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Report on Plans and Priorities

National Research Council Canada

2007-2008
Estimates

Maxime Bernier
Minister of Industry

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ACRONYMS AND ABBREVIATIONS

ACURA	Association of Canadian Universities for Research in Astronomy
AIP	Atlantic Investment Partnership
ALMA	Atacama Large Millimeter Array
CBRN	Chemical, Biological, Radiation and Nuclear
cGMP	Current Good Manufacturing Practices
CFHT	Canada-France-Hawaii Telescope
CNCB	Canadian Neutron Beam Centre
CRTI	CBRN Research and Technology Initiative
CTI	Competitive Technology Intelligence
DRDC	Defence Research and Development Canada
FCHP	Fuel Cell and Hydrogen Program
FTE	Full-Time Equivalent
GHI	Genomics and Health Initiative
HRM	Human Resources Management
ICT	Information and Communications Technologies
IP	Intellectual Property
IPF	Industry Partnership Facility
JCMT	James Clerk Maxwell Telescope
LRP	Long Range Plan for Astronomy and Astrophysics
LTRC	Language Technologies Research Center
MSE	Medium-Sized Enterprise
NIC	NRC Information Centre (NRC-CISTI)
NINT	National Institute for Nanotechnology
NMI	National Metrology Institute
NRC	National Research Council Canada
NRC-AMTC	Aerospace Manufacturing Technology Centre
NRC-ATC	Aluminium Technology Centre
NRC-BRI	Biotechnology Research Institute
NRC-CB	Commercialization Branch
NRC-CHC	Canadian Hydraulics Centre
NRC-CISTI	Canada Institute for Scientific and Technical Information
NRC-CPFC	Canadian Photonics Fabrication Centre
NRC-CSIR	Centre for Sustainable Infrastructure Research
NRC-CSTT	Centre for Surface Transportation Technology
NRC-GTL	Gas Turbine Laboratory
NRC-HIA	Herzberg Institute of Astrophysics
NRC-IAR	Institute for Aerospace Research
NRC-IBD	Institute for Biodiagnostics
NRC-IBS	Institute for Biological Sciences
NRC-ICPET	Institute for Chemical Process and Environmental Technology
NRC-IFCI	Institute for Fuel Cell Innovation
NRC-IIT	Institute for Information Technology
NRC-IMB	Institute for Marine Biosciences
NRC-IMI	Industrial Materials Institute

NRC-IMS	Institute for Microstructural Sciences
NRC-IMTI	Integrated Manufacturing Technologies Institute
NRC-INMS	Institute for National Measurement Standards
NRC-INH	Institute for Nutrisciences and Health
NRC-IOT	Institute for Ocean Technology
NRC-IRAP	Industrial Research Assistance Program
NRC-IRC	Institute for Research in Construction
NRC-PBI	Plant Biotechnology Institute
NRC-SIMS	Steacie Institute for Molecular Sciences
NSERC	Natural Sciences and Engineering Research Council of Canada
OAG	Office of the Auditor General of Canada
OAP	Oceans Action Plan
OECD	Organisation for Economic Co-operation and Development
OTEC	Ocean Technology Enterprise Centre
PEMFC	Polymer Electrolyte Membrane Fuel Cells
R&D	Research and Development
S&T	Science and Technology
SMEs	Small and Medium-sized Enterprises
SOFC	Solid Oxide Fuel Cells
STM	Scientific, Technical and Medical
TBS	Treasury Board of Canada Secretariat
TIS	Technology and Industry Support
TRIUMF	Tri-University Meson Facility

Minister's Message

Canada's New Government is committed to fostering a strong, competitive economy that benefits Canada and all Canadians. To achieve this goal, I firmly believe that our government must create an environment that encourages and rewards people who work hard, that stimulates innovation, and that avoids unnecessary regulatory burden. By modernizing and improving Canada's marketplace frameworks, we will ensure stability and fairness while creating new opportunities and choices for businesses, consumers and all Canadians.

Over the past year, our government has taken significant steps to improve Canada's economy. Early in our mandate we presented Budget 2006, which contained measures aimed at improving our quality of life by building a strong economy that is equipped to lead in the 21st century. These measures focused on making Canada's tax system more competitive internationally, and outlined our commitments to reduce paper burden on businesses and to continue to support science and technology in Canada.

Last fall, we presented a long-term economic plan in the Economic and Fiscal Update. *Advantage Canada: Building a Strong Economy for Canadians* focused on creating five Canadian advantages that will give incentives for people and businesses to excel and to make Canada a world leader.

One of these proposed advantages, called the "Tax Advantage," will create conditions more favourable to business in Canada by effectively establishing the lowest tax rate on new business investment in the G7. As well, the "Entrepreneurial Advantage" will ease the regulatory and paperwork burden imposed on business by ensuring that regulations meet their intended goals at the least possible cost.

Through *Advantage Canada*, our government committed to supporting science and technology in Canada, and underscored some of the elements of a science and technology strategy that will sustain research excellence in Canada and increase the competitiveness of the Canadian economy.

The Industry Portfolio consists of:
- Business Development Bank of Canada [1]
- Canadian Space Agency
- Canadian Tourism Commission [1]
- Copyright Board Canada
- Industry Canada
- National Research Council Canada
- Natural Sciences and Engineering Research Council of Canada
- Registry of the Competition Tribunal
- Social Sciences and Humanities Research Council of Canada
- Standards Council of Canada [1]
- Statistics Canada

[1] Federal Crown corporations do not prepare Reports on Plans and Priorities.

Canada's New Government has repeatedly demonstrated that we are committed to getting things done for all Canadians. As we move forward, we will work more closely than ever with our stakeholders and the provincial and territorial governments, and we will continue to foster an environment where the marketplace functions as efficiently as possible, and keep encouraging investment in Canadian innovation and in research and development.

It gives me great pleasure to present the annual *Report on Plans and Priorities* for the National Research Council Canada, outlining their main initiatives, priorities, and expected outcomes for the upcoming year.

Maxime Bernier
Minister of Industry

Management Representation Statement

I submit for tabling in Parliament, the 2007-2008 Report on Plans and Priorities (RPP) for the National Research Council Canada.

This document has been prepared based on the reporting principles contained in the *Guide to the Preparation of Part III of the 2007-08 Estimates: Reports on Plans and Priorities and Departmental Performance Reports:*

- It adheres to the specific reporting requirements outlined in the Treasury Board Secretariat guidance;
- It is based on the department's Strategic Outcomes and Program Activity Architecture that were approved by the Treasury Board;
- It presents consistent, comprehensive, balanced and reliable information;
- It provides a basis of accountability for the results achieved with the resources and authorities entrusted to it; and
- It reports finances based on approved planned spending numbers from the Treasury Board Secretariat in the RPP.

Name: _____

Title: President

Summary Information

Raison d'être

NRC is the Government of Canada's leading resource for science and technology (S&T) and innovation with a business focus on:

- Improving the social and economic well-being of Canadians;
- Fostering industrial and community innovation and growth through technology and industry support; and
- Supplying excellence and leadership in research and development (R&D).

Table 1-1: Financial Resources ($ millions)

2007-2008	2008-2009	2009-2010
712.4	693.8	692.3

Table 1-2: Human Resources

2007-2008	2008-2009	2009-2010
4,044	4,076	4,127

Table 1-3: Departmental Priorities

Name	Type
1. R&D in Key Sectors and Areas Critical to Canada's Future	Ongoing
2. Community Technology Clustering Initiatives	Previously committed
3. Integrated Industry Support that Engages Key Players	Ongoing
4. Program Management for a Sustainable Organization	Ongoing

Table 1-4: Program Activities by Strategic Outcome

Strategic Outcome: An innovative, knowledge-based economy for Canada through research and development, technology commercialization and industry support		**Planned spending ($ millions)**			**Contributes to the following priority**
	Expected results	**2007-2008**	**2008-2009**	**2009-2010**	
Research and Development	• Leadership in new and emerging research domains • Excellence in R&D and innovation • Stewardship of large-scale S&T infrastructure • Contribution to federal strategies and initiatives • Research that benefits Canadians • Harmonization of international standards • New international S&T alliances	413.88	399.30	402.80	Priority 1
Technology Clusters	• Competitive research and development base for cluster development • Innovative firms and deep talent pools in regions across Canada • Community ownership of cluster initiatives – local leadership and strategies • Improved quality of life through increased productivity and new technology-based solutions in health, for industry, the environment, etc.	30.04	22.00	22.00	Priority 2
Technology and Industry Support	• Advancement of new technology-based companies • Access to new technologies for Canadian companies through patents and licensing • Enhanced innovation capacity of firms • Improved dissemination of knowledge • Supporting Canadian industry	194.00	199.05	194.06	Priority 3
Internal Services* *Program Activities' contributions to this priority are significantly supported by NRC's Corporate Branches which provide policy, program advice and executive support for the coordination and direction of NRC's operations and the NRC Council. The Corporate Branches also specialize in finance, information management, human resources, administrative services and property management, and corporate services.	• Establishment of clear corporate strategic direction • Enhanced corporate governance • Enhanced decision support • Effective research management practices • Long-term stability of financial, human and capital resources • Effective communications with NRC stakeholders	74.51	73.46	73.46	Priority 4

NRC's Link to the Government of Canada Outcome Areas

NRC has a long history of making valuable scientific discoveries that strengthen Canadian industry and contribute to the well being of Canadians and others worldwide. NRC's priorities for 2007-2008 support two main Government of Canada priorities as outlined below.

A Sustainable Economy

Global leadership in science and technology, education and commercialization are the cornerstones to achieving a sustainable economy. Through its dedication to excellence in research and development and its focus on technology cluster growth, knowledge transfer and the development of outstanding people through education and training, NRC is a key contributor to a sustainable, innovative and prosperous economy.

Canada's Place in the World

Canada seeks to play a major role in meeting the economic, health, environmental and security challenges facing the world. NRC supports all of these goals –combining leading-edge research in key areas such as genomics, health, sustainable technologies and the environment with a strong focus on global reach and international research collaborations. The aim is to develop scientific and technological advances needed to enhance the quality of life of Canadians and others around the globe.

Figure 1-1: NRC Benefits to Canadians

The Government of Canada

NRC contributes to the Government of Canada's desired outcomes of strong economic growth, an innovative and knowledge-based economy, and a clean and healthy environment.

NRC's Strategic Outcome

An innovative, knowledge-based economy for Canada through research and development, technology commercialization and industry support

NRC's Priorities: 2007-08 to 2009-10

1. R&D in Key Sectors and Areas Critical to Canada's Future	2. Community Technology Clustering Initiatives	3. Integrated Industry Support that Engages Key Players
• Create value through R&D in sectors with the greatest impact for Canada • Invest in leading-edge research, including increased horizontal and multi-disciplinary R&D • Build sustainability through research in areas critical to Canada's future • Support Canadian industry and research community through codes, standards, and investments in large scale R&D infrastructure	• Contribute to the economic viability of Canada's communities • Help connect industry and key innovation players • Focus on cluster growth to create critical mass and build community innovation capacity • Develop a medium for regional delivery of national initiatives	• Increase innovation capacity of SMEs and help industry manage risks as new products are developed and marketed • Offer S&T information and intelligence to industry • Offer comprehensive commercialization support, including technology transfer and IP management

4. Program Management for a Sustainable & Agile Organization

- NRC Strategy: Science at Work for Canada
- Address Management Accountability Framework commitments
- Continue to address recommendations of the Auditor General of Canada

Plans and Priorities

Operating Environment

NRC has unique attributes that shape its operating environment, including:

- A national S&T infrastructure positioned to improve Canada's innovation capacity in existing and emerging fields of research builds networks for researchers and businesses, trains highly qualified personnel, creates new technology-based companies and jobs, and transfers knowledge and technology to Canadian companies.
- A core strength of over 4,000 talented and dedicated people, 19 research institutes, 16 industrial partnership facilities, the Industrial Research Assistance Program (NRC-IRAP), the Canada Institute for Scientific and Technical Information (NRC-CISTI) and two technology centres.
- The ability to help companies move from discoveries in the laboratory to the development, prototyping, and commercialization of these ideas and technologies for the global marketplace.
- The capacity to adopt an integrated approach that brings research, technologies and industrial links together in delivering its mandate to provide access to international S&T infrastructures.
- The skills to manage research projects towards specific outcomes as well as long-term goals.
- The capability to bring together multi-disciplinary research teams to tackle issues of national importance.
- The ability to put together national programs for delivery in regions across the country.
- The capacity to manage its own highly technical and complex operations - 175 buildings totalling approximately 517,406 square metres of space.

