan. The funding for CLS comes from the Canada Foundation for Innovation and a partnership of eleven institutions, including NRC, which has committed up to \$4 million toward construction costs. CLS will be completed in 2003.

In addition to its impact on Canada's research community, the synchrotron facility is expected to attract about \$35 million worth of commercial R&D spending and will generate 200 permanent jobs. Internally, SIMS, ICPET, IBD and BRI will all use the CLS.

Canadian Bioinformatics Resource (CBR)

CBR connects NRC's five biotechnology institutes and CISTI to a common bioinformatics resource. It gives Canadian biotechnology

companies and research institutes secure, lightning-fast access to information (such as that found in genome sequences). CBR is also a public server, providing databases and tools to universities and research organizations across Canada. In the planning period, the CBR structure and operation will be extended to provide access to SMEs. This will include the provision of support services to assist inexperienced users, translate their problems into bioinformatics language, and obtain the best possible information from the CBR facilities.

Metrology

The Institute for National Measurement Standards, as Canada's national metrology institute, plays an important role in supporting international trade. This role should be formally recognized in the Institute's mission statement and articulated in the preparation of its strategic plan. This contribution should also be highlighted in NRC's future strategic planning exercise.

INMS Assessment, Peer Review Committee, 1999

There is international recognition that national measurement standards and calibration services of a national metrology institute are taking an increased importance in the drive to reduce costs to international trade. Over the next year, INMS will develop a comprehensive new strategic plan that will reflect its expanding role in enhancing Canada's international trade position and meeting other industry and public sector needs. The new strategic plan will address the following major challenges:

- the dramatically increasing scope and quantity of international

collaborative efforts aimed at the reduction of barriers to trade;

- the requirement to develop advances in metrology to satisfy the needs of emerging new technologies adopted by Canadian industry and the health and life sciences sector for new products and services; and
- the maintenance of INMS' internationally recognized excellence in selected areas of fundamental metrology research, permitting INMS to continue to make significant contributions to the development, enhancement or comparison of world standards.

2. Economic growth by helping Canadian firms develop new, marketable technologies

Key outcomes include:

- **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**

Manufacturing Technology

The Manufacturing Technologies Group is developing a ten-year agenda to position the sector and align its plans with upcoming challenges. Cross-Canada consultations were conducted in 1999 to seek input from industry.

A clear consensus emerged that manufacturing is undergoing fundamental change, making

technological innovation, business best practices, and stakeholder coordination in areas such as R&D, technical support, access to information and S&T policies, critical to success.

The Manufacturing Technologies Group will align its plans with upcoming challenges and create new partnerships, develop cross-border collaborations, and encourage cross-disciplinary research and development.

Climate Change

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 to remain competitive.

Climate change requires cross-cutting research, technology development, and S&T infrastructure and support efforts. NRC's role is to help its industrial clients respond competitively to the imperatives of climate change initiatives where this can be done through technological innovation.

NRC performs research across the spectrum in: basic science and engineering; development of environmental technologies; mitigation of the effect of greenhouse gases; adaptation to the effects of climate change; impact assessment; and sustainability. NRC launched its Environmental Management Office

(EMO) in 1999 to provide a focus on environmental issues critical to the competitiveness of Canadian industry and to undertake analysis and design for addressing the management of environmental costs incurred in manufacturing.

The EMO is industry's window to cleaner manufacturing processes and environmentally friendly technologies. It supports climate change projects that involve three Technology Groups, including initiatives in biotechnology, fuel cells, cleaner manufacturing, the development of software tools for technology assessment and design, transportation, and building and communities.

The EMO is also linked to IRAP to ensure that Canadian SMEs have an early opportunity to exploit research results. NRC spends approximately \$10 million per year on climate change research. Approximately 85 FTEs are devoted to climate change research activities.

NRC will continue to play a major role in promoting industrial innovation related to climate change within the Industry Portfolio. NRC will also support NRCan and Environment Canada (EC) in their efforts to develop and implement policy and programs in response to the Kyoto Challenge and its longer term sustainable development implications.

Centre for Research in Cleaner Manufacturing (CRCM)

In 2000-2001, NRC will build, as part of the Institute for Chemical Process and Environmental Technology, the

CRCM as an experimental facility designed to house cleaner technology platforms on a scale sufficient to confirm both environmental and commercial performance. These platforms will provide the opportunity to advance the performance of components as well as overall systems.

The cost for the construction of this facility is \$1.7 million. Protocols for verifying the cleanliness of processes will be extended to other research activities at NRC, such as biotechnology and aerospace.

