

NRC-CMRC

From *Discovery*
to *Innovation...*

Science at Work for Canada

*A Strategy for the
National Research Council
2006-2011*

May 2006



National Research
Council Canada

Conseil national
de recherches Canada

Canada

Science at Work for Canada:

A Strategy for the National Research Council

Our Vision: *To be valued as the world's best national organization for research and innovation*

Our Purpose: *To provide integrated science and technology solutions in areas of critical importance to Canada*

Our Role: *To be a critical instrument of the federal government translating science and technology into social and economic well being for Canada*

Our Goals:

- *To contribute to the global competitiveness of Canadian industry in key sectors and to the economic viability of communities*
- *To strengthen Canada's innovation system*
- *To make significant contributions to Canada's priorities in health and wellness, sustainable energy and the environment – areas critical to Canada's future*

Our Strategy:

- *Anticipate and perform research and development that improves the global competitiveness of Canadian industry*
- *Provide integrated industry support that engages key players*
- *Invest in and focus NRC's unique strengths and competencies on areas of importance to Canada*
- *Build a sustainable and agile national organization for research and innovation for Canada*

Our Values:

- *Commitment to Canada's economic growth and public good*
- *Respect for all people*
- *Excellence and creativity in our work*
- *Ethical behaviour and integrity*
- *Service to our stakeholders*

Foreword

In 2005, Canada's National Research Council (NRC) completed a series of in-depth studies and consultations as the basis for a new corporate strategy. This work identified critical developments in science and technology, key trends in the global economy, and major challenges and opportunities for Canada and Canadian industry in the emerging world order. The new five-year strategy that has emerged for NRC underlines NRC's commitment to create sustainable economic and quality-of-life benefits for all Canadians.

The Strategy represents an important evolution for NRC as Canada's national R&D and innovation organization. It clearly outlines NRC's intentions and how it can continue to meet the needs and expectations of its many clients, partners, and key players in Canada's innovation system. True to its 90-year reputation for excellence, NRC will continue to deliver on all aspects of its mandate through its research, technology development and other innovation support to industry. It will do so with an unflinching focus and commitment to improving the competitiveness of Canadian industry in key sectors; to building a stronger innovation system for Canada; and with a dedicated effort to resolving enduring issues of health and wellness, sustainable energy and the environment – areas crucial to Canada's future prosperity.

The Strategy commits NRC to further contribute to the competitiveness of Canadian industry by enabling the innovation system to create market solutions that sustain our quality of life. NRC's competencies will be augmented through linking key players to address enduring critical issues of the nation. This will be achieved through greater focus and integration on NRC's part and by offering key players easier access to the vast array of NRC's research, innovation resources and talent. Only through such efforts will NRC increase its presence and its impact in the research and innovation communities across Canada and throughout the world.

By demonstrating value through a more efficient and concentrated application of NRC resources and by leveraging the collective capabilities of the Canadian innovation system to advance the Canadian agenda, NRC will be well positioned to attract talent and secure a sound financial foundation.

Above all, this strategy emphasizes NRC's dedication as Canada's national R&D and innovation organization, to putting Science at Work for Canada.

Pierre Coulombe, Ph.D., P.Eng.
President
National Research Council Canada

The National Challenge

Issues of a global dimension – including a rapidly changing international economic environment – are driving the economic-growth and competitiveness agendas of nations around the world. In responding to this new world order, Canada faces the challenge of dealing with enduring issues that affect the quality of life of its citizens and the performance of its economy.

The world is changing more rapidly than ever before and Canada must position itself to respond and act.

The Conference Board of Canada

Canada's competitiveness

Among the most critical challenges is the push to improve Canada's productivity performance and competitiveness. While Canada's economy is generally sound (with forecast growth of 3.1% for 2006), the country is facing several challenges that are cause for concern, including increasing competition from countries that used to be our markets; low productivity in many industrial sectors; and low private R&D investment.

Canada ranks 27th in its ability to compete relative to other OECD countries.

These challenges are closely tied to Canada's current industrial structure. Canada's private sector is dominated by small and medium-size enterprises (SMEs), of which 98% have fewer than 100 employees. While SMEs are the prime source and driver of innovation in Canada, they have few resources to invest in R&D and face unique innovation pressures.

SMEs must deal with increasingly complex issues such as the convergence of science and technology, the protection of intellectual property, and the emergence of global supply chains. In today's global economy, individual firms no longer simply compete against each other; rather, competition is now between supply chains. Within that context, Canadian SMEs often lack the capacity to invest in innovation and take full advantage of the 'outsourcing' and 'offshoring' realities of globalization that would make them key players internationally.

Canada needs to foster a dynamic environment that boosts the growth of its companies – from energetic and aggressive SMEs to large, globally competitive firms.

Canada % Gross Domestic Product by Industry

2004

	%
Agriculture & fishing	2.3%
Mining	3.6%
Utilities	2.5%
Manufacturing	17.3%
Construction & related industries	11%
Transportation	4.8%

Source: www.investincanada.gc.ca

Canada must also continue to support sectors that are major contributors to our national economy. For example, aerospace, construction, manufacturing, and information and communications technologies are important economic engines for Canada. Today Canadian aerospace manufacturers stand in third place in the world in sales, and Canada is a world market leader in key product areas. Canada's manufacturing sector contributes to about 18% of Canada's GDP, directly employing over 2 million Canadians. The information and communications technology sector has estimated revenues of \$130 billion and is the top performer in terms of R&D in Canada. Finally, with total revenues over \$100 billion annually and contributing to 11% of Canada's GDP, the construction sector is another key sector of the Canadian economy.

Enduring issues for Canadians

Canada must mobilize the nation to tackle key societal issues that affect not only quality of life, but also sustainable economic growth – issues such as: climate change and the development of alternative forms of

energy; environmental protection and sustainability; the increasing demands and cost of our health system; Canadians' desire to live in communities that are safe and connected; and the protection and management of our natural resources.

The World Health Organization projects that over the next 10 years in Canada, more than two million people will die from a chronic disease.

For example, chronic disease is the most common and costly health problem worldwide. With the increasing proportion of aged people making up the population of Canada – by 2026, one in five Canadians will be 65 years of age or older – it is imperative to address the challenges of chronic diseases. Only then can we ensure a better quality of life for Canadians and a healthy workforce.