NRC Strategic Direction: Building a Roadmap for Future Sustainability

NRC's Strategy, *Science at Work for Canada*, will guide the organization through 2011. It positions NRC to anticipate and respond to important national priorities by engaging innovation system participants in multi-stakeholder collaborations and developing key competencies that will ready NRC to support Canada's current and future S&T priorities. Recognizing that multi-stakeholder partnerships and horizontal initiatives are increasingly necessary to marshal effective responses to government priorities, NRC will continue to work closely with other science-based departments and agencies.

From an operational perspective, NRC will continue to explore ways to sustain its asset base in the face of annual inflationary pressures, aging buildings and equipment and a static core budget. The organization will also focus on strengthening its management systems and financial base for future sustainability. This will include continuing to address recommendations made by the Office of the Auditor General of Canada (OAG). NRC prides itself on being an adaptable, flexible organization. These attributes will be particularly important in the years ahead as NRC strives to deliver the best results possible for Canadians.

Priority 1: R&D in Key Sectors and Areas Critical to Canada's Future

Research and innovation are critical to Canada's future economic growth and an improved quality of life for Canadians. As Canada's foremost R&D agency, NRC concentrates its efforts on two vital elements of R&D excellence: quality and relevance. For the planning period, NRC will play a key role in helping Canada reach its full potential by performing research in fields that are of current and future importance to the Canadian economy and that address important public and Government priorities. To achieve this, NRC will work in collaboration with industry, university and government partners in Canada and abroad. Creating value from knowledge, providing a national S&T infrastructure, maintaining and fostering international alliances and supporting the commercialization of federal R&D are integral parts of NRC's business.

Planned Strategies

Over the planning period, NRC will:

- Create value through R&D in sectors with the greatest economic impact for Canada
- Invest in leading-edge research including increased horizontal and multi-disciplinary R&D
- Build sustainability through research in areas critical to Canada's future
- Support Canadian industry and the research community through codes, standards, and investments in large scale R&D infrastructure

Key Influencing Factors

Aerospace, Manufacturing and Information and Communications Technologies (ICT) are important economic engines for Canada - Aerospace remains one of Canada's most important advanced technology sectors, investing $1.2B in R&D on total revenues of $21.8B in 2005. Both of these figures show growth, for the first time since early 2000. Over 80% of this revenue is from the civil aviation sector, and primarily in export, with 85% of total revenues obtained from foreign customers. The Canadian Aerospace Industry faces tough global competition. Economic trends, including further appreciation of the Canadian dollar relative to the US dollar, also present challenges to the Canadian industry. These pressures highlight the importance of continued innovation.

In 2006, Canada's manufacturing sector contributed 15% of GDP, 71% of total exports and represented 59% of private industrial R&D. Canada is a significant player in the global ICT industry, with 32,000 ICT companies employing almost 590,000 skilled Canadian workers and generating over $136B in revenues. The communication equipment-manufacturing sector alone is the largest R&D spending industry, representing 10% of total R&D spending in Canada.

Nanotechnology is a strategically important area of research for Canada with substantial potential application and economic value for Canadians – The rich diversity of invention enabled by nanotechnology could allow for revolutionary developments in medicine, materials,

pharmaceuticals, and electronics. The economic and social impact of nanotechnology has the potential to be profound: discoveries and applications of nanotechnology could lead to a new industrial revolution in the coming century, and to commercial markets as large as $1.5 trillion per year within 10-15 years. Nanotechnology is a fast-growing and revolutionary field in which Canada needs to build and sustain world leadership. NRC will continue to help Canada stake its place in nanotechnology through its research in applications for medical devices, electronics, fuel cells and construction materials, and through the development of its new National Institute for Nanotechnology (NINT) **–** a partnership with the University of Alberta and the Province of Alberta.

Life Sciences, Genomics and Health research are fundamental to addressing critical public concerns such as health and wellness, dealing with chronic and infectious diseases, and developing more effective drug therapies, diagnostic tools and equipment – The global market for life sciences is estimated at $500 billion and is growing at 20% annually[1]. NRC has had significant success in this research area, providing important value to Canada and the world, including a number of world-firsts such as a non-invasive test for colon cancer and a new vaccine against meningitis C, and is continuing to provide the necessary R&D to develop a thriving Canadian nutraceutical industry.

Future energy sources and the environment continue to be major national issues – Elimination of toxins from the environment and the production and use of cleaner and more efficient energy sources are also issues of concern. A number of NRC research programs (e.g. ocean science, biotechnology, manufacturing, construction, aerospace, fuel cell and alternative energy technologies, chemical processes and environmental technology) focus on the physical environment and ways to reduce and reverse industrial and urban environmental impacts, as well as ways to accommodate changes in environmental loads resulting from climate variations on the built environment. The Institute for Aerospace Research (NRC-IAR) applies its research programs in partnership with Canadian industry on the development of more fuel-efficient air and road transportation and in the development of more environmentally friendly propulsion systems.

The disruption of ocean currents and weather patterns threaten habitats and coastal regions. Ocean technology has a major role to play in ocean observation systems that support modeling and forecasting of ocean-climate systems. Ocean technology supports environmentally sensitive exploitation of hydrocarbons beneath the ocean floor. There is also a new focus on energy derived from renewable sources such as ocean waves, tides and currents.

Over the coming year, the Minister of Industry will be unveiling a science and technology strategy, in collaboration with the Minister of Finance, that will encompass a broad range of government support for research, including knowledge infrastructure. NRC is focusing on expanding horizontal and multi-disciplinary R&D across the organization and with other federal S&T organizations to support the new federal S&T strategy – Over the planning period, NRC will continue its efforts to dismantle longstanding barriers between many different research domains (e.g., life sciences and information technology) to create powerful new technology platforms and partnerships to serve the interests of Canadian society and businesses. NRC will also continue to work actively with other science-based departments and agencies to address horizontal management issues related to federal S&T collaborations and infrastructure

[1]NRC Atlantic Initiatives: Building Technology Clusters, 2004. *Life Sciences* National Research Council Canada, p. 9

renewal. NRC is participating with other government organizations to combine efforts to better meet federal priorities such as the Oceans Action Plan, the Chemical, Biological, Radiation and Nuclear Research and Technology Initiative, and others.

The globalization of trade and emerging technology commercialization opportunities in areas such as biotechnology and nanotechnology continue to generate a need for new metrology and standards to assist Canadian manufacturers in transforming technologies into product applications so they can remain competitive in world markets.

PLANNING HIGHLIGHTS

Strategy: Create value through R&D in sectors with the greatest economic impact for Canada

Facilitate technology advantage for next generation aerospace industry – NRC-IAR's Aerospace Manufacturing Technology Centre was designed to support the complete aerospace manufacturing supply chain, from Small and Medium-sized Enterprises (SME) to Aerospace Primes, in the development and implementation of modern manufacturing methods with the potential of cost savings. The Centre has completed its first year of operation with increased partner participation, as evidenced by $1M in partner funding for its research and community recognition in the number of partnerships. The NRC-IAR-Gas Turbine Laboratory (GTL) continues a half-century of advanced industry-focused support and has been awarded Pratt & Whitney Canada's largest external collaborative research contract. Rounding out the key research programs in early 2008, the GTL will be the only facility in the world capable of mixed phase icing certification, an area of extreme interest for aircraft engine development and certification in the international community.

Integrate nanotechnology research and innovation – NRC's nanotechnology research is targeted at three main application areas that directly impact Canadian competitiveness: new materials and coatings; quantum devices for next generation computing and communications; and novel nanostructure devices for photonic, sensing, and biological applications. This research spans twelve NRC research institutes and combines a spectrum of competencies ranging from fundamental understanding of the properties of nanostructures, through manufacturing of nanomaterials and nanodevices, to collaborative efforts aiming at their applications in aerospace, construction, communication and health related industries. For example, the NRC Steacie Institute for Molecular Sciences (NRC-SIMS) will continue to collaborate with NRC-IRC and NRC-IAR in the development of new nanotechnology-based composite materials offering significant improvements in applications for their respective industries.

To build its competencies and leverage its resources and knowledge, NRC is developing a horizontal nanotechnology program that will increase the integration of expertise across NRC as well as facilitate collaborations with external partners, including other government departments, universities, industry, and international research centers. The program will be linked to a nascent nanotechnology network growing around NINT in which specialized nano centres across Canada are working together to share information and enable collaborative ventures. It is expected that the program will not only increase Canadian capacity in nanotechnology, but will also prove to be a training ground for young researchers entering this important new sector. The program is intended to grow over a five-year period and will feature a limited number of focused cross-disciplinary and multi-partner collaborative projects that will support the priority

areas delineated in NRC's Strategy, *Science at Work for Canada*.

Position Canadian industry as a key player in advanced manufacturing – Collaboration with industrial, university and government partners in virtual and reconfigurable manufacturing and precision and freeform fabrication will continue to be part of the Integrated Manufacturing Technologies Institute (NRC-IMTI) portfolio. These efforts are designed to help Canadian firms develop and market new leading-edge manufacturing systems and integrated technologies worldwide for application in the automotive, aerospace, medical and electronics, machinery and equipment sectors. The Institute for Chemical Process and Environmental Technology (NRC-ICPET) will continue to focus on two major research thrusts: energy-oriented processes and solution-driven materials, targeting applications in the oil sands, fuel cell, and bioproducts industries. The Institute for Fuel Cell Innovation (NRC-IFCI) will continue to focus on clean energy-oriented processes and solution driven novel materials, sensors and architectures, targeting applications in fuel cells and hydrogen and linking those to end users such as car manufactures, utilities, oil industries, pulp and paper, mining, and forestry-bio fuels. The Industrial Materials Institute (NRC-IMI) will continue to focus on the materials processing and forming industry, performing R&D and providing open laboratories and partnership opportunities to innovative companies. NRC-IAR's success in the area of aerospace manufacturing technology has led to a transition of these new technologies into the non-aerospace manufacturing sector.

Reduce industry risks and costs of working on next generation information and communications technology – The Institute for Microstructural Sciences (NRC-IMS) will continue to anticipate the future needs of Canadian industry by developing functional materials and quantum devices that will fuel the information revolution of the next decade. NRC-IMS is making significant advances in the development of nanomaterials and quantum devices that will help deliver solutions to diverse application areas such as biosensors, chemical sensing, and quantum computing. On the software side, the Institute for Information Technology (NRC-IIT) is developing technologies that facilitate the extraction of knowledge from data, enable people oriented systems, and advance e-business protocols. A key initiative, Social Networking Applied to Privacy, will see the development of automated methods that will assist companies in complying with privacy laws and obligations with respect to the handling of private information. Worldwide, compliance with privacy and fiduciary reporting requirements is one of the biggest challenges facing all organizations. This project was launched in April 2006 and is expected to be completed in the 2010-2011 timeframe.

The Language Technologies Research Centre (LTRC), a collaboration among NRC-IIT, the Université de Québec en Outaouais, Canada Economic Development for Quebec Regions and the Translation Bureau, officially opened its premises in May 2006. The Centre's focus will be on developing new technologies related to translation, multilingual content management, language training, and speech processing. A key activity continues to be the PORTAGE project, which aims to develop state-of-the-art software to permit computer translations from one human language to another. The PORTAGE technology's international visibility has been heightened by participation in the multimillion-dollar Global Autonomous Language Exploitation (GALE) project sponsored by the US Defence Advanced Research Projects Agency (DARPA). As a member of the Nightingale Consortium, one of the three consortia participating in GALE, NRC's role is to supply machine translation technology.

Working to ensure vaccines and pharmaceuticals can be produced in Canada – The Biotechnology Research Institute (NRC-BRI) will continue to pursue research opportunities that support domestic production of vaccines. In 2006, technology transfer and several 1500 L-production runs were completed

as part of a significant contract with Sanofi Pasteur Ltd. The contract involved the scale-up, production, and purification of a bacterial protein for the development of a new vaccine. The success of this work resulted in a Sanofi Pasteur senior executive recognizing Canada, in addition to Europe and the U.S., as a viable location for production work.