AIAC-NRC Programs Office in IAR

Launched in the spring of 1999, the AIAC (*Aerospace Industries Association of Canada*)-NRC Programs Office has been designed to facilitate multi-client collaborative research programs initiatives involving the aerospace industry, universities, and government laboratories.

In collaboration with Industry Canada, the IRAP Industrial Technology Advisors (ITA) community and AIAC, the Programs Office will update the aerospace technology roadmap developed a few years ago in collaboration with industry. This initiative is an opportunity for IAR to enhance services and support to SMEs. It should also result in an increase in collaborative research projects for NRC.

Canadian Centre for Housing Technology

Officially inaugurated in October 1999, the Canadian Centre for Housing Technology has been designed to

accelerate the development and application of innovative products and construction techniques, as well as promote Canadian housing technologies to the export market.

The three house facility will be used to evaluate the impact of innovative products and alternative construction techniques on total house performance. The focus is on sustainability, material performance, energy efficiency, and marketability.

With its close links to product-certifying agencies and world-class government laboratories, the Canadian Centre for Housing Technology brings promising ideas and innovative products to the attention of builders, housing professionals, consumers, and foreign visitors. This initiative is the result of a partnership between NRC's Institute for Research in Construction, Natural Resources Canada (NRCan), and Canada Mortgage and Housing Corporation (CMHC). During the next three years, CCHT will become self-financing through partnerships with industry.

Construction Technology

IRC's Strategic Plan (1999-2004) reaffirmed the institute's dedication to excellence in research relevant to the economic needs of Canada by:

- *ensuring that its program is aligned to the Canadian marketplace; and*
- *transforming research information into practical applications.*

3. Technology-based economic growth strategies for communities across the country

Key outcomes include:

- **results of regional initiatives**
- **use and impact of codes and standards**
- **impacts of collaboration with government and industry**

In accordance with its commitment to provide Canadians with technology-based economic growth in communities across the country, NRC has:

- developed a regional innovation strategy and made key contributions to develop a number of high-technology clusters across the country;
- provided critical integrating support to the innovation system; and
- provided incubation support facilities to young companies.

Industry Partnership Facilities

NRC opened two new major industry partnership facilities in Ottawa and Montreal in 1998. Over the next three years, the Plant Biotechnology Institute in Saskatoon will build facilities adding 6,500 square meters to support NRC's interactions with firms. NRC's cost of these facilities will be \$9 million.

These new facilities bring the total available industry partnership space at NRC to approximately 15,000 square meters. They will provide important

benefits and opportunities to expand the world-class technology clusters already in place in these communities. The Institute for Biodiagnostics in Winnipeg, the Institute for Biological Sciences and the Institute for Research in Construction in Ottawa also plan to develop such facilities in coming years.

Aquaculture Research Station Initiative

In 2000, the development of new aquaculture facilities at the Institute for Marine Biosciences' Aquaculture Research Station in Nova Scotia will meet the research needs of the Canadian aquaculture industry. This initiative includes the construction of new combination finfish and shellfish aquaculture research facilities for a total cost of \$3.1 million. The new facility will expand IMB's ability to undertake partnered research with industry and, in some cases, allow firms to locate in the facility.

Reducing Technical Barriers to Trade

The Institute for National Measurement Standards will continue to provide a basis for regulatory activities which should lead to reducing technical barriers to trade, helping Canadian companies and emerging industries compete in the global marketplace and creating wealth locally. INMS will do this by:

- participating in international metrology co-operation committees;
- playing a critical role in the promotion of Canada's regulatory and conformity assessment system

in support of the export promotion activities of other federal agencies; and

- renewing the infrastructural support required to assist in the removal of technical barriers to trade.

Innovation in the Construction Industry

The Institute for Research in Construction is leading a drive to transform Canada's construction codes (e.g. The National Building Code) into objective-based codes. This important change will foster the introduction of innovative products and systems and enhance the Canadian construction industry's position on international markets.

4. Transfer of NRC's research successes to Canadian firms

Key outcomes include

- **number of technology and information transfers to firms**
- **results of patent and licence sales**

Creating New Special Interest Groups

Over the last few years, 115 companies have joined one or more of the Industrial Materials Institute's seven Special Interest (Manufacturing) Groups. These groups have assisted in transferring technology to firms and addressing specific technology issues of importance to NRC's partners. Building on this proven formula, the Integrated Manufacturing Technologies Institute in London will develop two new Special Interest

Groups over the next three years to accelerate technology transfer and licensing activities. These groups will be in the areas of laser-based manufacturing technology and concurrent and distributed engineering.