Energy is considered the number one problem facing humanity over the next 50 years. Worldwide demand for all forms of energy is forecast to increase by about 40% by 2020. Meeting this growth will require access to resources, timely development of technological advances, and the cooperation of all levels of governments.

On the environmental front, ever-increasing human activity continues to damage and deplete natural resources, fresh water reserves are being threatened, and there is growing concern with the acceleration of climate change. Sustainable industrial technologies are critical for the protection and management of natural resources and a key element of long-term sustainability. They can also be a major force to determine productivity growth and lead to corresponding improvements in Canada's standard of living.

Canada's innovation system

There is a need to deal rapidly and effectively with the gaps and weaknesses in Canada's innovation system that limit the nation's capacity to generate and transform new knowledge into real economic value. One weakness – as a result of changing demographics – is a shortage of highly skilled workers in all sectors of the economy. This is sure to have an effect on Canada's productivity.

Other factors, such as the convergence of technologies, will also impact the timely development and deployment of science and technology (S&T). Convergence of science domains and disciplines offers Canada the promise of increasing its capacity to compete in the global knowledge economy. However, this promise cannot be realized without interdisciplinary collaboration and the engagement of all sectors, and access to S&T networks nationally and internationally. Science and technology know no boundaries: the domain of work is international and the impact of science is pervasive. Canada produces only 4% of the world's knowledge. Canadian R&D organizations must be internationally connected and recognized to access knowledge produced by the rest of the world.

There is also the reality of our new global economy. In the new international marketplace, businesses scour the world for greater efficiencies, cost savings and competitive advantage, and nations compete against nations to attract this business activity. Commercial relationships in the global economy extend well beyond exports and imports; companies can gain access to international technology, expertise, resources or distribution networks through licensing deals, strategic alliances, personnel exchanges or management contracts. In Canada, our national advantage as a global player is not a given. It must be enhanced through the right business environment at home, the right S&T partnerships, and the right strategies to deal with risks and capitalize on opportunities abroad.

In this environment, the Government of Canada is focusing its S&T and innovation resources to help businesses exploit solutions and opportunities in this increasingly complex and competitive global marketplace.

From all viewpoints, the scope of the challenge is unprecedented; therefore, it demands an unprecedented response. Science, technology and innovation have the capacity to contribute to sustainable solutions. Such a response, however, will require a concerted effort by all. As Canadians and citizens of the world, we all have a vested interest in seeing the response succeed.

NRC - A Capacity to Serve

On the eve of its 90th anniversary as Canada's foremost R&D organization serving the needs of Canadian industry, NRC has undertaken a major renewal exercise. It has continued a tradition of adapting its vision, strategies and commitments to respond to the S&T and innovation challenges, opportunities and needs of Canada.

In order for NRC to reach its full potential and maximize its impact for Canada, it must continually adapt its R&D, industry and commercialization support programs, not only to meet today's needs and priorities, but also to anticipate and position itself to respond to the needs of the future.

Pierre Coulombe, Ph.D., P.Eng.
President, National Research Council Canada

A proud history

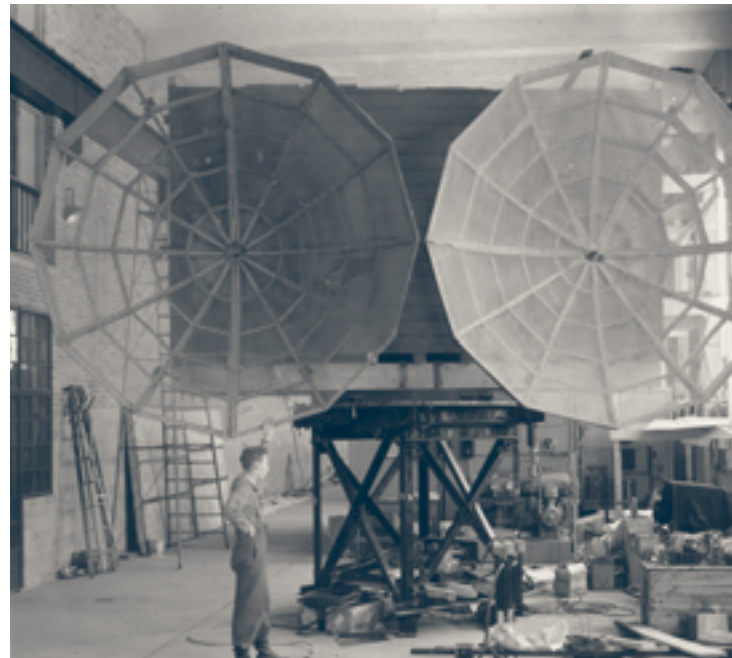
Since its creation in 1916, NRC has been Canada's foremost national science and technology institution, working with governments, universities and industry to push the limits of science and technology – and to address enduring national issues for the benefit of Canadians.

NRC's history reveals a profound ability to tackle new challenges and to respond to Canada's continually evolving needs. During the Second World War, for example, NRC grew rapidly as it developed processes and devices critical to the Allied effort.

NRC played a major role in the innovation explosion of the post-war period. The organization continued to bring to bear its world-class expertise in targeted science and engineering research in the 1960s, '70s and '80s. During these decades, NRC provided industry with cutting-edge research, developed critical S&T infrastructure, increased its S&T knowledge and information dissemination activities, and developed industrial research and innovation programs to help SMEs increase their innovation capacity.

- NRC played an important part in the development of radar during the Second World War. **Radar** (radio detection and ranging) is still in use to make travel safer by air, land and sea.

Early radar



A successful present

With NRC's *Vision to 2006*, we affirmed our commitment to our clients, our partners and our country. This vision set the stage for NRC achievements in several key areas: creating value for Canada; championing technology clusters; nurturing excellence and leadership in R&D; creating a global reach; and acting as an outstanding employer, with outstanding people. In each of its five pillars, NRC has demonstrated time and again its capacity to deliver on commitments:

- *Creating value* for Canada through new technology-based enterprises, technology transfer to industry and knowledge dissemination to industry;
- *Fostering technology clusters* that develop the innovative capacity and socio-economic potential of Canada's communities;
- *Demonstrating leadership in research and development*, integrating public-private strengths to create opportunities and meet national challenges for Canada;
- *Ensuring Canada's place in the world* by securing access to global research networks and facilities, and enhancing international opportunities for Canadian firms and technology products; and
- *Nurturing an outstanding workforce*, ensuring its research infrastructure and programs remain at the forefront of excellence and creativity.