The Institute for Biological Sciences (NRC-IBS) is also engaged in work to support this strategy, including:

- Transformative Vaccine Formulation and Delivery: Researchers at NRC-IBS have discovered that Archaea, one of the world's toughest microbes, can lead to promising new generation of vaccines for cancer and intracellular pathogens. Through a licensing deal with Nicholas Piramal India Limited, one of India's largest health care companies, the promising archaeosome technology will move into clinical trials, with the aim of leading to the marketplace. The NRC archaeosome technology has the potential to revolutionize the global vaccine industry, and could lead to protective vaccines against grave diseases such as Tuberculosis (TB) and Acquired Immune Deficiency Syndrome (AIDS), which currently kill millions of people each year.
- New Cancer Therapies: NRC-IBS' groundbreaking work on single domain antibody techniques has led to licensing agreements with Canadian companies Helix Biopharma Corp. and Protox Therapeutis Inc. to develop unique and specific antibody-based cancer therapies.
- Group B meningitis: There is currently no approved vaccine against Group B meningitis, a major cause of illness and death in the developed world. Through a research collaboration with a leading multinational vaccine company and a University in the UK, NRC obtained proof of principle for a lipopolysacharide-based vaccine strategy against Group B meningitis. The LPS-based platform holds great promise in developing a vaccine to protect infants against all groups of this deadly pathogen.

Strategy: Invest in leading-edge research including increased horizontal and multi-disciplinary R&D

Supporting Canada's leadership in Fuel Cells - The Fuel Cell and Hydrogen Program mobilizes fuel cell expertise and research strength from a network of NRC research institutes across Canada. A total of $6.2M over five years from 2003-04 through 2007-08 has been allocated to NRC and will be applied to its Fuel Cell and Hydrogen Program – a key horizontal initiative. By linking these institutes through a coordinated national program, NRC will help build a strong Canadian fuel cell industry. Linked through a horizontal program, each participating institute will also work with regional R&D providers, universities, government agencies, and local industry to support the development of regional fuel cell clusters. Transfer of fundamental research results from the current program to companies is already underway. Signed collaborative projects between NRC and Canada's top three fuel cell companies (Ballard, Hydrogenics, and Tekion) all stem from research developed in the program.

As noted, the horizontal program is just part of the integrated fuel cell and hydrogen research work across NRC, which includes additional activities in Vancouver and Ottawa. In British Columbia, NRC-IFCI's Technology Centre and its Incubation/Acceleration and Networking Facility will provide a focus for SMEs' technology acceleration, integrated technology demonstrations, and industry-university-government partnerships. NRC-ICPET's activities are helping to build significant fuel cell activity in Ontario through participation with the Kingston-based Fuel Cell Research Centre (FCRC), which brings together researchers at Queen's and other Ontario universities and Ontario firms such as DuPont and Hydrogenics.

Overall NRC will play a key role in fuel cell and hydrogen research through the development of next generation Polymer Electrolyte Membrane Fuel Cells (PEMFC) and Solid Oxide Fuel Cells (SOFC) aimed at reducing fuel cell costs and improving reliability and durability. Projects will focus on polymeric and ceramic materials for fuel cell applications, virtual engineering of fuel cells, novel fuel cell stack architecture, embedded sensors and supporting diagnostics, advanced nano-materials research for an intermediate temperature SOFC, high temperature PEMFC (both polymer and ceramic proton conducting) and electrocatalysis. Collaborations with NRC's Centre for Surface Transportation Technology will begin developing opportunities for the commercial application of fuel cells to military vehicles to meet the needs of the Canadian Armed Forces.

During the planning period, workshops with NRC scientists and experts from other departments, industry, and universities will allow for detailed discussions on research activities and focus areas to allow NRC to continually evaluate the relevance of its research and plan for future activities in the program. With its long affiliation with fuel cells and hydrogen, Natural Resources Canada (NRCan) will be a key partner in these discussions.

NRC Genomics and Health Initiative – The National Research Council's Genomics and Health Initiative (NRC-GHI) will continue to invest in large-scale horizontal research programs focused on bringing the benefits of rapid advances in the genome sciences and health research to a variety of Canadian industrial sectors. The program will invest $22M in 2007-08, involving a total of ten different NRC institutes, other government departments, universities, industry and organizations such as Genome Canada and CIHR. The primary goal of NRC-GHI is to advance the frontiers of scientific and technical knowledge within the areas of genome sciences and health-related research to create a knowledge base that will contribute to Canada's competitiveness. Current research programs are in the development of personalized approaches to cancer diagnostics and treatment, management of chronic cardiovascular disease, development of pathogen detection technologies, the study of functional genomics of Brassica (Canola) seed development and metabolism, and vaccine development against pathogens affecting aquacultured fish.

Support horizontal and multi-disciplinary collaborations – The McGill University Health Centre (MUHC) and its affiliated institutions and collaborators signed an agreement with NRC-BRI to create and expand the existing model of the NRC-BRI Accelerator Project. This joint collaboration between NRC-BRI and MUHC, which takes advantage of the combination of clinical research and R&D conducted at NRC-BRI, will funnel external funding to support the valuation and transfer process; identify and prioritize the best potential innovations from both BRI and MUHC; offer project management for selected technologies; incubate and accelerate the development of technologies; and ultimately facilitate the transfer of technologies to the private sector or create spin-off companies to exploit such Intellectual Property (IP). This project will speed the translation of innovation from bench to bedside to business and thus accelerate value creation from excellence of the research conducted in both institutions.

Support National Security – Funded by CRTI, NRC-INMS is participating in an ongoing collaboration with the Canadian Food Inspection Agency (CFIA), DRDC and Ionalytics Corporation to develop analytical methodology for the rapid and highly sensitive detection of chemical warfare agents, toxic agrochemicals and toxins. The combination of instrumentation and procedures will provide Canada with unique capability and capacity to address chemical terrorist threats. It is anticipated that these leading edge procedures will be rapidly adopted internationally. The project will be completed in 2009.

Speech Security Projects - NRC-IRC is collaborating in several projects with the RCMP and PWGSC concerning the design and assessment of the speech security of meeting rooms. The idea is to determine whether an eavesdropper can hear or understand speech from an adjacent meeting room where confidential material is being discussed. The work involves both physical measurements and subjective listening tests. New procedures have been developed to predict the likelihood of a security lapse from measurements or predictions of the acoustical characteristics of the meeting rooms. A better understanding of the factors influencing people's ability to understand low levels of speech in noise has been achieved and work is underway to have the new procedures adopted into measurement standards.

Strategy: Build sustainability through research in areas critical to Canada's Future

Continue to support Canada's commitment to reduce green house gas emissions and improve the environment – A number of NRC research institutes and programs are applying their knowledge and competencies to climate change, energy, the environment, and sustainable development. These research efforts include: NRC's Fuel Cell and Hydrogen Program, involving NRC-IFCI and five other institutes; work on advanced materials and energy-efficient processes for manufacturing; NRC-IRC's development of new materials for buildings and construction and codes for sustainable municipal infrastructure; the application of biotechnology to the remediation of contaminated lands and water; and development of new infrastructure in support of the aerospace sector.

NRC will continue to participate in the Program for Energy Research and Development and the Climate Change Technology and Innovation. It will also contribute to the federal energy S&T strategy led by NRCan to ensure that its planned activities are aligned with federal priorities.

Positively influence indoor conditions - NRC's Institute for Research in Construction (NRC-IRC) will continue to focus on three activities to positively influence indoor conditions. One research activity, together with other government departments and the private sector, focuses on improving indoor air quality, including better selection of low-emitting, non-toxic building materials, and improved ventilation/heating regimes. A second activity focuses on establishing the necessary daily light dose in buildings for good physical and mental health. The third activity is the development of the Building and Health Science Network, a community of Canadian researchers whose work touches on the effects of indoor environmental conditions on health and well-being. Results will be shared with the Canadian construction industry, health community, and Provincial/Territorial authorities to promote indoor health through design, construction, and operation of buildings.

Build sustainability through oceans science – Canada's oceans are a strategic resource of prime importance to humanity, the environment, and industry. The NRC's Institute for Ocean Technology (NRC-IOT) integrates advanced technologies to achieve innovative solutions to meet the challenges relating to safe and effective transportation, food production, energy development, recreation and information gathering on the oceans. In 2005, NRC-IRAP received two-year funding under the umbrella of the Oceans Action Plan (OAP) to contribute to networking efforts that promote oceans science and technology. This has led to the creation of the Ocean Science and Technology Partnership Organization (OPO), a federally incorporated not-for-profit entity that will encourage national linkages between regional oceans networks.

Properly supported, these relationships will lead to increased and timely information sharing, awareness building and new technology demonstrations, partnerships and joint ventures.

Natural health products and nutraceuticals – At its Plant Biotechnology Institute (NRC-PBI), NRC is working to enhance the innovative capacity and competitiveness of the Canadian plant-based natural health products industry for the health and wellness of Canadians by leading efforts to create a world recognized plant-based natural health products industry in functional foods, natural health products, and nutraceuticals. Scientists at the National Research Council Institute for Nutrisciences and Health (NRC-INH) are also involved in identifying how bioactive compounds found in nature can be used to improve human and animal health. Research focuses on the role natural compounds play in three key areas: neurological disorders (such as Alzheimer's disease); obesity-related disorders (such as Diabetes); and infection and immunity (such as viral infections). Focusing on plant product development and commercialization for health and wellness will serve to address important Canadian economic and social issues associated with the wellness of Canadians and the health system. By helping to build a natural health products industry, NRC is contributing to the global competitiveness of an emerging and important Canadian industry.

Make breast cancer diagnosis less invasive - With their improved magnetic resonance imaging (MRI) methods for diagnosing all types of breast cancers, NRC-IBD researchers hope that non-invasive examinations will become the norm for detecting breast cancer, rather than invasive biopsies. Biopsies can vary, but these medical procedures can involve a needle or surgery to remove human tissue, cells or fluids from a breast lump. Then the samples are examined for evidence of cancer. Scientists at IBD hope to reduce the number of unnecessary invasive procedures by observing biochemical changes in cancerous tissues.

Neurochip for drug screening and testing — NRC scientists have pioneered the development of a neurochip - a complex interface of living neurons or brain tissue with patterned materials and multi-electrode arrays that can potentially be used in drug screening and diagnostic testing. NRC is working to create a Neurochip Consortium to promote the future development and commercialization of this technology.

Revealing the secrets of brain adaptation and regeneration — NRC scientists have discovered the molecules that could help reduce the burden of Alzheimer's disease or enhance brain recovery (angiogenesis-modulating peptides) after stroke-induced damage. These discoveries have resulted in two patent applications, publications and the award of a Heart and Stroke Foundation grant exceeding $200,000 for further research and development.

Strategy: Support Canadian industry and the research community through codes, standards, and investments in large scale R&D infrastructure

Support Canada's long term competitiveness through the adoption and mutual recognition of international standards – NRC's Institute for National Measurement Standards (NRC-INMS) is Canada's National Metrology Institute (NMI), determining standards and methods of measurement that impact directly on the ability of Canadian firms to trade internationally. The increasing globalization of trade over

the last two decades, including regional trade agreements and organizations such as the World Trade Organization, has made metrology and the establishment of national measurement standards a key element for export dependent economies, such as Canada. Over 35% of Canadian GDP is directly dependent on exports, four times the level of the United States. NRC-INMS plays a vital role in assuring global market access to Canadian industry by reducing non-tariff trade barriers. NRC-INMS will continue to work internationally, particularly with the Security and Prosperity Partnership with Mexico and the U.S., toward establishing mutual recognition of standards for testing and measurement in the automotive and chemical sectors, as well as the development of regulatory standards for nanotechnology and other emerging technologies. Canada's participation in establishing the initial standards for emerging technologies will provide a competitive edge to innovative Canadian firms, providing them with early access to state of the art international standards for effective participation in global markets.

The demand for advanced measurement standards for Canada's key industrial sectors and emerging sectors, such as biotechnology and nanotechnology, is increasing at a previously unseen pace. For example, several International NMIs have stated that metrology has to advance in parallel to nanotechnology research for the technology to gain acceptance and be transformed into product applications. Over the planning period, NRC will be preparing a proposal for the renewal of the Canadian strategic measurement innovation infrastructure in support of industrial innovation and the export of high technology products.