Commercialization Alliance

In partnership with Memorial University of Newfoundland's (MUN) Ocean Engineering Centre and a local SME, in 1998-1999 the Institute for Marine Dynamics created OCEANIC Consulting Corporation, which acts as a commercialization vehicle for IMD's and MUN's technology. Up to twenty private sector jobs in marine systems evaluation will have been created by 2003. An increase in the number of IMD's research collaborations and an additional \$2 million in income is expected in the next three years because of OCEANIC activities.

Guide for Municipal Infrastructure

The Institute for Research in Construction is developing the **National Technical Guide for Municipal Infrastructure**, a key resource to help change procurement practices from a lowest-initial-cost to a best-value approach. The Guide will help municipal officials to better manage their \$15 billion annual investment in physical infrastructure. It will enable them to take into consideration maintenance costs, and the social, economic and environmental consequences of their decisions.

The Guide will address new construction, maintenance and rehabilitation of infrastructural

systems, such as water distribution and wastewater collection, roads and sidewalks, bridges and overpasses, and other physical infrastructure systems. It will also provide an effective mechanism to transfer this knowledge.

Over the next three years, it is expected that municipal infrastructure practitioners will have the opportunity to use the draft Guide's tools. The release of the Guide, a first in North-America, is expected in five years.

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

A. Net Planned Spending (\$ millions) and Full Time Equivalent (FTE)

(\$ millions)	Forecast Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002	Planned Spending 2002-2003
Net Business Line Spending:	165.7 *	176.6	161.8	161.7
FTEs	355	362	362	362

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

B. Business Line Objective

The objectives of the “Support for Innovation and the National Science and Technology Infrastructure” business line are:

- to improve the innovative capability of Canadian firms through the provision of integrated and co-ordinated technological

and financial assistance, information and access to other relevant resources; and

- to stimulate wealth creation for Canada through technological assistance, information and access to other relevant resources.

C. Business Line Description

The “Support for Innovation and the National Science and Technology Infrastructure” business line reinforces NRC’s role as a major R&D participant within the larger Canadian science and technology infrastructure. The business line encompasses the dissemination of scientific and technical information and the provision of innovation assistance to Canadian SMEs.

The NRC also maintains key engineering and technology-based facilities to support specific industrial

sectors of the economy. This business line comprises:

- Canada Institute for Scientific and Technical Information (CISTI)
- Industrial Research Assistance Program (IRAP); and
- Technology Centres:
 - Canadian Hydraulics Centre (CHC);
 - Centre for Surface Transportation Technology (CSTT); and
 - Thermal Technology Centre (TTC).

Dissemination of Scientific and Technical Information

NRC is mandated to operate a national science library and to publish and sell scientific and technical information. It fulfils this mandate through the Canada Institute for Scientific and Technical Information (CISTI). CISTI plays an essential role in Canada's science and technology infrastructure, and is a world leader in the provision of international scientific, technical and medical information. CISTI is Canada's largest publisher of scientific journals. It serves the Canadian scientific community and the general public, but targets Canadian firms performing R&D.

Provision of Innovation Assistance to Canadian SMEs

IRAP helps Canadian companies, primarily small-and medium-sized enterprises develop and exploit technologies through the provision of knowledge-based innovation assistance and access to relevant resources. This support is tailored to client needs, helping them meet the challenges of a changing and competitive economy.

IRAP is a unique national network of 260 Industrial Technology Advisors (ITAs) located in some 150 communities. IRAP ITAs work in collaboration with 130 Network Member organisations such as universities, colleges, provincial research organisation and specialised technology centres. IRAP provides technical advisory services, cost-risk shared innovation financing as well as

pre-commercialisation assistance to SMEs in collaboration with Technology Partnerships Canada (TPC).

IRAP offers SMEs access to a comprehensive package of services through the Canadian Technology Network, which provides easy access to the services of over 1000 member organisations. CTN provides enhanced opportunities for its members to communicate and collaborate, and plays an important role in building the linkages necessary for a strong national system of innovation.

Support Specific Industrial Sectors

The Technology Centres (TCs) offer specialised testing and other engineering-oriented services to clients. While not part of NRC's core research activities, the centres provide unique engineering facilities and services to Canadian industry.

The Canadian Hydraulics Centre (CHC) offers physical and numerical modelling services, consulting services, and software sales and support in the broad field of hydraulic engineering and more specifically in coastal engineering, environmental hydraulics, cold regions technologies and laboratory technologies.

The Thermal Technology Centre (TTC) provides the services of a nationally and internationally recognized and accredited testing laboratory, as well as consultation services and expertise in the field of thermal technology with a particular emphasis on air-conditioning, heat

pumps, refrigeration and process heat transfer equipment.

The Centre for Surface Transportation Technology (CSTT) provides research, development, engineering and product evaluation services to manufacturers, operators and regulators of rail and heavy road, and off-road vehicle products and systems in order to further their corporate goals.