NRC's vision received a strong endorsement from the federal government, particularly in support of NRC's role in driving regional innovation through technology clusters. In recent years, NRC's regional offices have become central hubs for dynamic technology clusters from coast to coast.

• In 1945, NRC's Chalk River labs produced the first functioning nuclear reactor in the world outside the U.S. (ZEEP). ZEEP provided a model for other small-scale research reactors around the world and supported the development of the NRX, which became operational at Chalk River in 1947 as **the most powerful research reactor in the world**. With access to the NRX and ZEEP, Canadians rapidly developed new nuclear energy technologies and systems that laid the ground for the multi-billion dollar industry in Canada.

• In 1952, NRC's Atomic Research Division was spun-off as AECL. NRC's atomic research at the time also supported the development of the **cobalt bomb, then the most effective cancer cure and therapy** of the 20th century, and underpinned the development of radioisotope industries related to medical applications. This early work also led to a Canadian winning the Nobel Prize in Physics in 1992 on neutron scattering.

• Today, medical isotopes produced in the AECL reactor are used in the treatment and diagnosis of more than 5 million patients around the world each year, and the reactor is supporting next generation power production and materials research for Canada. Beyond its historical contributions, NRC maintains a key presence in Chalk River with the NRC Canadian Neutron Beam Centre.

• In 1950, NRC scientist Dr. John Hopps developed **the first pacemaker** and became the acknowledged father of biomedical engineering in Canada.

Pacemaker





Bomb sniffer

- In the 1950s, NRC scientists proved vital to the development of **canola**, now Canada's second most important agricultural crop.

- A **bomb sniffer** small enough to fit in an attaché case and able to detect explosives in parts per trillion was developed at NRC in 1966. Improved versions are still used today by police, customs, airports, airlines and embassies.

- In the early '70s, in collaboration with the Bank of Canada and Identocard, NRC researchers developed an optical coating technology for **anti-counterfeiting applications** currently used in Canada in all bank notes of \$20 and up, and also used in many other countries. This technology is being used by NASA, the Canadian Space Agency, and the military for display screens.

- In 1971, NRC's Dr. Gerhard Herzberg won the **Nobel Prize** for his work identifying molecules in space. He has been hailed as the father of molecular spectroscopy.

Anti-counterfeit



Dr. Gerhard Herzberg



A promising future

Today, NRC is again stepping forward to play a key role in Canada's evolving S&T and innovation needs. NRC will bring to bear its long-term targeted research capacity, its diverse S&T portfolio, its impressive infrastructure of state-of-the-art facilities, and its capacity to assemble large teams of leading-edge researchers and innovation support experts to help Canada tackle its sizable innovation challenge.

While renewing its efforts and mobilizing for the task ahead, NRC recognizes the need to become a more integrated and adaptable organization – to focus its R&D programs on critical issues for the nation such as increasing the productivity and competitiveness of key industry sectors, health and wellness, sustainable energy and the environment. NRC is also preparing to enhance program delivery, and expand and strengthen national and international collaborations to further increase its efficiency.

This strategy will unfold over a five-year period. It will incrementally refocus business activities within NRC to reinvigorate the organization's position – on the up-ramp towards 2020 – as a critical S&T and innovation organization of the federal government. It will do this in a manner that most powerfully impacts on the Canadian economy and quality of life.

• In 1973, NRC researchers developed a system that retrieves and analyzes data from flight recorders – more commonly known as the **black box** – which is still used today.

• In the 1980s, NRC helped **Acadian Seaplants Limited** grow from a small firm selling a single product to a high technology enterprise with 130 full-time staff and about 1,000 seasonal workers. The company now exports to more than 50 countries.

• Eating shellfish has never been safer thanks to a team of NRC researchers that quickly identified the **shellfish toxin**, domoic acid, in 1987 that had caused a closure of the entire East Coast shellfish industry.

• In 1997, NRC worked with the Canadian company Iogen to develop the **industrial enzyme BioBrite™** used in mill bleach plants. BioBrite helps mills decrease organochlorine discharges by about 100 tonnes per year and reduce operating costs by about \$500,000 per year.

• NRC researcher, Dr. Harold Jennings, developed a synthetic **vaccine against meningitis C**. Baxter Bioscience International brought Dr. Jennings' vaccine to market in 2000 as part of a mass immunization program in the UK, where 18 million people received it. This resulted in many lives being saved.



Dr. Harold Jennings

• NRC spin-off company IMRIS markets a **magnetic resonance imager (MRI)** that reduces repeat surgery from roughly 20% of cases to near zero at a significant saving in cost and trauma. In 2003, IMRIS received regulatory approval from the FDA and from the European Community to sell its state-of-the-art MRI system in the U.S. and European markets.

• NRC **3-D technology** has led to various successful applications such as: a space vision system to be used by NASA for the on-orbit inspection of space shuttle surfaces; scans of important heritage sites and works of art; and special effects wizardry created by Ottawa-based firm, XYZ RGB (a second-generation NRC spin-off firm) in major films such as *The Lord of the Rings* and *Catwoman*, earning an Academy Award nomination from the Academy of Motion Picture Arts and Sciences in 2004.



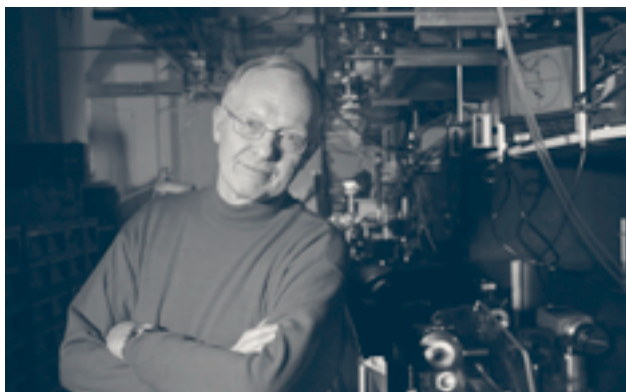
MRI

• NRC researchers have created a **single molecule electrical circuit** – a breakthrough published in *Nature* on June 2, 2005. This discovery could pave the way to miniaturizing computers and creating sensors fine enough to detect single molecule interactions.