Leverage "Big Science" partnerships – TRIUMF (Tri-University Meson Facility) is one of the country's key investments in "Big Science" infrastructure. It provides world-class facilities for research in sub-atomic physics, nuclear physics, nuclear astrophysics, life sciences and condensed matter and encourages the transfer of technology developed at the laboratory to the marketplace. NRC provides funding for the facility on behalf of the Government of Canada via a contribution agreement. TRIUMF has a 2005-2010 Plan, with five-year funding totalling $222 million.

Facilitate the implementation of Canada's Long Range Plan for Astronomy and Astrophysics (LRP). The Herzberg Institute of Astrophysics (NRC-HIA) plays a unique role in implementing the LRP. It is within NRC's mandate to manage national astronomy observatories and to facilitate Canadian academic access to international facilities including the Canada-France-Hawaii Telescope (CFHT), the James Clerk Maxwell Telescope (JCMT) and the Gemini Telescopes. NRC-HIA also provides data management and processing support that allows astronomers worldwide to work with the latest information. Canada ranks among the world leaders for excellence in astronomy research and for economic-industrial benefits accruing from activities in astronomy. Canadian industry is the world leader in observatory construction, which is directly related to the integrative approach promoted by NRC-HIA. NRC brings research, technologies and industrial links together in delivering its mandate to provide access to international S&T infrastructures to the Canadian Astronomy Research Community.

Astronomy represents significant value to Canada. Research and knowledge transfer from astronomy and astrophysics provides social and economic benefits in far-ranging areas, from medical resonance imaging in the health sector, to remote sensing, to advances in telecommunications. LRP is a ten-year strategy to maintain Canada's position as a world leader in both the scientific and industrial development aspects of astronomy and astrophysics. Working closely with Canadian universities, Natural Sciences and Engineering Research Council (NSERC), the Canadian Space Agency and the Association of Canadian Universities for Research in Astronomy (ACURA), as well as industry partners, NRC-HIA has had a major role in delivering a number of projects under the LRP. Currently, the Atacama Large Millimeter Array

(ALMA), a World Observatory now under construction in Chile, is the only new international project in the LRP to which NRC is committed. Early phase work is also underway for the two longer-term priorities of the LRP, the Thirty Metre Telescope project and the Square Kilometre Array. While the government has provided incremental funding and other support to the LRP through organizations such as NRC, to continue to meet its obligations to international partners, NRC will need new investments beginning in 2007, when funding for NRC's share of LRP projects ends. In addition, there are three LRP next-generation ground based telescopes, which are international projects that will require a considerable investment of resources if Canada is to continue to participate in a significant way. Over the planning period, NRC will continue to coordinate discussions with key stakeholders and will be seeking a policy decision on Canada's national programs in astronomy and astrophysics, as well as additional funding for its share of future LRP projects.

Work with partners in industry and academia to enable leading edge research – The Canadian Neutron Beam Centre (CNBC), part of the NRC-SIMS, enables neutron beam experiments to be undertaken on behalf of universities, industry and government researchers across Canada and internationally. It is a facility for developing new experimental methods, for exchanging knowledge among visiting scientists and staff, and for enabling the convergence of ideas, theories, and experiments to address problems of relevance to Canada and the world. The Centre is one of about 20 similar neutron scattering facilities worldwide and a key part of Canada's science infrastructure. Neutron beams are a unique source of very valuable data about materials and contribute to advances in physics, chemistry, life sciences, materials research, and engineering. Research undertaken at the CNBC has resulted in many benefits to Canadians including health and the economy (Canada is a leader in producing medical isotopes for cancer treatment); industrial competitiveness (product improvements in jet aircraft, plastics, gas pipelines, metals and ceramics, etc) and in supporting Canada's nuclear energy industry (ensuring the safety and longevity of nuclear reactors in Canada). Over the planning period, CNBC will be focusing on applying new neutron beam methods to soft materials and nanostructures. In addition, a new, specialized spectrometer being installed this year promises to make significant contributions to hydrogen research by enabling the study of new hydrogen storage materials.

Priority 2: Community Technology Clustering Initiatives

Canada's private sector is dominated by SMEs, of which 98% have fewer than 100 employees. Within this context, Canadian SMEs often lack the capacity to invest in innovation to take full advantage of the outsourcing and off shoring realities of globalization, and realize the opportunity that would make them key players internationally. Canada needs to develop a dynamic environment that boosts the growth of its companies – from energetic and aggressive SMEs to large, globally competitive firms. Clusters are broadly based community partnerships that focus on achieving competitiveness for Canadian industry and, as such, are an appropriate mechanism to encourage SMEs to invest together and share risks in pre-competitive R&D.

Nations around the world have recognized the central role of science and technology in addressing the challenge to competitiveness and productivity caused by the advent of globalization. Many countries have recognized the importance and potential of technology clusters. Technology clusters are broadly based community partnerships focused on building competitive advantage through research and innovation. Business, academia, and governments form partnerships. Typically, the partners jointly develop a

technology roadmap to identify critical research and technology domains important to the community. This is the basis for coordinated and integrated action. Clusters are recognized as requiring 10-20 years to mature before full results are achieved.

A cluster's lifecycle can be broken down into several phases. Phase 1 - the first five years - focuses on augmenting the research and innovation capacity in communities. Phase 2 - the next five years - focuses on attracting additional private sector partners, a more comprehensive integration of community players, the operation of infrastructure and technology transfer and commercialization. Almost three quarters of NRC's cluster initiatives are in, or are approaching, Phase 2 of their development lifecycle. Future phases of NRC's cluster initiatives will need to be tailored to individual circumstances and progress. That being said, commercialization is the central theme in all-later phases.

In response to the economic challenges noted above, the Government of Canada has injected staggered investments of $480 million in NRC's 11 cluster initiatives since 1999/2000. To date, NRC has received two investments from the Government of Canada for its Atlantic Canada cluster initiatives (Round I funding). It is currently seeking to renew investments in Central and Western Canada technology cluster initiatives (Round II funding), and, in 2007-2008, NRC will be approaching the Government of Canada to seek reinvestment in its Charlottetown, PEI and Regina, Saskatchewan cluster initiatives (Round III funding). Table 1-5 provides a list of NRC's cluster initiatives, their funding cycles and financial resource allocations that have been made to date.

Table 1-5: Allocation of Resources for NRC Technology Cluster Development

Location	Focus	Resources
2005-2006 to 2009-2010		
Halifax, NS	Life Sciences (NRC-IMB and NRC-IBD)	$19.5 million
Fredericton and Moncton, NB	Information Technology and e-Business	$48.0 million
St. John's, NF	Ocean Technologies	$16.0 million
Atlantic Canada	Coordination, administration, special studies, innovation assistance, S&T knowledge,/ information dissemination	$26.5 million
2002-2003 to 2006-2007		
Saguenay-Lac-Saint-Jean, QC	Aluminium Transformation	$27.0 million[1,2]
Ottawa, ON	Photonics	$30.0 million
Winnipeg, MB	Biomedical Technologies	$10.0 million
Saskatoon, SK	Plants for Health and Wellness	$10.0 million
Edmonton, AB	Nanotechnology	$60.0 million[1,3]
Vancouver, BC	Fuel Cells and Hydrogen Technologies	$20.0 million
2003-2004 to 2007-2008		
Charlottetown, PEI	Nutrisciences and Health	$ 20.0 million
Regina, SK	Sustainable Urban Infrastructure	$ 10.0 million

1: An additional $5 million was received in 2001-2002
2: CED contributed an equal amount
3: The Province of Alberta also contributed $60 million

Planned Strategies

Over the planning period, NRC will:

- Contribute to the economic viability of Canada's communities
- Help connect industry and key innovation players
- Focus on cluster growth to create critical mass and build community innovation capacity
- Develop a medium for regional delivery of national initiatives

Key Influencing Factors

NRC is actively supporting the Government of Canada's commitment to improving Canada's productivity and competitiveness through community-based technology cluster initiatives – NRC's technology clustering activities build on existing local strengths by: undertaking R&D that responds to cluster needs; collaborating with partners (particularly firms); fostering networking; and providing industry with access to pre-commercialization assistance, such as incubation opportunities and financial and technical advisory services.

Development of sustainable technology clusters requires attraction and retention of sustained resources from key cluster stakeholders – Dynamic technology clusters require specialized infrastructure, highly-qualified people, risk capital, and the ongoing and active support of local stakeholders to sustain growth and generate economic and social benefits for Canadian communities.

NRC is implementing new tools and approaches to track the growth of its investment in regional clusters – NRC has developed a unique cluster measurement approach that collects comprehensive data on cluster development and the role of NRC. This cluster measurement approach will be used as part of the evaluation of NRC's Round II and III Clusters and will enable NRC and its partners to track cluster growth over time and identify areas for concerted action.

PLANNING HIGHLIGHTS

Strategy: Contribute to the economic viability of Canada's communities

Engage and link community groups through horizontal support (NRC-IRAP and NRC-CISTI)
NRC's Industrial Research Assistance Program (NRC-IRAP) continues to engage and link regional groups as part of developing the technical, financial and business networks vital to cluster development. NRC-IRAP builds innovation support capacity that benefits all SMEs by providing expertise, advice and financial assistance to organizations. To foster specific cluster development, NRC-IRAP will take on a leadership role in collaborating and developing integration between regional players in order to strengthen the required integrated regional innovation infrastructure. NRC-IRAP will also directly impact firm growth within the cluster by providing non-repayable contributions on a cost-sharing basis for their technological research projects.

In various clusters, NRC-CISTI has established NRC Information Centres (NIC), co-located at NRC institutes. NICs offer scientific, technical, medical, and business-related information and analysis services to NRC researchers, companies located onsite, and external clients in the region. NRC-CISTI will partner with institute outreach activities to promote and deliver an integrated package of services to regional clientele.

Strategy: Help connect industry and key innovation players

Expand network of Industrial Partnership Facilities (IPFs) – In support of its cluster development activities, NRC will continue to develop, build, and operate Industry Partnership Facilities across Canada. These unique facilities are workplaces for collaborative research and the incubation of new firms and NRC spin-offs. They also serve as community resources for access to mentoring, innovation financing and competitive technical intelligence for new enterprises. In 2006-2007, NRC had 16 IPF locations across the country with a complement of 116 incubating firms. With the addition of two new facilities (Edmonton and Charlottetown) in 2006-2007, this brings the total space available in IPFs to 29,989 square metres.

Enhance collaborative partnerships – The full development of NRC cluster initiatives is expected to be a long-term commitment, with a cluster taking at least 10 to 20 years to reach full maturation. NRC will increase its efforts to develop collaborations and partnerships with industry and engage stakeholders to contribute to the development of clusters across Canada. NRC-IRAP's involvement will increase significantly in Phase 2 of a cluster's lifecycle. NRC-IRAP will become a key integrator and attractor, and will bring synergy to the clusters. NRC-IRAP's approach to building and supporting technology clusters differs from, and builds on, its usual method of reacting to a specific firm need. Its cluster approach is community, not firm-based; proactive, not reactive; benefits are intended to accrue to all players within the cluster supply chain, not just one firm; and support is targeted to the specific needs of the cluster's stage of development, not on one organization's readiness.

Strategy: Focus on cluster growth to create critical mass and build community innovation capacity

The successful growth of dynamic technology clusters will not be the result of a single organization – clustering is a collaborative and iterative process that requires active commitment from all stakeholders. NRC is uniquely positioned to contribute to the growth of Canadian technology clusters by:

- Bringing the leadership needed to gather stakeholders together to define a collective vision
- Building trust within a cluster by fostering networking and collaborative R&D between firms
- Motivating other levels of government to share in the vision
- Maximizing the use of scarce resources by leveraging funds (e.g. investing in much-needed scientific infrastructure, sharing experts between universities and NRC labs)
- Establishing a focal point for the cluster by acting as a neutral ground for the private sector to meet and attract in outside investment

- Identifying bottlenecks to SME growth, and creating targeted solutions for technology transfer and commercialization
- Connecting firms and researchers across the country and around the world through its national mandate and international reputation

The following are examples of early-stage cluster initiatives that NRC intends to move forward:

Nanotechnology (Alberta) – NRC is helping Canada stake its place in nanotechnology through its role in NINT. Established in 2001 with five year funding, NINT is a multi-disciplinary institution funded by the federal government, the University of Alberta and the Government of Alberta. NINT's goal is to deliver nanotechnology applications in areas that can create and grow a sustained cluster of high technology industries that deliver social and economic benefits to Alberta and to Canada.