All three TCs have developed a comprehensive business plan based

on a full cost-recovery model. Although the centres operate primarily on the revenue they generate, they still depend on NRC for infrastructure support. At the end of the last fiscal year, two of these centres were already operating on a cost-neutral basis and efforts are being made to move the third one in the same direction. NRC continues to monitor the situation and explore alternatives such as possible transfer to the private sector.

D. Key Plans and Strategies

The “Support for Innovation and the National Science and Technology Infrastructure” business line contributes to NRC by:

1. helping Canadian firms develop new marketable technologies; and
2. stimulating technology-based economic growth in communities across the country.

1. Provide Canadians with economic growth by helping Canadian firms to develop new marketable technologies

Key outcomes include

- ***technical and commercial successes of firms that work with NRC***
- ***Client and partner satisfaction with NRC’s services and support***

National Scientific, Technical and Medical (STM) Information Infrastructure

Access to relevant STM information is critical to the research and development activities of Canada’s innovative firms. CISTI will support this need by expanding existing and developing new state-of-the-art current awareness services and targeted information resources. Tools will be developed that respond to the information needs of key industrial sectors. CISTI will continue to maintain and develop its world-class STM collection and will work at leveraging the expertise acquired in technology forecasting and information management.

Document Delivery Services and Client Service

Demand for CISTI’s document delivery services will continue to expand. To better serve clients, CISTI will provide

access to document ordering from the client's desktop 24 hours a day, seven days a week. This will improve service to Canadians and facilitate use by CISTI's international clientele.

The volume of document delivery services is expected to increase by 14% in 2000-2001 over the previous fiscal year. While the markets in the US will continue to expand, growth in the number of orders from the Asia/Pacific area is also anticipated as a result of strategic alliances and increased marketing activity.

Revenues from the document delivery services will continue to be used to support the improvement of CISTI's ability to deliver STM information to Canadians.

The ability to serve clients will also be enhanced through the implementation of web-based electronic commerce applications, including a "pay per view" access system for the publications of the NRC Research Press and instantaneous online registration and ordering for all clients. The implementation of the new SAP version in NRC will facilitate CISTI's efforts in this regard, providing greater ease of use and new functionality.

Scientific Publishing

The NRC Research Press will continue to play a leadership role in the development of electronic publishing in Canada. Future steps include the linking of references in electronic publications to the source documents and the introduction of multimedia components, such as video clips, 3-D modelling, and interactive mathematics and graphics, in NRC

Research Press documents accessed through the web.

The NRC Research Press has developed a successful program that offers electronic publishing services to Canadian scientific societies. This benefits the societies, which otherwise may not have been able to move into this new form of delivery. To date, three societies have taken advantage of this program and at least three others are expected to join over the next three years.

The peer review process is a key component for ensuring the quality of scientific publications. To further support this process, the Press will develop a fully automated integrated manuscript submission and review system that will be available to the 14 editorial offices it is currently supporting in universities and private industry across the country.

The very successful monograph publishing program, established by NRC Research Press in 1999, currently includes over 40 titles with an average of 10 titles published per year. The program will be expanded in the next three years with an objective of 15 titles per year and will actively seek to diversify its offerings with publications from scientific and technological disciplines not previously represented.

Building a Federal Interdepartmental Digital Library

CISTI will explore opportunities for interdepartmental co-operation to develop online access to the wealth of STM information resident in the Federal Government departmental

library collections. The successful partnering of CISTI and the Canadian Agriculture Library, which provides one point of access for researchers to both collections and easy document delivery, will serve as a model for future strategic alliances with other government departments.

Digital Archiving

The growth in the number of electronic-only STM publications has raised questions as to how to maintain these electronic collections and to provide access on a continuing basis. This problem is international in scope and CISTI will work with national and international organizations, such as the International Council for Scientific and Technical Information (ICSTI), to develop practices and standards to resolve this growing issue.

IRAP Pre-commercialization Assistance (PA)

The development of networks and linkages with CISTI, CTN, OGDs, and external financial partners is an ongoing priority of IRAP's PA program. Plans for the upcoming year include the development of guidelines and policies as well as the finalization of the collection system. As part of Technology Partnerships Canada, the PA element is scheduled to undergo a program evaluation in 2000-01.

IRAP's Business Process

IRAP has recently conducted an extensive review of its business processes as a result of an Office of the Auditor General (OAG) study. In the next year, a number of activities

will be undertaken to put in place recommendations from IRAP's business process review:

- the deployment of an information management system to effectively serve IRAP's clients and provide appropriate information for the benefit of both clients and management;
- improvement of tools to help ensure due diligence; and
- the continuation of the National Quality Assistance Process.