• NRC researcher, Dr. Paul Corkum, has received worldwide honours for **spectacular advances in probing atomic and molecular reactions**, including Canada's prestigious Killam Prize in April 2006. Many of these reactions are measured in femtoseconds (one 10^{-15} of a second). Dr. Corkum pioneered many of the concepts underlying the new physics that permit the measurement and control of electrons, atoms, molecules, solids and light, and possibly atomic nuclei.



3-D technology



Dr. Paul Corkum

A Strategy for NRC

Beginning in the spring of 2005, NRC undertook a series of in-depth studies of global issues, industry needs, government priorities and S&T trends, as well as extensive consultations with stakeholders and decision-makers in government, industry, the academic community and business sectors. The outcome of this exercise was a clear understanding of current challenges and opportunities for Canada, and expectations for NRC. It was instrumental in defining NRC's new strategic focus.

NRC's strategy recognizes and responds to the new global reality and to the evolving needs of its stakeholders. It recognizes the need to place more focus on addressing national issues, challenges and opportunities, and to strive for more effective alignment with Canadian business interests. It is a strategy that will ensure NRC, as a major player in Canada's innovation system, continues to provide relevant, integrated and valued contributions to Canadian industry and Canadians.

Our Vision:

To be valued as the world's best national organization for research and innovation

This vision statement is a natural outcome of some 90 years of responding to Canada's evolving national socio-economic challenges and opportunities through R&D and innovation.

It is a vision that respects the need to win the recognition of industry, of the research community in Canada and internationally, of governments and of Canadians – when NRC truly succeeds in creating value for Canada.

NRC must be known not only for what we do, but also for how our actions result in increased sustainable industrial growth and competitiveness, in an improved Canadian innovation system, and in the maintenance of the hard-won quality of life Canadians now enjoy.

And NRC must continue to be a relevant, sustainable organization – one that is capable of bringing its entire array of strengths, competencies and resources to the table over the long term to support the needs of industry and Canada's agenda for the future.

Our Purpose:

To provide integrated science and technology solutions in areas of critical importance to Canada

NRC's purpose is to help industry succeed and to ensure the effectiveness of Canada's innovation system by providing integrated S&T solutions as the foundation for sustained economic growth.

NRC does not stand alone in its delivery of programs. No organization can be 'all things to all people' in a world where convergence and complexity demand partnership, collaboration and cooperation across all sectors (government, academia and industry) and across all countries. Only by engaging all key players in the national and international innovation systems can a country build the foundation for global success.

Our Role:

To be a critical instrument of the federal government translating science and technology into social and economic well being for Canada

As a major player in Canada's innovation system and a leading innovation instrument of the federal government, NRC has an essential role to play in this national effort. NRC's contributions encompass activities across the innovation spectrum – from cutting-edge R&D programs in key industrial sectors, to commercialization and innovation capacity-building programs, through to providing industry and other innovation system players with access to key networks and opportunities, both nationally and internationally.

As an instrument of government, NRC's role includes:

- performing research of importance to Canadian industry, translating science and technology into value for Canada, and enabling economic and social development;
- managing national engineering and science facilities for the benefit of its clients and partners;
- establishing national standards, measures, codes and guidelines, which ensure health and safety for Canadians, and provide assurance for industry and better access to world markets;
- supporting public health, safety, environmental and/or defence research needs;
- providing access to national and international S&T information and networks; and
- promoting innovation in Canadian industry.

Our Goals:

I. Contribute to the global competitiveness of Canadian industry in key sectors and to the economic viability of communities

To achieve this goal, NRC will adapt and integrate its programs to increase its emphasis on technology development. It will also increase its innovation and commercialization support to industry. These efforts will engage NRC's full capacities across the innovation spectrum – from developing highly valued technologies and helping increase the innovation capacity and growth of firms (particularly SMEs) through to promoting environmentally sustainable business practices.

NRC will continue to dedicate significant resources and expertise in programs to support industry in key sectors such as aerospace, construction, information and communications technologies, life sciences and manufacturing.

NRC builds on existing capacity to contribute S&T and innovation resources to industry. Examples of NRC's capacity-building initiatives include:

- research institutes and centres across Canada, which provide knowledge and innovation resources in key sectors for industry;
- commercialization support and services, such as intellectual property management, technology transfer, entrepreneurship, licensing, prototyping, testing, trials and demonstrations;
- industry partnership facilities across Canada;
- S&T information and competitive intelligence;
- local, regional, national and international networks;
- industrial research assistance program and innovation capacity building services for SMEs; and
- national standards, measures, codes and guidelines, which provide assurance for industry and better access to world markets.

Equally valuable is NRC's commitment to contribute to the economic viability of Canada's communities. Community clustering initiatives provide Canada with effective mechanisms to create economic value. They help connect industry and key innovation players to create critical mass and build community innovation capacity. They help develop local networks that are able to access regional, national and international gateways, and to serve as natural commercialization platforms. And they provide an exceptional medium for regional delivery of national programs.

NRC Community Technology Cluster Initiatives

Helping build sustainable communities...