The main focus of NINT's research is the integration of nano-scale devices and materials into complex nanosystems that are connected to the outside world. The long-term objective is to discover "design rules" for nanotechnology, and to develop platforms for building nanosystems and materials that can be constructed for specific applications. NINT will be a key participant in the planned NRC cross-council program on nanotechnology, and in particular, will work with NRC-INMS on measurement science in support of nanometrology. NINT will continue to work with nanoMEMS Edmonton and Tec Edmonton to bring together local proponents, and accelerate the growth of nanotechnology by attracting firms and investment to the region. The NINT building includes incubation space for companies, and NINT expects to have two companies in residence by the end of 2007/2008. Capacity in packaging and assembly, and market-facing product development was identified as a critical need for the region, and both NINT and NRC-IRAP will continue to be involved in the development of the proposal for the Alberta Centre for Advanced MicroNanoTechnology Products (ACAMP).

Biosciences (PEI) – Since 2003, in working closely with the PEI biosciences cluster, the Institute for Nutrisciences and Health (NRC-INH) has helped to double the number of biotechnology companies in PEI (20 to 40). The numbers of biotechnology jobs have grown by approximately 55% (from approximately 450 to 700 FTEs) and sector revenues by 50% ($41M to $62M). NRC-INH has been involved in three successful Atlantic Canada Innovation files (Chemaphor, Phycobiologics and ACBV), which helped secure three new companies into the cluster and over $13M in additional funding over a 5-year period. NRC will continue supporting this cluster through its stages of development.

Strategy: Develop a medium for regional delivery of national initiatives

Clusters offer NRC a tool for better understanding regional economies, R&D needs and commercialization gaps. By pulling key industry stakeholders together (in the form of cluster initiatives) to address common innovation-related problems and challenges, NRC is better able to tailor its national network of R&D resources to meet the needs of innovative communities across Canada.

By establishing regional networks of clusters of firms and other community stakeholders, NRC is ensuring that its national R&D and commercialization support programs are accessible and remain regionally relevant. Overall, NRC's cluster initiatives give Canada's national R&D organization the capacity to:

- better understand the innovation needs of regions
- engage regional industry leaders to determine how best to deliver nationally-driven services and support
- physically deliver regionally tailored R&D and commercialization services and support that meet the needs of private industry

Build on successes from NRC's Atlantic Initiatives, Phase I – NRC will continue to nurture the growth of its Atlantic cluster initiatives by maintaining leading-edge research capabilities (infrastructure and human capital), developing research collaborations with cluster firms, fostering increased networking and knowledge-sharing, and supporting the involvement of firms and other partners in the cluster.

- **Information Technology (New Brunswick)** – NRC-IIT is continuing to be a key provider of innovation infrastructure and programs to bridge R&D to innovative New Brunswick products. One key initiative is the Cancer Populomix Institute, a collaboration among UNB, Université de Moncton, the New Brunswick Innovation Foundation, the Beauséjour Medical Research Institute, Dalhousie University, and NRC-IIT. The aim of this collaborative group is to advance research for the prevention and early detection of cancer. NRC-IIT is contributing to the undertaking through the development of tools that will assist in the analysis of DNA microarray data. This technique for tumour classification and analysis may lead to dramatic improvements in cancer detection and treatment regimes, and shows potential for application across a spectrum of disease issues.
- **Ocean Technologies (Newfoundland and Labrador**) – NRC-IOT will continue to lead the ocean technology cluster-building process by working with industry, government and academia. Building on Atlantic Investment Partnership (AIP) funding, NRC-IOT has opened the Ocean Technology Enterprise Centre (OTEC), a hub designed to bring together key services (SME partners, IRAP, CISTI and cluster initiatives) to produce new economic development endeavours and support ocean technology company growth. NRC-IOT will also work with Ocean Advance to develop and implement a community-wide action plan.
- **Life Sciences (Nova Scotia)** – In 2005-2006 the Institute for Marine Biosciences (NRC-IMB) partnered with BioNova, the Nova Scotia biotechnology industry association, InnovaCorp (a provincial economic development organization), Nova Scotia Office of Economic Development, Atlantic Canada Opportunities Agency, and Nova Scotia Business Inc. to facilitate the development of a roadmap for the revitalization of the cluster. Stage one of the process, the Asset Map, has been completed and the request for proposal for stage two is in preparation. The Atlantic Commercialization Centre (ACC), located in the IPF, currently houses the Business Development Officer for the Institute, a Senior Life Sciences Development Officer dedicated to working with the Life Sciences Community, an NRC-IRAP Industrial Technology Advisor, and a Cluster Administrative Assistant, thus providing an integrated approach to NRC's presence in the community. Through ACC programs, a new collaboration with the only local public life sciences company, MedMira, has been initiated and is geared towards discovery and commercialization of breast cancer biomarkers. The Industry Partnership Facility currently houses eight organizations.

  A large new laboratory for NRC's Institute for Biodiagnostics (NRC-IBD) -Atlantic and its partners has just been completed at the IWK Hospital in Halifax. It will house a 3 Tesla MRI for animal studies, as well as a vertical bore 7T instrument for solution studies. The 3T system has been donated by NRC-IBD, and the 7T system by NRC-IMB. Collaborations will be with a wide variety of organizations, including Dalhousie University. When all instruments are operating, Halifax will have one of the best MR imaging laboratories in Canada. NRC-IBD Atlantic's 4 Tesla MRI at the QE II hospital is

outperforming its specifications and running many human protocols. It was built and commissioned by the NRC-IBD spin off company IMRIS.

Encourage more involvement / commitment of cluster partners – During the planning period, NRC will follow up on lessons learned from the evaluation of its Atlantic Canada cluster initiatives, and will build upon existing successes, such as:

- **Manitoba Cluster -** The rapidly growing NRC-IBD spin-off company IMRIS is but one example of a success in Manitoba's biomedical cluster. It has moved into new quarters in Winnipeg to accommodate its 70 employees and several demonstration systems. The company has recently been valued at $60M, demonstrating some of the economic benefits of NRC activities. It has successfully penetrated the US market and has an impressive order book. Several US hospitals with the IMRIS equipment have been advertising the value of the instrument very aggressively, including a live web cast of a neurosurgery using the device at the Boston Children's hospital.

- **Canadian Photonics Fabrication Centre (Ontario**) – CPFC, a partnership among NRC, the Province of Ontario, and Carleton University was officially opened in 2005, filling an important gap in the photonics community by providing not only fabrication and prototyping services, but also expertise and advice through the NRC-IMS. CPFC is the only industrial fabrication facility for photonics components in Canada, and one of the few in the world. CPFC not only extends its services to the local SMEs that have emerged in the wake of lab closures at JDS Uniphase and Nortel Networks, but to firms and photonics clusters across Canada. CPFC's services substantially reduce start-up and production development costs, helping to reduce technology risk for Canadian firms, and mitigating investment risk to support venture capital investment. A technology roadmapping exercise is planned with clients and partners to determine which other platforms should be selected for CPFC's future directions.

Priority 3: Integrated Industry Support that Engages Key Players

The forces of globalization are placing increasing pressure on Canada's competitiveness – making innovation an imperative for economic survival. In 2004, Canada's ratio of Gross Expenditures in Research and Development (GERD) to Gross Domestic Product (GDP) (1.91%) fell short of the Organisation for Economic Co-operation and Development (OECD) average of 2.24%.[2] While Canada's Industrial Research and Development spending rose 1.6% to $13.8 billion in 2005[3], it remains 3.3% below the peak level of $14.3 billion observed in 2001.

In Canada, 98% of firms have fewer than 100 employees, the majority of which do not have the resources or the capacity to either develop their own or contract out significant R&D projects. With its industrially-focused technology support, NRC's role becomes even more important. For the planning period, NRC will build upon its critical mass and expertise in key technologies, knowledge transfer mechanisms, business support facilities and services across Canada to strengthen innovation and growth in Canadian businesses. It will also continue to develop strategic initiatives to help Canadian businesses better compete in the global marketplace.

[2]OECD, Main Science and Technology Indicators, GERD as a percentage of GDP, p.18, Volume 2005/1
[3]Statistics Canada, Service Bulletin, Science Statistics, Industrial Research and Development, June 2005

Planned Strategies

Over the planning period, NRC will:

- Increase the innovation capacity of small and medium-sized enterprises (SMEs)
- Help industry manage risks as new products are developed and marketed
- Offer S&T information and intelligence to industry
- Offer comprehensive commercialization support, including technology transfer and IP management

Key Influencing Factors

Innovation plays a key role in economic progress and raising living standards, and SMEs are a key source of innovation for Canada but challenges still exist:
SMEs account for over 95% of manufacturing enterprises and an even higher share in many service industries.[4] However, SMEs are struggling to survive and grow as approximately 20% exit in the first year and many more leave the market during the second year.[5] Interestingly, high-knowledge firms experience faster growth and tend to have a survival rate higher than low-knowledge firms.[6] There is now a fundamental shift in how firms generate new ideas and bring them to market. In today's connected world, the commercialization challenge is not simply one of producing the best product. Entrepreneurs and innovative firms require certain business expertise, and experience to complement their knowledge, intelligence, and skills, sometimes even before they recognize their importance. Continued support of SMEs is essential to building Canadian industrial innovation and growth.

PLANNING HIGHLIGHTS

Strategy: Increase the innovation capacity of small and medium-sized enterprises (SMEs) and help industry manage risks as new products are developed and marketed

Build innovation capacity within SMEs – NRC-IRAP is the agency's innovation and technology assistance program in support of Canadian SMEs. Since its inception close to 60 years ago, the program has broadened its strategic purpose from a limited focus on technology transfer to its current strategic objective of increasing the innovative capabilities of Canadian SMEs. Today, NRC-IRAP provides comprehensive innovation assistance to technology-based SMEs in almost every industrial sector of importance to Canada's current and future economic development. SMEs engaging in high-risk, technologically sophisticated R&D face increasingly complex challenges. NRC-IRAP will support these technology-based SMEs in growing and becoming more competitive by focusing on: increasing the rate of

[4] SME and Entrepreneurship Outlook, Organization for Economic Co-operation and Development (OECD), 2005.
[5] ibid.
[6] Business Dynamics in Canada 2001, Sri Kanagarajah, Statistics Canada, 2005 (high knowledge industry is defined as high R&D and capital intensive)

growth of SMEs; expanding the number of SMEs that successfully commercialize their products, services and processes; assisting with potential international collaborations on technology development projects; and providing international opportunities to clients looking to gain knowledge to advance their R&D projects.

Build on the success of the Competitive Technical Intelligence (CTI) program: NRC-IRAP and NRC-CISTI will continue to develop CTI services in order to provide best-in-class strategic advice to Atlantic cluster participants and optimize NRC investments. For example, NRC-IRAP and NRC-CISTI have added a Technical Business Analyst presence in St. John's NL and are integrating CTI advice into NRC-IRAP's portfolio of services to Atlantic and Nunavut firms. NRC-CISTI and NRC-IRAP are also working together to provide CTI to SMEs in other parts of Canada, including Montreal, Winnipeg and Edmonton. NRC-IRAP has developed an in-house capability to capture CTI, and as a next step, will integrate this information into the strategic planning and business strategies of client firms.

Strategy: Offer S&T information and intelligence to industry

Scientific and Technical Information – The Canada Institute for Scientific and Technical Information (NRC-CISTI) is Canada's national science library, and the largest comprehensive source of scientific, technical and medical (STM) information in North America. Through its publishing arm, NRC Research Press, NRC-CISTI is also Canada's foremost scientific publisher. NRC-CISTI's information specialists, technical business analysts and technical information analysts provide value-added information services and competitive technical intelligence reports to NRC-IRAP SMEs, NRC researchers, and other clients through the NRC Information Centers co-located with NRC institutes across Canada.