IRAP – International Linkages

IRAP will continue to develop important linkages with a variety of international S&T organisations in Europe and Southeast Asia. The Program will work with Canadian SMEs, expanding alliance opportunities in order to exchange technologies and establish joint-ventures with foreign enterprises. Past international missions have proven to be very fruitful for participating SMEs and IRAP will continue to help SMEs take advantage of future opportunities. Up-coming activities also include the development of a workplan under the framework of ANVAR (Agence nationale de valorisation de la recherche), increasing SME participation in the European Union 5th Framework Programme, and proposing an extension of the Canada/Indonesia Technology Network.

Technology Centres

The impact of climate change will be felt strongly by coastal communities. Adaptation strategies need to focus on issues such as coastal erosion,

dredging, inundation, changing groundwater salinity and increased exposure of structures to wave attack.

The Canadian Hydraulics Centre (CHC) is already working with Environment Canada on hydrological and watershed problems. CHC has become involved on an ongoing basis in Climate Change projects and if new funding is made available, the Centre will study the effects of a changing maritime climate on coastal structures, their repair, protection and recommendations for the future.

The CHC is also pursuing new clients for its coastal engineering and environmental hydraulics services and technologies as a result of a recently completed analysis of the Canadian and American markets. Over the next three years, the Centre expects to generate additional revenues, particularly from environmental hydraulics.

Diversification of the client base and development of new alliances will also be of strategic importance to the Centre for Surface Transportation Technology (CSTT).

The Thermal Technology Centre (TTC) will use certification testing to broaden its network of contacts in industry. It is expected that the revenue stream from performance and standards testing of equipment will be maintained. The Centre will continue to examine opportunities to partner with other commercial testing laboratories and standards organisations in Canada and the US.

2. Providing Canadians with technology-based economic growth in communities across the country

Key outcomes include

- **results of regional initiatives**
- **impacts of collaboration with government and industry**
- **influence of NRC's industrial support and information network**

Expansion of CISTI's Regional Presence

CISTI will explore opportunities to develop regional information services in Alberta, Montreal and New Brunswick. These services will be built on the NRC Information Centre concept, which has been successfully implemented at ten sites across the country.

In parallel, CISTI will develop specific information services in support of the NRC strategic initiatives on fuel cells, aerospace and genomics.

Over the years, CISTI has been working more closely with IRAP. CISTI will continue to add value to the information used by IRAP's Industrial Technology Advisors (ITAs) and node members of the Canadian Technology Network (CTN) in the service of innovative firms in several regional clusters in Canada. Collaboration with industrial associations and other groups will also continue in order to define and meet clients needs. CISTI and IRAP will work in collaboration for the development of new services such

as competitive technical information and technology forecasting.

Networking

After a few years of rapid growth, CTN is now looking to strengthen its relationships with members to fill strategic regional gaps. Over the next three years, special events, such as technology fora and competitive intelligence workshops will be organized in all regions to increase participation in the network and generate more collaboration among members. CTN will also continue to develop electronic communications tools such as the Web site and the Intranet to facilitate exchange of information and knowledge among members and increase the effectiveness of the network.

The Federal Partners in Technology Transfer will continue to act as an exchange forum for technology transfer best practices and will be further developed to enhance collaborations, including those with universities.

IRAP's Youth Employment

IRAP also delivers two programs under HRDC's Youth Employment Strategy. At the moment, the future of this Strategy is uncertain and a decision to provide permanent funding for the programs will be taken following a formal evaluation of the HRDC Youth Employment Strategy, scheduled for 2001-02.

Business Line 3: Program Management

A. Net Planned Spending (\$ millions) and Full Time Equivalents (FTE)

(\$ millions)	Forecast Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002	Planned Spending 2002-2003
Net Business Line Spending:	63.6 *	61.9	62.0	60.0
FTEs	544	554	554	554

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

B. Business Line Objective

The objective of the Program Management business line is to provide efficient, client-focused services that enhance NRC's

effectiveness as an integrated, dynamic and entrepreneurial science and technology organization.

C. Business Line Description

The Program Management business line comprises two components:

1. The Executive Support function which provides policy, program and executive support for the coordination and direction of NRC's operations and its governing Council; and
2. 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.

D. Key Plans and Strategies

Program Management focuses on excellence and knowledge that is relevant to Canadian needs. It also develops and supports the introduction of new and improved management policies, tools and

procedures that will enable NRC to become a more entrepreneurial and business-like organization. A description of the planned major undertakings of the five components of the business line follows:

Corporate Services

Communications and Government Relations

Effective communications is critical to help position and promote NRC, both within and outside the Government of Canada. Building on its vision to be a leader in the development of an innovative, knowledge-based economy through science and technology, NRC's communications will be focussed on promoting the organisation as a key national resource with federal and provincial government stakeholders.