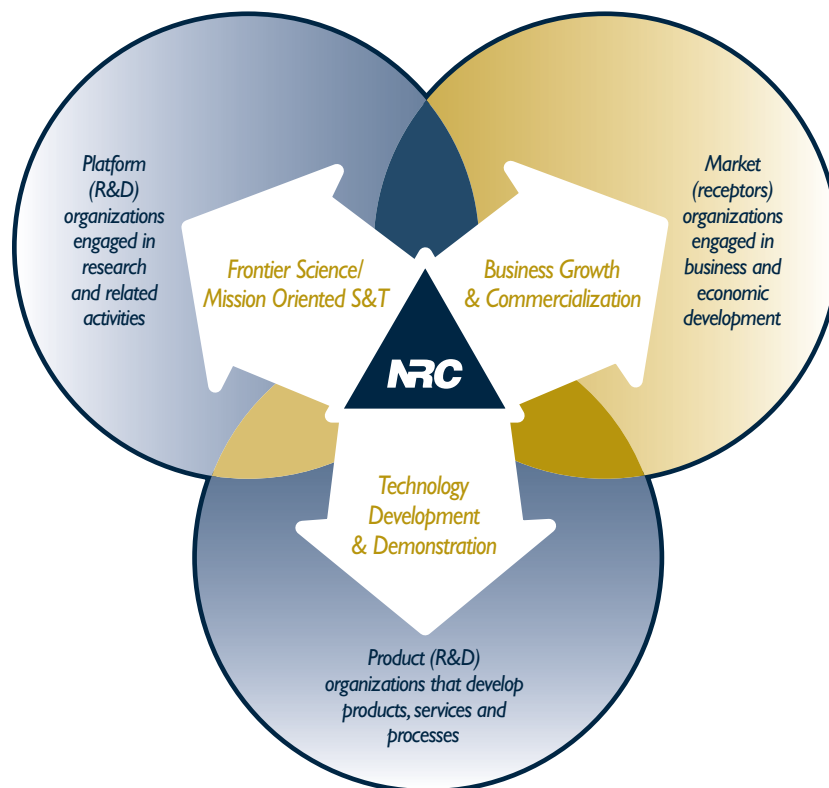
- *Ocean technologies*
- *Marine biosciences*
- *Nutrasciences and health*
- *E-business*
- *Aluminium technologies*
- *Aerospace technologies*
- *Photonics*
- *Bio-medical devices*
- *Nutraceuticals*
- *Municipal infrastructure*
- *Nanotechnologies*
- *Fuel cells*

... across Canada

II. Strengthen Canada's innovation system

The Canadian innovation system comprises all the organizations that support and conduct research, and transform new knowledge into new products and services for sale into both domestic and international markets. These organizations provide platforms for advances in knowledge, offer investments, develop products and services, and provide access to markets. Innovation in products and services is a crucial determinant for success in today's competitive environment, and all the key stakeholders – the financial sector, all levels of government, the academic community and other S&T organizations – must share the innovation and commercialization agenda with industry.

NRC's Roles in Canada's Innovation System



With its strong presence across the country, and its history of working across the innovation spectrum, NRC is well positioned to be a critical instrument of the federal government's plan to strengthen Canada's innovation system.

Canada boasts world-class researchers and research institutes, first-rate universities, teaching hospitals, and an excellent research infrastructure. These elements must come together to create critical mass and facilitate convergence of technologies on a national scale if Canada is to maintain its standing in the world and find solutions to the challenges it faces.

Across the federal government, initiatives for concerted efforts on national issues have already begun. NRC has taken a leadership role and will remain a key player in these efforts. Within its own borders, NRC has recently implemented a portfolio structure and horizontal programs aimed at consolidating its competencies for more effective delivery of research and services to clients.

To deliver on this goal, NRC will increase its capacities in technology transfer; better integrate its strengths to improve SME innovation capacity; create single-point gateways for industry to access the entire range of NRC's programs, services, infrastructure and facilities; and engage key players from across the innovation system to ensure NRC's programs and services respond to their priorities and needs.

To strengthen Canada's innovation system, NRC targets its actions to support industry and overcome innovation challenges:

- Helps industry manage risks as new products are developed and marketed, and as new processes and practices are integrated into their operations;
- Offers S&T information and intelligence to industry;
- Targets R&D and innovation capacity-building support to SMEs;
- Offers comprehensive commercialization support, including technology transfer, intellectual property management (IPM), licensing, entrepreneurship, industry partnership facilities, testing, prototyping, demonstrations and more;
- Develops and updates national codes, standards, measures, guidelines and certification programs, which provide assurance for industry, remove barriers to national and international markets, and provide valuable validation of performance;
- Supports major science and technology infrastructure in collaboration with the scientific community and industry, notably in areas such as astronomy, astrophysics and material sciences; and
- Develops networks, partnerships and access for industry – on local, regional, national and global scales – extending industry's reach to the world.

III. Make significant contributions to Canada's priorities in health and wellness, sustainable energy and the environment – areas critical to Canada's future

NRC R&D priorities: Focused on the future

In health & wellness:

- *Chronic diseases*
- *Agri-food*
- *Water*

In energy:

- *Hydrogen*
- *Biofuels*

For the environment:

- *Environmental technologies*
- *Bioproducts*

NRC's consultations and analysis identified health and wellness, sustainable energy and the environment as areas of national priority in which NRC should strengthen its research and innovation support to maximize the impacts of its programs.

These are national priority areas in which NRC can make the most significant contribution by bringing to bear its research excellence and multi-disciplinary competencies – converging enabling technologies such as biotechnology, information technology and nanotechnology with disciplines such as manufacturing, transportation, advanced materials and construction – to develop new technologies that allow more sustainable economic growth and development. Moreover, because of its multi-disciplinary nature and its international reach, NRC can mobilize and engage all sectors to tackle critical issues that require integrated solutions.

To pursue this goal, NRC will work to strengthen its contributions through multi-disciplinary, multi-partner initiatives in specific areas. NRC will gather the full force of its S&T competencies to tackle these issues in a concerted fashion with universities, industry and all levels of government.

In the area of health and wellness, NRC will assemble world-class expertise to address issues related to chronic diseases, agri-food and water. This wide-ranging area includes competencies in diagnostics, medical devices and equipment, vaccines, and food products. It also includes new types of semiconductor materials and devices that are used in such products as medical prostheses, new bioactive materials, and new plant varieties.

NRC will focus its research and development efforts in hydrogen and biofuels on finding alternative technologies and sources of energy for Canada. NRC possesses a broad spectrum of crosscutting competencies needed to develop new technologies for sustainable economic growth and development. These competencies range from processing technologies and bioproducts to fuel cells and energy efficiency in buildings and in transportation.

NRC will dedicate substantial resources to the protection of our environment, specifically in the development of environmental technologies and bioproducts. NRC has a wide array of competencies it can call upon to further establish Canada as a source of first-class environmental technologies, products and services – improving our natural environment in Canada and around the globe.