NRC-CISTI's Strategic Plan 2005-2010 sets out its vision: to be a leader in driving the exploitation of scientific information to create value for Canadians. Its mission is to advance research and innovation through high-value information and publishing services in science, technology and medicine.

NRC-CISTI will create value for Canadians by improving the flow of scientific information in three ways:

- An integrated "infostructure:" storage of and access to electronic scientific information, using intelligent search and analysis tools. Partnerships will be key to developing this system.
- Scientific publishing infrastructure, using online peer review, editing and publishing tools that will shorten the time between discovery and publication without sacrificing quality.
- Services to support commercialization and SMEs, such as Competitive Technical Intelligence and patent information analysis – "actionable" information.

Companies in NRC industrial partnership facilities are key clients and will be offered enhanced services to support their research and development activities.

Strategy: Offer comprehensive commercialization support, including technology transfer and intellectual property management

During 2006-07, NRC undertook an in-depth examination of all its industry support programs, policies and practices as part of a project called Business Review. This Business Review project was launched to ensure NRC was well-equipped and well-positioned to carry out client based activities described in NRC's Strategy, *Science at Work for Canada*. Recommendations from the Business Review project include: working increasingly on an industry-sector basis; increasing NRC's capacity to develop industrially relevant technologies and their commercialization; and ensuring NRC's internal operations make it easier for our Institutes and Programs to serve clients. In early 2007, NRC senior executives are expected to prioritize Business Review recommendations for implementation over the five-year period covered by the Strategy.

Improve NRC's Intellectual Property Management: Guided both by a 2003 benchmarking study of best practices in Intellectual Property (IP) management, and the results of the Business Review project (described above), NRC will continue to strengthen its IP management. Specific activities will include: increased focus on high value IP; increased use of technology assessments; increased market research tools; and adoption of the world's best practices and tools. As well, NRC's corporate business office will undertake an innovative invention disclosure review process that promises to provide better guidance to institutes. This process will also engage the breadth of NRC's Technology and Industry Support expertise and seek opportunities for technology bundling and convergence.

Priority 4: Program Management for a Sustainable Organization

The ability to perform at the leading-edge of R&D and to support Canadian industry in becoming more technology intensive and innovation-driven requires the best available equipment, facilities and highly qualified scientists, engineers, technicians and other professionals. NRC faces challenges in sustaining these key resources and will continue to focus on strategies to address these challenges.

Planned Strategies

Over the planning period, NRC will:

- Reposition for the future through the NRC Strategy, *Science at Work for Canada*
- Address its Management Accountability Framework commitments
- Continue to address the recommendations of the Auditor General of Canada

Influencing Factors

Looking forward: science and technology for the 21st century – NRC's Renewal Initiative has included foresight enquiry, studies of global and national challenges, national stakeholder consultations and dialogue with the federal science community and central agencies about the role and expectations for NRC. The results were crafted into a vision and strategic direction in the Spring of 2006. Since then, the Renewal Initiative has moved into Phase 4 to focus on the implementation and monitoring of NRC's Strategy.

Taking action to be a more flexible, adaptable organization – Today's organizations must be able to make timely decisions in order to respond quickly and appropriately to constantly changing external opportunities, challenges and risks. NRC will need to strengthen and better integrate its planning, risk and performance management capabilities to support effective

decision-making and priority-setting by Senior Management and NRC institutes, programs and branches.

Need to attract, develop, and retain highly qualified personnel – The key to NRC's performance and success is the knowledge, imagination, dedication and creativity of its staff. NRC's ability to attract, train and retain highly qualified S&T professionals is critical. Approximately 25% of NRC's S&T professionals and 39% of NRC's management cadre will be eligible for retirement by 2011. Current HR literature identifies looming shortages of skilled workers and competition for rare talent as significant threats. Over the planning period, NRC will ascertain the impact of these predicted trends on our ability to attract and retain our critical workforce.

Need for increasing horizontal S&T linkages among S&T-based departments and agencies – The Government is striving to increase horizontal S&T linkages among S&T-based departments and agencies to ensure the optimization of federal S&T investments. To this end, NRC is actively involved in the S&T Integration Board and the Senior ADM Advisory Committee (SAAC). To optimize its future performance, NRC will need to manage its human resources along cross-functional, cross-organizational and multi-disciplinary lines.

Addressing significant budget pressures around NRC's on-going operations, buildings and equipment – As part of the implementation of its strategy, NRC will need to formulate a long-term financial plan to deal with significant pressures ranging from a relatively flat A-base (operating and capital) over the past decade to ever-increasing facilities and equipment pressures arising largely out of the rapid pace and evolution of science and technology, higher industry standards, and the natural ageing of our infrastructure. A Long-Term Capital Plan will be developed, looking at the challenges of maintaining and repairing 175 buildings across the country, 60% of which were constructed over 30 years ago. Furthermore, NRC continues to address significantly rising energy costs. Despite a number of innovative measures to achieve energy savings, these costs have risen from $19 million in 1998-99 to $32.25 million in 2004-05. A sound financial strategy is an essential cornerstone of NRC's immediate and long-term capacity to contribute to Canada's productivity, standard of living, and other key national priorities. Priority-setting and resource allocation decisions will be central to this strategy.

Addressing recommendations made by the Office of the Auditor General of Canada and Management Accountability Framework commitments – The OAG notes NRC's good progress in addressing the recommendations of its 2004 audit while acknowledging that the process of consultation and development of NRC's new strategy (the NRC Strategy) has not allowed NRC to move as quickly as possible on some. With the new Strategy now in place and with a corporate business plan due in March, 2007, NRC should be in a better position to address the remaining issues more directly and more effectively. Since 2004, NRC has made satisfactory progress in 7 of 10 areas examined. These include corporate governance, corporate strategic direction, and human resources management. More progress is required in the documenting of key decisions at the institute level and in performance measurement and reporting. In implementing this strategy and its complementary business plan over the coming years, NRC is committed to ensuring that the excellence of its research is matched by the highest quality management of all of its programs, processes, and resources.

PLANNING HIGHLIGHTS

Strategy: Implementation of NRC's Strategy: *Science at Work for Canada*

Key projects supporting the implementation of NRC's Strategy include:

New corporate business plan – NRC's Strategy, *Science at Work for Canada*, will continue to be implemented over the planning period. At the beginning of 2007/08, NRC will put in place a corporate business plan to help transform its strategy into operational details. NRC's priorities under the business plan will focus on ensuring the organization's financial sustainability, the implementation of new R&D initiatives (including cross-cutting programs involving other science-based departments and agencies) aimed at addressing the needs of key economic sectors and enduring issues critical to Canada's future, and sharpening the focus of NRC's R&D program portfolio. The actions described in the business plan will help guide NRC's operational activities over a three-year period.

An integrated solution to planning, risk and performance management – In 2007/08, NRC will formally implement an integrated management framework for providing senior management and NRC Institutes, Programs and Branches with the planning and performance information they need to support integrated decision-making, resource allocation and functional planning (human resources, capital assets and finance). This framework aims to embed modern management practices in the planning and performance management process (e.g. risk and research management) and minimize the reporting burden (one-pass planning and reporting). As part of this solution, NRC will review its Program Activity Architecture (PAA) to ensure it reflects the organization's strategic direction and management of resources.

Strategies for sustainable resources – Faced with ongoing resource pressures, NRC will need to make more strategic choices regarding the use of future resources. This will involve:

- **Addressing funding issues** – NRC will continue to prioritize key R&D and technology and industry support activities, initiatives and programs in the context of the organization's strategy. It will also produce strategies and mechanisms for ongoing reallocation and conduct efficiency improvement reviews to ensure effective investment of resources for sustainability in priority areas.

- **Talent Management** - During 2007/2008 the Human Resources Branch will prepare a business plan for 2007-2010. As part of the process, an environmental scan will be conducted, including administration of a client survey to determine HR needs and challenges. In addition, the integrated business planning process, which includes HR planning, will offer an opportunity for HR planning information to be systematically analyzed and addressed.

  Our HR planning, performance management and succession planning processes will be examined with a view to supporting NRC's strategy. Performance measures will be established to enable us to track our progress over time in key areas of recruitment and retention. We will critically assess issues of attraction, retention and workforce planning, so as to diagnose the extent to which these issues will impact NRC and to develop a strategy to mitigate them.

A comprehensive learning plan for NRC will be developed, with a focus on NRC's strategic objectives of organizational agility and horizontality. With our counterparts in the Federal S&T Community, we will continue to work at addressing the key HR Barriers impeding horizontal collaboration across the Science Based Department and Agencies (SBDA). More specifically, NRC will continue to play a leadership role in the coordination of this work through its direct involvement in co-chairing the Strategic Renewal Group in response to the SAAC agenda.

- **Maintaining and upgrading NRC S&T infrastructure** – In addition to ongoing infrastructure modifications and upgrades to address specific research/program requirements, NRC has budgeted $2.5M annually to address urgent rust-out concerns identified through a Long Term Capital Planning exercise. Projects with a health and safety component will be the top priority, followed by those that address life cycle management. The Treasury Board Secretariat-led Capital Asset Review will provide additional context regarding how NRC manages its assets.

- **Developing three-year NRC Communications Outlook** – NRC continues to implement a three-year Communications Outlook (to be updated annually) that positions, profiles and promotes the organization's unique contributions to national S&T and innovation priorities in support of industry, as well as the creation of true economic value and social benefits for Canada and all Canadians. NRC will implement recommendations from a comprehensive NRC Communications Situation Assessment undertaken to align and position NRC's communications function, organization, structure and resources in support of major NRC and relevant Government of Canada business priorities. In addition, NRC will continue its involvement in interdepartmental and government-wide horizontal S&T and innovation initiatives, including the Oceans Action Plan, the Canada-U.S. Enhanced Representation Initiative, the S&T Integration Board Communications Committee and the Government of Canada S&T web portal. Finally, NRC will develop and implement a strategy to guide NRC internal communications, with particular focus on supporting the implementation of NRC's strategy.

- **Creation of an Audit, Evaluation and Risk Management Committee of Council** – NRC recognized the importance of the internal audit function through the creation in 2005 of an independent Audit, Evaluation and Risk Management Committee of Council, which includes external members. NRC is committed to having and maintaining a strong and effective internal audit infrastructure in the years ahead. This will be accomplished through the provision of adequate financial and staffing resources to fully carry out its mandate. NRC will also amend its Internal Audit Charter to reflect the provisions of the government's new 2006 Internal Audit Policy.

NRC's strategy implementation initiatives will help address Management Accountability Framework commitments.

Strategy: Continue to address recommendations of Auditor General of Canada

Implement Action Plan on recommendations of the Auditor General of Canada – The OAG has made subsequent recommendations to NRC in the areas of corporate governance, setting of corporate strategic

direction, research management at the institute level, human resources management, and performance measurement and reporting.

OAG Recommendations	NRC Response
Corporate Governance	▪ NRC will continue to advise the government of its view of the general profile for its ideal membership on Council to assist it in appointing new Council members in a timely fashion. ▪ NRC will continue to develop and communicate lists of candidates based on this profile, to the Minister of Industry, the Industry Portfolio, as well as to the Privy Council Office. ▪ The National Research Council is in the process of clarifying Council's role as mandated by the *National Research Council Act*. This clarification, expected to be completed by the end of 2007, will be embedded thereafter in the orientation of new members.
Setting of Corporate Strategic Direction	▪ NRC's Corporate Business Plan, which operationalizes the NRC Strategy, will be completed by March 31, 2007. NRC will continue to monitor its implementation for important milestones and risks.
Research Management at Institute Level	▪ Best practices will continue to be developed and strengthened as part of the Planning, Performance and Resource Management (PPRM) project for implementing the NRC Strategy. Mechanisms will be developed as part of the next project planning cycle for 2007-08 to ensure their transfer and application throughout the National Research Council.
Human Resources Management	▪ The National Research Council, as part of the "One NRC" implementation project of the NRC Strategy, will integrate compensation, rewards, promotions, awards and other forms of recognition, recruitment, succession planning and performance planning with the strategic priorities of the NRC Strategy. This will be done via NRC's business planning process. ▪ The NRC Corporate Business Plan which will be released in March 2007 will reflect NRC's priorities for the next three years and will capture key human resources requirements to deliver on those

	priorities. ▪ It is anticipated that the strategies to address recruitment, succession planning, performance management and compensation (as it applies to position based classification) will be developed by mid-2007, while strategies to address rewards, promotions, compensation, awards and other forms of recognition will be completed by mid-2008. The priorities for addressing these human resources issues will be confirmed with the development of the NRC Corporate Business Plan.
Performance Measurement and Reporting	▪ The National Research Council is developing a corporate performance framework based on the balanced scorecard approach and directly aligned to NRC's Strategy for March 31, 2007. The integration of the balanced scorecard with NRC's corporate business plan will provide performance measures and costs linked to the NRC Strategy. ▪ The completion of the Management, Resources and Results Structure is scheduled for March 2008 and will be greatly expedited through the newly approved institute, program and branch business planning process which collects all of the information necessary to comply with the Treasury Board Secretariat Management, Resource and Results Structure policy.