Specific corporate goals include:

- the communication of NRC's major strategic initiatives;
- the development, implementation and communication of NRC's Vision to 2006; and
- the development of more strategic, consistent and sustained corporate-level internal and external communications.

International Relations

Through its international linkages, NRC aims to enhance the quality and impact of research that it conducts, increase national capabilities to generate wealth through the involvement of Canadian industry in international research collaborations and to strengthen the Canadian innovation system by building linkages and by attracting direct foreign investments.

Over the past few years, NRC has substantially enhanced its

international efforts. It has built important linkages in Southeast Asia and has strengthened long-standing relationships with partners in Europe. NRC will continue to foster the development of international cooperation by:

- identifying opportunities to build or strengthen bilateral and multi-lateral S&T cooperation;
- promoting NRC's role internationally;
- gathering and disseminating international S&T intelligence;
- supporting the participation of Canadian SMEs in NRC's international efforts especially in technology-based joint ventures; and
- supporting the participation of Canadian scientists in organizations under the umbrella of the International Council for Science (ICSU).

Business Relations

New ways of effectively transferring technologies to Canadian firms are continually being explored as a means to increase the economic impacts arising from NRC's research. NRC's Entrepreneurship Program supports the development of a stimulating environment for the creation of new business ventures and spin-offs. A number of agreements with private sector organisations have been established to support the creation of NRC derived business ventures.

Efforts will be intensified to improve the collection of performance data in order to facilitate timely feedback concerning technology transfer

initiatives. Information on patents issued, licences granted, collaborative research projects, licensing revenues, spin-offs, etc. will be analysed so as to take advantage of opportunities that may be presented.

Enhanced tracking of the impact of NRC research will also be a priority through indicators such as job creation, increased sales (including export sales) and significant business milestones achieved by Canadian firms which commercialise NRC's technologies. The impact of NRC research on improvements to the quality of life of Canadians will be tracked at a later date.

Assessment

NRC draws on a number of methodologies to assess its programs and activities, including peer reviews by panels of eminent external authorities, to ascertain the overall quality and relevance of its work.

In accordance with NRC's plan for the regular assessment of its programs and institutes, a full-scale assessment of the Biotechnology Program is currently underway and estimated to be completed by 2001. This evaluation will assess the overall quality and performance of NRC's biotechnology program, the largest of NRC's three technology groups. The economic impact of NRC's biotechnology activities will be considered at the national, regional and firm levels and will include an assessment of their role and contributions to innovation in a knowledge-based economy.

NRC is also completing a full-scale assessment, including a peer review, of the Institute for Marine Dynamics, located in St. John's, Newfoundland. This study, which began in 1999, has focused on a number of issues critical to the development of the Institute's next five-year strategic plan. These issues include IMD's future research directions based on existing core competencies, expertise and facilities; IMD's role in the regional innovation system; and an analysis of the results and impacts of IMD activities. This assessment will be completed early in the new fiscal year and will be used to assist IMD to complete its strategic plan.

Human Resources Management

In 2000, NRC will launch a new 'Employment Philosophy' in preparation for the commencement of NRC's next long range plan in 2002. The key objectives will be:

- recruitment of the "best of the best";
- achievement of a highly committed workforce;
- achievement of a highly productive workforce; and
- achievement of a change-ready work force via the constant growth of intellectual capital.

This new strategy will move NRC into an '*employer of choice*' status and address current key human resource management issues, including:

- increased labour market competition for outstanding researchers;
- creation of a highly engaged and innovative and 'ready' workforce;

- the need for compensation systems that encourage and reward both productivity and personal growth; and
- meeting NRC's Employment Equity and Official Languages targets.

From this major undertaking, NRC expects the following outcomes:

- development of a human resources services organization focused on the provision of strategic (e.g. organization development) as well as transactional assistance (e.g. filling job vacancies) to managers at the local level. The benefits will be increased organizational productivity, employee commitment and growth of NRC's intellectual capital;
- 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);
- new 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;
- 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;
- revision of compensation policies and programs to link them to the development of the employee in the job (competency/state of professional development), and to the employee's performance (an across-NRC performance program for all categories of employees will provide first payouts in April 2000); and
- development and implementation of a new gender-free classification system.

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

Administrative Services and Property Management

NRC will continue to implement energy efficiency projects in order to obtain cost savings in NRC buildings. In addition to energy conservation benefits, these projects help support overall government-wide priorities of reducing harmful emissions and eliminating hazardous materials.

Many firms are locating within NRC facilities in order to work in close proximity to researchers and benefit from access to technical infrastructure. NRC is exploring the possibility of converting under-utilized laboratory space for spin-offs and incubators.