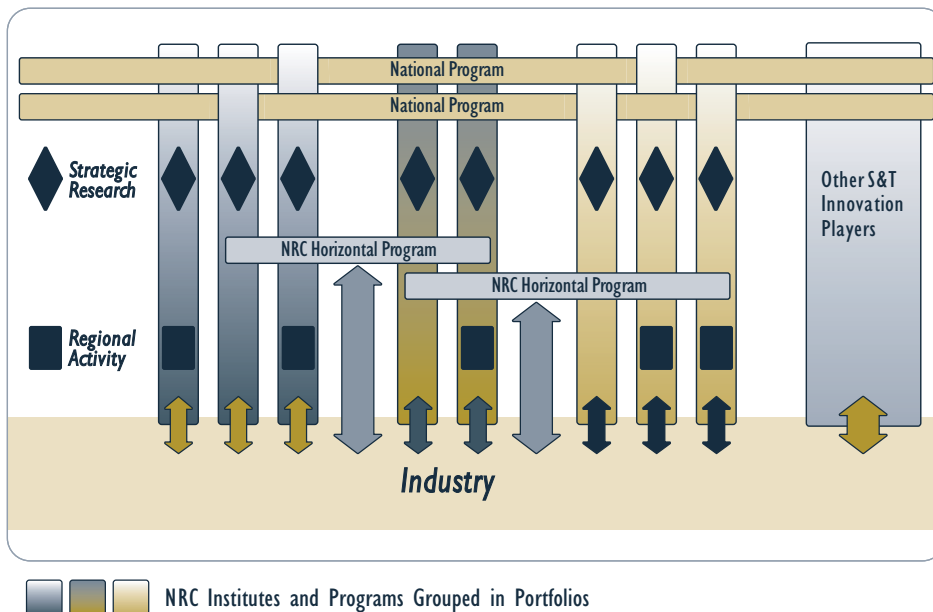
NRC will build on its partnerships and collaborations with industry, the academic community and other government organizations, both in Canada and abroad. It will also ensure that its efforts in key research fields are positioned to support its overarching goal of improving the competitiveness of Canadian industry. This will further enable Canadian firms to take S&T solutions and discoveries from the lab to the world's markets.

Fundamental to achieving this goal on behalf of Canadians is the need for NRC to maintain a dynamic R&D environment and to invest in its competitiveness focus areas. This will be a priority for NRC as it defines its future organization, infrastructure, systems, business processes, human resource management and other operational practices.

Typical NRC Institute / Program Structure



NRC's Program Structure



NRC will recruit and develop top talent to lead in these strategic areas. We will continue to serve as stewards of young, promising researchers and innovation experts, providing them with exciting opportunities to apply knowledge to industry problems. In this manner, we will help increase the supply of highly skilled personnel for the benefit of Canadian industry and the innovation system.

Our Strategy:

To meet these goals for Canada, NRC has developed a strategy comprising four key thrusts:

- **Anticipate and perform research and development that improves the global competitiveness of Canadian industry**
- **Provide integrated industry support that engages key players**
- **Invest in and focus NRC's unique strengths and competencies on areas of importance to Canada**
- **Build a sustainable and agile national research and innovation organization for Canada**

A Commitment to the Future

Building on a tradition of evolution and adaptation, and on NRC's capacity, competencies and research excellence, this five-year strategy has been developed to ensure that NRC can and does deliver integrated, relevant and sustainable solutions that meet the challenges and needs facing Canadian industry and the nation today.

By year five, NRC's research and development efforts will have been successfully targeted on meeting the needs of industry in key areas of economic growth. With a balanced research portfolio, NRC will enhance R&D services for industry, increase collaborations with other research organizations, and establish both national and international R&D consortia. The organization's portfolio approach will ensure major programs and projects are underway in priority areas.



Canada must mobilize the nation to tackle key societal issues that affect not only quality of life, but also sustainable economic growth

Top national and international talents with access to extensive and diverse research teams within the organization will lead NRC's enhanced R&D environment. Enterprising companies will find themselves able to reap the benefits of an increased flow of technologies into the marketplace through NRC technology transfer and commercialization support activities – enhanced by a winning strategy based on return on investment (ROI).

NRC will offer single-point gateways for industry to access the organization's full range of programs, services, infrastructure and facilities – providing a form of industry support that will engage key S&T players not only in Canada, but also around the world.

NRC will be recognized as a leader, initiating and managing large-scale, multi-disciplinary, multi-partner, cross-sectoral programs and projects, and integrating NRC-wide solutions to increase the innovation capacity of SMEs.

NRC R&D efforts will demonstrate a stronger alignment to address enduring issues of the nation more effectively. Uniting its unique strengths and competencies to focus on R&D goals of importance to Canada, NRC will lead major Government of Canada R&D initiatives and take part in other national programs. The organization will collaborate with key players of the government's chosen critical R&D fields, creating national programs and continually monitoring, assessing and refining those programs and their delivery mechanisms.

NRC will increase its level of influence in public and private sectors and be recognized as the leader of major Government of Canada R&D and innovation initiatives. NRC will also engage in a number of major collaborations with other government departments to further leverage its competencies while meeting the commercialization needs of its partners. Moreover, the organization's new business model will be in full force, helping to guide NRC's commitment to a unified, corporate-wide philosophy of excellence.

Much of NRC's success in the above areas is predicated upon its ability to remain a sustainable and agile national research and innovation organization – and to secure continued funding from various sources. By year five, NRC will receive renewed government support based on the value of its achievements, and be widely recognized as a prime R&D investment of the federal government. NRC will also attract ample funding from external sources, such as major national and international funding programs and R&D investment companies, both in Canada and abroad.

NRC's new strategy will propel these changes over five years, not only ensuring NRC's continued relevance on national and international stages, but also as a sustainable and adaptable organization contributing to Canada's economic growth and quality of life.

Our Strategy: A Commitment to the Future

I. Anticipate and perform research and development in areas that will improve the competitiveness of Canadian industry

Key Actions:

A. Focus NRC R&D:

- Evaluate global economic and industry trends to identify challenges and opportunities
- Increase understanding of markets
- Assess national and international trends in science sectors to prioritize and target efforts
- Select and target R&D efforts

Milestones:

Year 1:

- Increased forecasting capacity in place
- Evaluation of competencies, capabilities and opportunities completed
- Commercialization capacity assessed and augmented capacity in place

Year 2-3:

- NRC revamped R&D portfolio finalized
- Research commercialization capacity augmentation underway – to fill competency gaps
- R&D focused on areas of economic growth for Canadian industry in global markets
- Requisite critical mass in place (funding, talent and infrastructure in focus areas)

Year 5:

- NRC R&D targeted on meeting needs of industry in key areas of economic growth

B. Maintain a portfolio approach to manage NRC programs and competencies

Year 1:

- Tools, systems and competencies to support programs identified and developed
- Portfolio dimensions and priorities defined

Year 2-3:

- Strategies and systems for responding to multi-dimensional opportunities and issues in place

Year 5:

- NRC total research portfolio balanced – short and long-term R&D services, collaborations, consortia in place, both national and international
- Major programs and projects underway in priority areas

Key Actions:

C. Create a dynamic R&D environment:

- *Grow, attract and retain top talent and build teams around it*
- *Gain access to top talent through strategic relationships*

D. Increase NRC capacity to support development of technologies and their commercialization:

- *Build receptor and innovation capacity in select areas with high potential for return*
- *Move R&D outcomes to commercialization through clinical trials, prototyping, proof of concept and other stages*

Milestones:

Year 1:

- NRC human resource policies and programs – compensation, rewards and recruitment – evaluated to identify and exploit flexibilities and opportunities
- Increased communications, interchanges and exposure across NRC institutes underway via exchanges, assignments and sabbaticals

Year 2-3:

- Investment and support actions aligned with recruitment and retention initiatives and practices
- Two to four top-flight teams in place in key areas
- Major R&D initiatives in key areas launched

Year 5:

- Internationally and nationally recognized programs, led by top talent, with full teams, in place in key strategic areas

Year 1:

- New model and management framework developed for technology development and commercialization

Year 2-3:

- Key partnerships with external players developed – to complement NRC internal expertise
- Funding mechanism for commercialization support in place

Year 5:

- Technology transfer and other commercialization support activities in place – supported by ROI-based strategy
- A number of companies demonstrating success in commercializing NRC technologies and products

Key Outcome

Increased flow of technologies into high-impact sectors of the economy

II. Provide integrated industry support that engages key players

Key Actions:	Milestones:
<p><i>A. Provide single-point gateways to NRC expertise, services and facilities, with links to innovation players, to strengthen regional communities and their national and international outreach</i></p>	<p>Year 1:</p> <ul style="list-style-type: none"> • Single-point gateway concept developed building on existing community cluster and corridor strategies • Management and accountability frameworks defined • Key innovation system players identified and engaged in development of innovation strategies <p>Year 2-3:</p> <ul style="list-style-type: none"> • Single-point gateway pilot developed, implemented and assessed • Investment in and development of support infrastructure completed • Concept and model refined, based on pilot gateway experience <p>Year 5:</p> <ul style="list-style-type: none"> • Single-point gateways implemented nationally • Effective international linkages demonstrated
<p><i>B. Build a “Quick Response” capacity to serve clients</i></p>	<p>Year 1:</p> <ul style="list-style-type: none"> • Identify client needs and performance expectations for Quick Response <p>Year 2-3:</p> <ul style="list-style-type: none"> • Test the value of Quick Response teams <p>Year 5:</p> <ul style="list-style-type: none"> • Adjust model and implement nationally
<p><i>C. Increase NRC capacity to work in large-scale, multi-disciplinary, multi-partner, cross-sector programs and projects, taking advantage of the potential of convergence of technologies</i></p>	<p>Year 1:</p> <ul style="list-style-type: none"> • Match competencies and their stewardship within institutes, branches and portfolios • Complete assessment of competency portfolio (build, maintain, terminate) <p>Year 2-3:</p> <ul style="list-style-type: none"> • Define resource model for multi-disciplinary, multi-partner, cross-sectoral programs and projects • Internal conferences to capitalize on opportunities underway • Engagement of internal partners underway <p>Year 5:</p> <ul style="list-style-type: none"> • NRC recognized as leader in managing and undertaking large-scale, multi-disciplinary programs and projects

Key Actions:

D. Refine and augment NRC efforts to increase innovation capacity of SMEs

Milestones:

Year 1:

- Identify and review NRC's capacity for meeting the innovation needs of SMEs

Year 2-3:

- Develop principles, practices and processes for sustainable programs, and pilot them

Year 5:

- Integrated NRC-wide solutions to increase innovation capacity of SMEs in place

E. Maintain capacity for NRC to support major science infrastructure and technology platforms aligned with NRC competencies and mandate, and based on needs

Year 1:

- Identify and review NRC's role and capacity for supporting major science and technology infrastructure, based on community needs

Year 2-3:

- Develop priorities and actions for future requirements in major S&T infrastructure

Year 5:

- Recognition of NRC's role and competencies in supporting major S&T infrastructure in Canada

Key Outcome

NRC national access gateways providing integrated R&D and innovation support to industry

III: Invest in and focus NRC's unique strengths and competencies on areas of importance to Canada

Key Actions:	Milestones:
<p><i>A. Articulate and implement NRC's national approach, framework, programs and infrastructure for science contributions – in concert with federal science players</i></p>	<p>Year 1:</p> <ul style="list-style-type: none"> • Develop framework concept and secure federal partner buy-in <p>Year 2-3:</p> <ul style="list-style-type: none"> • Other partners – internal and external, national and international – identified and engaged • Priorities for common programs defined • NRC framework integrated with overall federal S&T strategy <p>Year 5:</p> <ul style="list-style-type: none"> • NRC installed as recognized leader of major Government of Canada R&D initiatives
<p><i>B. Lead federal R&D programs in chosen critical fields for government, in collaboration with key players in these fields nationally and internationally</i></p>	<p>Year 1:</p> <ul style="list-style-type: none"> • Program charter for emerging areas developed: biofuels/bioproducts; fuel cells/hydrogen; water; agri-food; ICTs; environmental technologies; chronic diseases <p>Year 2-3:</p> <ul style="list-style-type: none"> • Internal programs launched • National and international collaborations in place <p>Year 5:</p> <ul style="list-style-type: none"> • National programs in place • Ongoing monitoring, assessment and refinement of programs and delivery mechanisms begins • Delivery model evaluated and approved

Key Outcome

NRC R&D efforts better aligned to more effectively address enduring issues of the nation

IV: Build a sustainable and agile national research and innovation organization for Canada

Key Actions:

A. Present and market NRC as a prime opportunity for investment in R&D within government



B. Attract new funding, nationally and internationally

Milestones:

- Year 1:**
- Rationalization of existing programs and other elements of NRC to deal with immediate financial and other business pressures within context of new strategic directions and priorities
 - NRC “compelling message” for new investment defined
 - Key government and non-government organization stakeholders and influencers engaged to gain their support in seeking investment
 - Key private sector stakeholders and supporters engaged
- Year 2-3:**
- Significant investments by government in NRC in support of new strategic directions and priorities
 - Integrated communications, marketing and corporate relations strategy, program and capacity developed in support of unified NRC “brand”
 - Engagement and dialogue with all stakeholders continues
- Year 5:**
- Level of new investment by government in NRC maintained

- Year 1:**
- Collect information on major national and international R&D funding programs and R&D intensive companies – in NRC priority areas
- Year 2-3:**
- Establish relationships and initiate proposals and collaborative agreements
- Year 5:**
- Maintain adequate income from external sources

Key Actions:

Milestones:

C. Increase NRC's level of influence in public and private sectors

Year 1:

- Undertake targeted initiatives as part of overall effort to demonstrate NRC as unique opportunity for investment

Year 2-3:

- NRC included in the major consultations on growth and innovation in Canada

Year 5:

- NRC installed as the recognized leader of a major Government of Canada R&D and innovation initiative

D. Leverage NRC competencies by meeting the R&D and commercialization needs of other federal government entities

Year 1:

- Evaluation of potential areas of collaboration with OGDs completed
- OGDs engaged to discuss/scope out potential R&D collaborations/support from NRC

Year 2-3:

- One funded R&D collaboration in each key R&D field (health, sustainable energy, the environment) in place

Year 5:

- Five major collaborations with OGDs signed

E. Build an agile organization:

- *Develop supporting approaches and structures*
- *Build critical mass*
- *Refine NRC resourcing*

Year 1:

- Constraints and priorities defined – human resource management, risk management, resource sharing, intellectual property management, tech transfer, others
- Tools, systems and competencies to support programs identified and developed

Year 2-3:

- Implementation of solutions to constraints underway
- Leadership and governance framework in place

Year 5:

- New business model for NRC implemented

Key Actions:

F. Build a more unified NRC with a commitment to common objectives and values

Milestones:

Year 1:

- Communicate with and engage staff in the Strategy, and their individual roles

Year 2-3:

- Evaluation of current business practices and policies completed and targeted on maximizing flexibilities while integrating a focus on NRC priorities and success
- Shared value systems, common business practices and visible management commitment and support in place

Year 5:

- Commitment to unified NRC philosophy, values and goals
- Ongoing efforts to sustain commitment begin

Key Outcome

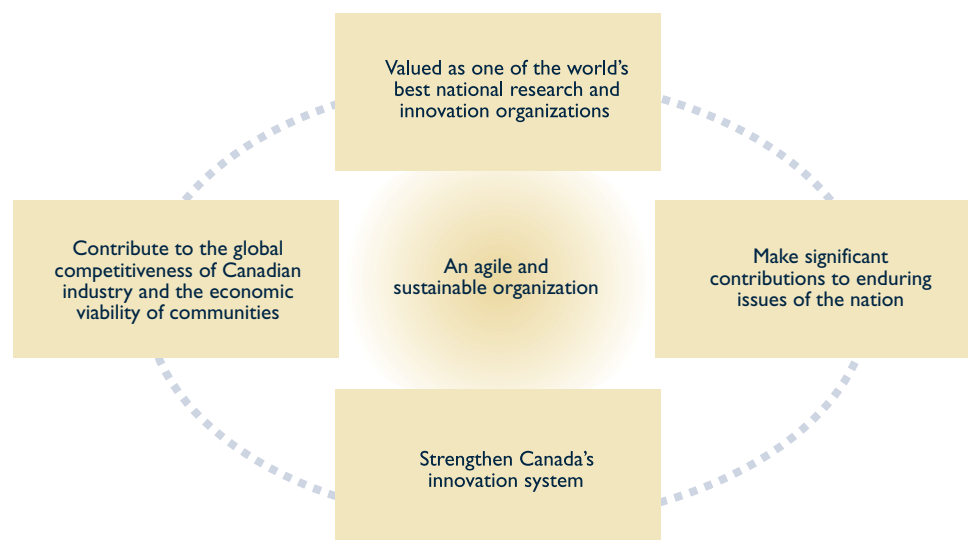
A sustainable and agile organization contributing to Canada's economic growth and quality of life

Measuring Our Performance

NRC will measure its progress in managing and implementing this strategy using a dedicated performance management framework (see below). It will develop specific measures for both its overall vision, as well as each of its defined goals, providing a firm basis for planning and managing operations in pursuit of milestones and key outcomes. In support of this strategy, specific measures of NRC's performance management and reporting system will be adjusted to reflect these new goals and strategies, allowing us to report on our achievements and outcomes in implementing our plans.

While overall performance metrics are highlighted in the performance management framework, they will be refined to reflect NRC's staged progress toward intended outcomes, and will include annual targets. The framework will be finalized in the early implementation stage of the Strategy and will be the driver for NRC's planning cycle.

NRC: Performance Management Framework



Conclusion

For nearly a century, NRC has remained relevant on the national and international stages by continually refocusing its activities to better tackle new national challenges and priorities.

Our new Strategy is again an important evolution for NRC as Canada's national R&D and innovation organization. It will position NRC as a critical S&T and innovation organization of the federal government, making significant contributions to the enduring issues of the nation, and generating a powerful impact on the global competitiveness of Canadian industry and the economic viability of our communities.

Today, more than ever before, NRC has an opportunity to stimulate the growth of world-class science and technology-based industries, nurture groundbreaking technology clusters nationwide, and contribute to large-scale, multi-disciplinary R&D initiatives in priority areas across the country. Our five-year Strategy capitalizes on those opportunities.



NRC brings integrated solutions to national challenges through S&T

Implementation of the Strategy will require committed, coordinated efforts from all parts of NRC. It will also involve some difficult decisions to address the issue of NRC's sustainability. But it represents a turning point for NRC. This new strategy will allow NRC to become a much stronger organization that is able to realize its goals and meet the needs and expectations of its many clients, partners, and key players in Canada's innovation system.

NRC's purpose has never been more focused; the need for evolution never more pressing. Informed by 90 years of proud service to Canada, NRC's five-year Strategy reaches forward to embrace a promising future.



Canada must position itself to respond to the rapidly changing international economic environment



www.nrc-cnrc.gc.ca