SECTION II – ANALYSIS OF PROGRAM ACTIVITIES

This section provides an overview of NRC's Program Activities and how they will be contributing to the organization's priorities and strategic outcome. NRC Program Activities include Research and Development and Technology and Industry Support. These provide a balance between conducting R&D and delivering technical and innovation support services to industry and the public.

Strategic Outcome

An innovative, knowledge-based economy for Canada through research and development, technology commercialization and industry support

Program Activity: Research and Development

This program activity includes research programs, technology development initiatives and management of national science and engineering facilities. These efforts all focus on key technological and industrial areas of Canada's economy where NRC has specific roles and recognized competencies, and where it can have a significant impact.

Financial Resources ($ millions)		
2007-2008	**2008-2009**	**2009-2010**
493.1	469.3	472.8

Human Resources (FTEs)		
2007-2008	**2008-2009**	**2009-2010**
3,160	3,181	3,221

Program Activity: Technology and Industry Support

This program activity includes dissemination of scientific, technical and medical information; provision of innovation assistance and engineering and technology-based facilities; contributions to the commercialization process; intellectual property management; new company creation and strategic partnerships for Canadian SMEs, NRC institutes, the public and other government research organizations.

Financial Resources ($ millions)		
2007-2008	**2008-2009**	**2009-2010**
219.3	224.5	219.5

Human Resources (FTEs)		
2007-2008	**2008-2009**	**2009-2010**
884	895	906

Priority 1: R&D in Key Sectors and Areas Critical to Canada's Future	
Key contributor	Program Activity: Research and Development
Expected results	• Leadership in new and emerging research domains • Excellence in R&D and innovation • Stewardship of large-scale S&T infrastructure • Contribution to federal strategies and initiatives • Research that benefits Canadians • Harmonization of international standards • New international S&T alliances
Performance Indicators	• Technology transfer (patents, licences) • Spin offs/ ins • Publications in refereed journals / proceedings and technical reports • External grants • Leadership and contribution to federal horizontal initiatives • Multi-researcher networks and centres of excellence • Number and value of international collaborative agreements

The Research and Development portfolio will contribute to areas that are recognized as priorities for Canada through its core strengths: national research institutes and innovation dedicated to technology fields important to Canada; value creation through knowledge and technology transfer; the pursuit of leading-edge and integrated research in emerging cross-disciplinary fields; and the creation of economic and social benefits for Canadians. Continued support of Canadian industry and the research community through codes and standards, access to national facilities and stewardship of Canada's "big science" will remain an underlying foundation to global marketplace access and international R&D alliances. The portfolio will also continue to develop new technologies leading to commercialization opportunities for Canadian industry.

Priority 2: Community Technology Clustering Initiatives	
Key Contributors	Program Activity: Research and Development Program Activity: Technology and Industry Support (NRC-IRAP & NRC-CISTI)
Expected results	• Competitive research and development base for cluster development • Innovative firms and deep talent pools in regions across Canada • Community ownership of cluster initiatives – local leadership and strategies • Improved quality of life through increased productivity and new technology-based solutions in health, for industry, the environment, etc.
Performance Indicators	• Size of network and degree of interaction among cluster partners • Increase in research collaborations, licensing, joint patent applications, etc. • New firm formation (firms gravitate to the cluster, incubating firms and co-locating firms, etc.) • Investment attracted to the cluster

NRC is committed to fostering the growth of community-based technology clusters across Canada. NRC's technology cluster strategy builds on existing local strengths by: implementing R&D programs that support local industry needs; providing state-of-the-art facilities, trained personnel,

business incubation opportunities and other specialized services (NRC-IRAP, NRC-CISTI); and supporting the alignment of key stakeholders around community strengths. NRC is currently seeking to renew investments in its Central and Western technology cluster initiatives and will also be seeking to renew Government of Canada investments in 2007-2008 for its Charlottetown, PEI and Regina, Saskatchewan cluster initiatives. The ultimate benefit for Canadians will be the emergence of globally competitive technology clusters leading to higher productivity, new jobs, increased investment and expanded trade.

Priority 3: Integrated Industry Support that Engages Key Players	
Key Contributor	Program Activity: Technology and Industry Support
Expected results	• Advancement of new technology-based companies • Access to new technologies for Canadian companies through patents and licensing • Enhanced innovation capacity of firms • Improved dissemination of knowledge • Supporting the Canadian industry
Performance Indicators	• Technology transfer • Knowledge dissemination • Highly-qualified personnel to Canada • Client success • Economic, social and environmental impact

NRC-TIS will work closely with NRC's Research and Development portfolio to increase the commercialization of research through: technology licensing; provision of pre-commercialization assistance, mentoring and business intelligence to Canadian firms; access to vital national and international networks; knowledge dissemination and expertise; and helping companies create new products and/ or new technologies. In addition, it will collaborate with key partners to develop strategic initiatives to accelerate the successful competitiveness / commercialization of new technologies. NCR-TIS will also help to fuel the growth and innovative capacity of SMEs, and continue to streamline its approach to intellectual property management and the transfer of technology. During 2007-08, NRC plans to examine ways the Council can better support the innovation needs of Canadian SMEs as part of implementing the new Strategy: Science at work for Canada. To speed this examination, the NRC-TIS Portfolio will assemble its own Strategy team to ensure the unique needs of the SME community are taken into consideration.

Priority 4: Program Management for a Sustainable Organization	
Key Contributor	NRC-Wide Contribution: Program Activity: Research and Development* Program Activity: Technology and Industry Support* *(NRC's Corporate Branches actively support the Program Activities' contributions to this priority. The Corporate Branches provide policy, program advice and executive support for the coordination and direction of NRC's operations and the NRC Council. They also specialize in finance, information management, human resources, administrative services, property management and corporate services.)
Expected results	• Establishment of clear corporate strategic direction • Enhanced corporate governance • Enhanced decision support • Effective research management practices • Long-term stability of financial, human and capital resources • Effective communications with NRC stakeholders
Performance Indicators	• HR turnover rates • Sustained investments in priority areas • Evaluation of research management practices • Extent that corporate management framework is used to support/ identify priorities and make management decisions • Extent that NRC Council fulfills its mandated role • Survey with key stakeholders on perception of NRC

An essential component of the implementation of NRC's strategy is to review the value and continuing relevance of NRC's program activities. From an operational perspective, NRC is exploring ways to sustain its asset base in the face of annual inflationary pressures, aging buildings and equipment and a static core budget. The organization will focus on strengthening its management systems and its financial base for future sustainability. This includes continuing to address recommendations made by the OAG.

Organizational Information

NRC Mandate

Under the National Research Council Act, NRC is responsible for:

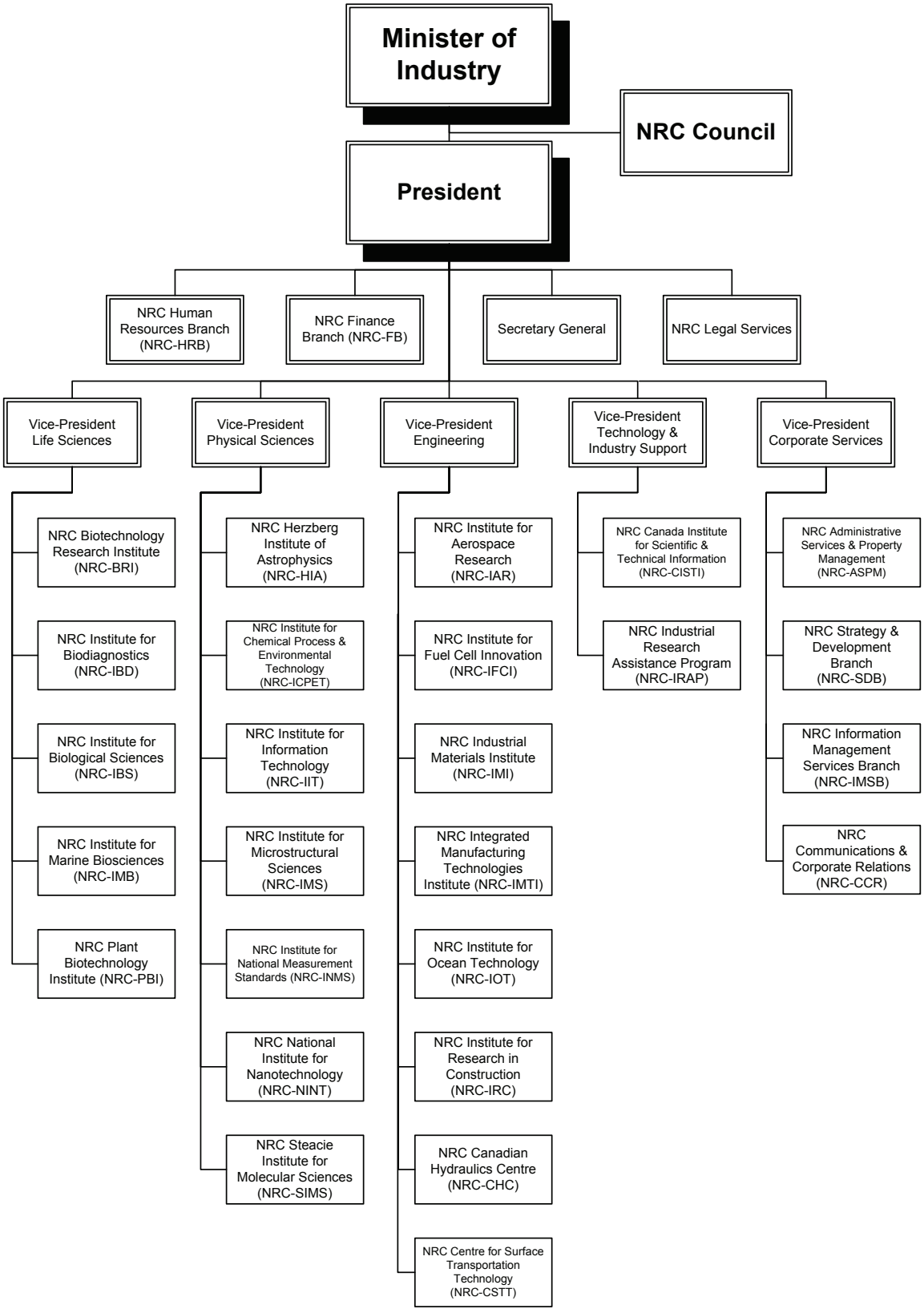
- Undertaking, assisting or promoting scientific and industrial research in different fields of importance to Canada.
- Establishing, operating and maintaining a national science library.
- Publishing and selling or otherwise distributing such scientific and technical information as the Council deems necessary.
- Investigating standards and methods of measurement.
- Working on the standardization and certification of scientific and technical apparatus and instruments and materials used or usable by Canadian industry.
- Operating and administering any astronomical observatories established or maintained by the Government of Canada.
- Administering NRC's research and development activities, including grants and contributions used to support a number of international activities.
- Providing vital scientific and technological services to the research and industrial communities.

Consult http://laws.justice.gc.ca/en/showtdm/cs/N-15 for more details about NRC's legislative framework.