NRC has initiated emergency preparedness plans in order to ensure that all its facilities have adequate precautions in place to protect personnel and property. Emergency preparedness plans for each building in the National Capital Region will be completed by the end of year 2000 and plans for facilities in other regions will be ready by year 2002.

Information Management Services

Over the past two years, NRC has implemented a SAP-based enterprise resource planning system, known internally as Sigma. The Sigma system includes financial, materiel management, human resources, and project systems modules, and currently has 3000 users across the organization.

During the 2000-2001 fiscal year, NRC will undertake the development and configuration of a new iteration of Sigma, based on SAP Version 4.x. This migration to a more recent SAP version, to be completed by March 2001, is necessary in order to allow NRC to comply with the Government of Canada FIS initiative.

In addition, it is anticipated that implementation of the new SAP version will provide clients with

greater ease of use and new functionality. This new version will also allow NRC to implement new e-commerce initiatives, particularly with respect to the services provided by the Canada Institute for Scientific and Technical Information (CISTI).

During 1999-2000, a formal governance structure for the management of information management (IM) and information technology (IT) resources, was developed. This included the creation of new senior-level advisory committees and the development of an IM/IT Policy Framework. This committee structure and policy framework will be fully implemented in year 2000. The result of this initiative will be development of an increased number of strategic IM/IT approaches, greater standardization of NRC's IT architecture and the development of formal policies and guidelines with respect to IM/IT activities.

NRC will continue to rely heavily on an efficient and secure data network infrastructure for the delivery of its programs. Internally, network performance monitoring and tuning will be strengthened, as well as IT security activities. In addition, NRC's presence on the national networking scene will be enhanced through its participation in a number of planned optical network initiatives, and through its increased presence on the Boards of Directors of a number of Canada's key Regional Advanced Networks.

In 2000-2001, Information Management Services Branch (IMSB)

will ensure that it provides NRC with cost-effective, business-like client services, by undertaking a comprehensive external benchmarking exercise and then, as required, developing and implementing subsequent continuous improvement initiatives.

Finance

NRC has adopted the Government's Financial Information Strategy (FIS) allowing for full accrual financial statements and improved asset management. FIS is to be fully

implemented at NRC by April 1st, 2001.

This implementation will require new interfaces to be developed with the Receiver General for Canada, upgrades to other systems and changes to NRC's financial and accounting policies, practices and procedures. It is estimated that one-time costs of \$400,000 will be incurred for the 1999-2000 fiscal year and an additional \$500,000 in costs will be incurred in 2000-2001.

Section IV: Horizontal Initiatives

NRC's programs are designed to address current and emerging national priorities. Information is provided below on the organization's support of two government-wide initiatives.

Sustainable Development

As a primary Canadian scientific and technical resource, NRC will contribute to sustainable development through its applied research activities in several fields, for example:

- **biotechnology** to develop bio-herbicides and transgenic, disease resistant plants; new enzymes for pulp and paper bleaching; and bio-remediated soils to remove industrial pollutants;
- **construction materials** to make home and building construction more energy efficient, and to improve infrastructure practices in areas such as water and sewer systems;
- **fuel cells and advanced batteries and membranes** to develop transportation and power systems that are non polluting, as part of the Climate Change Action Fund;
- **engines and transportation systems** to improve the land, sea, and air environments through energy efficiencies;
- **technical standards** to protect the environment, users and the public from industrial chemicals and radioactive devices;

- **manufacturing processes** to eliminate waste and redundancy in production processes; and
- **computer based modeling** to better understand the physical and chemical processes that affect the environment, the workplace and the home including, for example, the release of greenhouse gases.

Regulations and Regulatory Activities

While NRC is not a regulatory authority, it does supply research and technical knowledge that is used by regulators to set specific limits and tolerances for various important functions that affect all Canadians, such as:

- aircraft operations and maintenance, including de-icing and anti-icing procedures;
- surface transport vehicle load design and operational factors;
- building construction, operation and safety;
- urban infrastructure design and installation;
- application of fundamental physical measures of weight, size, time etc. for food, materials, precise time and dimension applications;
- use of ionizing radiation for health and medical applications;
- chemical standards for industrial chemicals;

- design and operating guidelines for nuclear magnetic resonance machines;
- reciprocity standards for global and regional free trade involving cross certification of national measurement and metrology systems for products; and
- wind tunnel and other test facilities to ensure that new product designs by industry comply with performance criteria and governmental regulations.