NRC Accountability Framework

NRC reports directly to the Parliament of Canada through the Minister of Industry. NRC works in partnership with the members of the Industry Portfolio to leverage complementary resources and exploit synergies in areas such as innovation of firms through S&T, growth of small and medium-sized firms (SMEs) and economic growth of Canadian communities. The NRC Council provides strategic direction and advice to the President and reviews organizational performance. The President is the leader, responsible for fulfilling corporate strategies and delivering results. Five Vice Presidents (Life Sciences, Physical Sciences, Engineering, Technology and Industry Support and Corporate Services) are responsible for a portfolio of research institutes, programs, and centres. Figure 3-1, provides an overview of NRC's organization.

Figure 3-1: NRC Organizational Chart



NRC Resources

Table 3-1: Agency Planned Spending and Full-Time Equivalents

($ millions)	Forecast Spending 2006-2007[1]	**Planned Spending 2007-2008**	Planned Spending 2008-2009	Planned Spending 2009-2010
Research and Development	498.0	**459.5**	523.5	527.0
Technology and Industry Support	194.4	**212.9**	242.5	237.5
Budgetary Main Estimates (gross)	692.4	**672.4**	766.0	764.5
Non-Budgetary Main Estimates (gross)	0.0	**0.0**	0.0	
Less: Respendable revenue	0.0	**0.0**	0.0	
Total Main Estimates	692.4	**672.4**	766.0	764.5
Adjustments:[2]				
Procurement Savings:				
Research and Development	(1.5)			
Technology and Industry Support	(0.7)			
Biotechnology Budget 99			6.0	6.0
Capital Carry Forward	0.9	**1.0**		
Collective Bargaining 05-06	13.5			
Collective Bargaining 05-07 Employee Benefits Plan	2.7			
Climate Change	(0.4)			
Canadian Police Research Centre (CPRC)	1.0			
TRIUMF	6.2			
Treasury Board Vote 10 - Operations		**0.3**		
Renewal of NRC's Central & Western Cluster Initiatives (Round II – Phase 2)		**38.7**	39.7	39.7
Total Adjustments[2]	*21.7*	***39.9***	*45.7*	*45.7*
Total Planned Spending	714.1	**712.3**	811.7	810.2
Total planned Spending				
Less: Spending of Revenues Pursuant to section 5(1)(e) of the NRC Act	73.5	**75.4**	75.4	75.4
Plus: Cost of services received without charge	20.5	**23.1**	23.1	23.8
Total Departmental Spending	661.1	**660.1**	759.4	758.6
Full time Equivalents	4,033	**4,044**	4,076	4,127

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

[1] Reflects best forecast of total planned spending to the end of the fiscal year.

[2] Adjustments are to accommodate approvals obtained since the Main Estimates and are to include Budget, Initiatives, Supplementary Estimates, etc.

Table 3-2: Resources by Program by Activity

2007-2008									
Budgetary									
Program Activity	Operating[1]	Capital	Grants	Contributions and Other Transfer Payments	Gross	Spending of Revenues	Total Main Estimates	Adjustments (planned spending not in Main Estimates)	Total Planned Spending
Research & Development	314.9	40.0	1.1	56.7	412.6	46.9	459.5	32.8	492.3
Technology and Industry Support	97.0	1.3	0.3	85.9	184.5	28.5	212.9	7.1	220.0
Total	**411.9**	**41.3**	**1.2**	**142.5**	**597.1**	**75.4**	**672.5**	**39.8**	**712.3**

[1]Includes Employee Benefits.

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

Table 3-3: Voted and Statutory Items ($ millions)

Vote or Statutory Item	Truncated Vote or Statutory Wording	**Current Main Estimates**	Previous Main Estimates
55	Operating expenditures	**365.7**	393.5
60	Capital expenditures	**41.3**	47.0
65	Grants and contributions	**144.0**	130.3
(S)	Spending of revenues pursuant to paragraph 5(1)(e) of the National Research Council Act	**75.4**	73.5
(S)	Contributions to employee benefits plans	**46.2**	48.1
	Total Agency	**672.5**	692.4

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

Budgetary/ ($ millions)			Loans, Investments and Advances ($ millions)		
2006-2007	2007-2008	Net Increase/(Decrease)	2006-2007	2007-2008	Net Increase/ (Decrease)
692.4	672.5	(19.9)	-	-	-

Explanation of Major Changes

The Main Estimates for the National Research Council are $672.5 million, a net decrease of $19.9 million. The major changes are as follows:

Decrease of $19.9 million in budgetary spending due to:

Operating ($27.8) million:

- An increase of $10.2M for salaries and benefits related to collective agreements
- An increase of $1.5M related to the termination of the annual transfer to Industry Canada for the IRAP/TPC Pre-Commercialization Assistance Program.
- A decrease of $2.2M related to the Expenditure Review Committee Savings - Procurement
- A decrease of $5.7M related to the sunset of the Aluminium Technology Centre Initiative. NRC received $27M over 5 years starting in 2002-2003 to establish an Aluminium Technology Centre in Chicoutimi Quebec.
- A decrease of $6M, representing a year over year change in approved cash flow requirements for the Innovation Centre Clusters (Regina/PEI/Alma). NRC received $50M over the five year period starting in 2003-2004 for leading edge technologies and to expand NRC's regional innovation and technology cluster initiatives.
- A decrease of $28.6M related to the sunset of the Regional Innovation/National Innovation Infrastructure Initiative. NRC received $183M over 5 years starting in 2002-03 to fund new programs and initiatives.
- An increase of $1.9M related to the change in forecast for statutory revenue.

- **Capital $(5.7) million**
- A decrease of $4.9M related to the sunset of the Regional Innovation/National Innovation Infrastructure Initiative. NRC received $183M over 5 years, starting in 2002-03 to fund new programs and initiatives.

- **Transfer Payment – Contributions & Other $13.6 million**
- An increase of $13.45M related to the termination of the annual transfer to Industry Canada for the IRAP/TPC Pre-Commercialization Assistance Program.

Table 3-4: Services Received Without Charge

2007-2008 ($ millions)	**Total**
Accommodation provided by Public Works and the Government Services Canada (PWGSC)	**0.1**
Contributions covering employer's share of employees' insurance premiums and expenditures paid by TBS (excluding revolving funds), Employer's contribution to employees insured benefits plans and expenditures paid by TBS	**21.4**
Worker's compensation coverage provided by Human Resources and Skills Development Canada	**0.3**
Salary and Associated expenditures of legal services provided by Department of Justice Canada	**0.8**
Audit Services provides by the Office of the Auditor General	**0.4**
Payroll Services provided by Public Works and Government Services Canada	**0.2**
2007-2008 Services Received Without Charge	**23.1**

Table 3-5: Summary of Capital Spending by Program Activity

($ millions)	Forecast Spending 2006-2007	**Planned Spending 2007-2008**	Planned Spending 2008-2009	Planned Spending 2009-2010
Research and Development	45.7	**53.7**	43.1	43.1
Technology and Industry Support	1.3	**4.0**	2.7	2.7
Total	47.0	**57.7**	45.7	45.7

Table 3-6: Details of Revenue

Spending of revenues pursuant to the NRC Act ($ millions)	Forecast Spending 2006-2007	**Planned Spending 2007-2008**	Planned Spending 2008-2009	Planned Spending 2009-2010
Research and Development				
Fee for Service	31.4	**45.9**	45.5	45.4
Rentals	3.1	**3.6**	3.7	3.9
Royalties	5.5	**3.8**	4.3	3.7
Publications	7.3			
Other	2.7	**3.5**	3.3	3.0
Technology and Industry Support				
Fee for Service	1.1	**27.4**	26.6	25.7
Rentals	0.2	**0.2**	0.2	0.2
Royalties	0.1			
Publications	21.4			
Other	0.7			
Total	73.5	**84.4**	83.5	82.0

Table 3-7: Resource Requirements by Branch or Sector

2007-2008			
($ millions)	Business Lines		
Organization	**Research and Development**	**Technology and Industry Support**	**Total**
Research Institutes	493.1		493.1
Industrial Research Assistance Program		159.7	159.7
Scientific and Technical Information		53.9	53.9
Technology Centres		5.5	5.5
Total	**493.1**	**219.3**	**712.4**

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

Table 3-8: User Fees (see note)

NRC collects between $60 million to $70 million in revenues annually; however, none of it is applicable to the User Fee Act (UFA) for the following reasons:

- As the definition and criteria upon which a User Fee is determined is very specific to the operations and legislative framework within each department, Treasury Board advised departments to seek legal counsel within their own department to assess its application.
- NRC's Legal and Financial Advisory Services examined the application of the UFA as it related to the various sources of NRC's revenue. This examination resulted in the legal opinion that the UFA was not applicable to NRC because NRC does not fix its fees pursuant to the authority of an act of Parliament and that NRC uses its common law right of the Crown to contract. None of NRC's revenue is derived as a result of regulation and most of its revenue is based upon negotiated agreements.

Table 3-9: Project Spending

Over the next three years, NRC expects to undertake the following projects that require Treasury Board approval as they exceed NRC's delegated authority level. Further information on these projects may be found at http://www.tbs-sct.gc.ca/est-pre/20072008/p3a_e.asp.

2007-2008
Lease Project Approval for the Institute for Nutrisciences and Health, Project Implementation Phase (Prince Edward Island) I-APL
Lease Project Approval for the National Institute for Nanotechnology – Project Implementation Phase (Alberta) I-APL

Table 3-10: Transfer Payment Programs

Over the next three years, the National Research Council will manage the following transfer payment programs valued at over $5 million. Further information on the Transfer Payments may be found at http://www.tbs-sct.gc.ca/est-pre/20072008/p3a_e.asp.

2007-2008 to 2009-2010
Tri-University Meson Facility (TRIUMF)
Industrial Research Assistance Program (IRAP)
International Astronomy Observatories and Canadian Participation in International Facilities

Table 3-11: Horizontal Initiatives

Over the next three years, NRC will be partners in the following horizontal initiatives. Further information on the Horizontal Initiatives may be found at http://www.tbs-sct.gc.ca/est-pre/20072008/p3a_e.asp.

2007-2008 to 2009-2010
Oceans Action Plan
CBRN Research and Technology Initiative
Climate Change Technology and Innovation
Enhanced representation Initiative
Program for Energy R&D
Public Security Technical Program
Youth Employment Strategy

Table 3-12: Internal Audits and Evaluations

Name of Internal Evaluations / Audits	Estimated starting time	Estimated completion time
Evaluations*		
Evaluation of the Implementation of NRC's activities under the Long Range Plan for Astronomy (NRC-HIA)	March 2006	January 2007
Implementation Evaluation of the Sustainable Urban Infrastructure Initiative (NRC-IRC) – A Round III Technology Cluster initiative)	December 2006	June 2007
Implementation Evaluation of the Nutri-Sciences and Health (NRC-IMB-INH) – A Round III Technology Cluster initiative	December 2006	June 2007
Evaluation of Industrial Research Assistance Program (NRC-IRAP)	September 2006	September 2007
Audits		
Management Control Framework Audit – Industrial Research Assistance Program	2005/06	Spring 2007
Management Control Framework Audit – Management of Information Technology Security	Summer 2006	Winter 2007
Limited Annual Compliance Audits – Hospitality, Travel and Acquisition Cards	Winter 2007	Summer 2007
Management Control Framework Audit - Capital Investment and Planning	Spring 2007	Fall 2007
Management Control Framework Audit – Occupational Health and Safety	Fall 2007	Spring 2008
Management Control Framework Audit – Integrated Risk Management	Fall 2007	Spring 2008
Limited Annual Compliance Audits – Hospitality, Travel and Acquisition Cards	Winter 2008	Summer 2008
Follow-up Audit to 2006-07 Industrial Research Assistance Program	Spring 2008	Winter 2009
Management Control Framework Audit – Industry Partnerships Facilities	Fall 2008	Spring 2009
Management Control Framework Audit – Intellectual Property Management	Fall 2008	Spring 2009
Management Control Framework Audit – Financial Management	Fall 2008	Spring 2009
Management Control Framework Audit – Human Resources	Winter 2009	Fall 2009
Management Control Framework Audit – Horizontal Initiatives	Winter 2009	Fall 2009
Follow-up Audit to Management of Information Technology Security	Spring 2008	Winter 2009
Limited Annual Compliance Audits – Hospitality, Travel and Acquisition Cards	Winter 2009	Summer 2009

*Evaluations scheduled for FY2007-2008 are subject to the update of the risk-based evaluation plan and the approval of Senior Executive Committee.

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