Section V: Financial Information

Table 1: Summary of Capital Spending by Business Line

(\$ millions)	Forecast Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002	Planned Spending 2002-2003
Research and Technology Innovation	37.7	33.4	27.3	26.3
Support for Innovation and the National Science and Technology Infrastructure	0.3	0.0	0.0	0.0
Program Management	6.0	8.4	8.4	6.4
Total	44.0	41.8	35.7	32.7

Table 2: Details on Major Capital Project Spending...

(\$ millions)	Currently Estimated Total Cost	Forecast Spending to March 31, 2000	Planned Spending 2000-01	Planned Spending 2001-02	Planned Spending 2002-03	Future Years' Requirements
Research and Technology Innovation						
Nova Scotia						
Upgrade of Aquaculture Research Station (DA)	0.5	0.5				
Replacement of Microscopes at the Institute for Marine Biosciences (DA)	1.2	1.2				
Québec						
Montreal Centre of Excellence for Site Rehabilitation (DA)	1.4	1.2	0.2			
Innovation Program in the Manufacture of Plastic Film (DA)	1.9	1.9				
Purchase of Industry Partnership Facility (S - EPA)	6.4	6.4				
Virtual Environment Technologies for Material Processing (DA)	1.2		1.2			
Biotechnology Research Institute Administration Wing (DA)	0.5	0.5				
Ontario						
Upgrade to Institute of Biological Sciences - Sussex Drive Laboratories (DA)	1.4	1.4				
High Resolution Inductively Coupled Plasma Mass Spectrometer (DA)	0.7	0.7				
Energetic Process Multilayer Deposition System (DA)	1.4	1.4				
M-10 Test Cell Facilities for Combustion Research and Development (DA)	1.6	1.0	0.6			
Centre for Research in Cleaner Manufacturing (DA)	1.7	0.8	0.9			
Acquisition of Enhanced Vision System for Flight Research (DA)	0.5	0.5				
Computational Facilities for Aerospace Research and Development (DA)	1.1	1.1				
Upgrade of Analytical Facilities for Ultrathin Organic Films (DA)	0.5	0.5				
Manitoba						
Replacement Program for Obsolete Magnetic Resonance Equipment (DA)	0.7	0.7				
Saskatchewan						
Addition to Plant Biotechnology Institute Building Building (I - PPA)	9.0	0.5	3.0	3.5	2.0	
British Columbia						
Upgrade and Expansion of the Herzberg Institute of Astrophysics's Facilities (S - EPA)	9.6	3.8	5.6	0.2		

...Table 2: Details on Major Capital Project Spending

(\$ millions)	Currently Estimated Total Cost	Forecast Spending to March 31, 2000	Planned Spending 2000-01	Planned Spending 2001-02	Planned Spending 2002-03	Future Years' Requirements
Support for Innovation and the National Science and Technology Infrastructure						
Ontario						
Electronic CISTI (DA)	1.8	1.8				
Program Management						
Ontario						
MS Exchange Deployment (DA)	2.1	2.1				
Renovation of M-55 Building (DA)	0.5	0.5				
Renovation of Uplands Airport U-61 Building (DA)	0.5	0.5				
Building M-58 Chiller Replacement (DA)	0.5	0.5				

Table 3: Summary of Transfer Payments

(\$ millions)	Forecast Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002	Planned Spending 2002-2003
Grants				
Program Management	1.0	1.0	1.0	1.0
Total Grants	1.0	1.0	1.0	1.0
Contributions				
Research and Technology Innovation	40.0	45.9	46.8	45.0
Support for Innovation and the National Science and Technology Infrastructure	100.0	110.4	93.4	93.4
Total Contributions	140.0	156.3	140.2	138.4
Total Grants and Contributions	141.0	157.3	141.2	139.4

Table 4: Respendable Revenue

	Forecast Revenue 1999-2000	Planned Revenue 2000-2001	Planned Revenue 2001-2002	Planned Revenue 2002-2003
(\$ millions)				
Fee for Service	37.0	35.0	37.8	37.8
Publications	13.1	12.4	12.8	12.8
Royalties	3.9	4.0	4.4	4.4
Rentals	1.4	1.1	1.1	1.1
Other	2.3	0.9	1.1	1.1
Total Respendable	57.7	53.4	57.2	57.2

Table 5: Net Cost of Program for the Estimates Year

(\$ millions)	Total
Net Planned Spending	549.3
<i>Plus: Services Received without Charge</i>	
Accommodation provided by Public Works and Government Services Canada (PWGSC)	0.1
Contributions covering employers' share of employees' insurance premiums and expenditures paid by TBS	10.0
Workman's compensation coverage provided by Human Resources Canada	0.3
Salary and associated expenditures of legal services provided by Justice Canada	0.3
	10.7
<i>Less: Respendable Revenue</i>	53.4
2000-2001 Net Cost of Program	506.6

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