

NRC-CNRC

Science  
at work for  
Canada

# From Discovery to Innovation

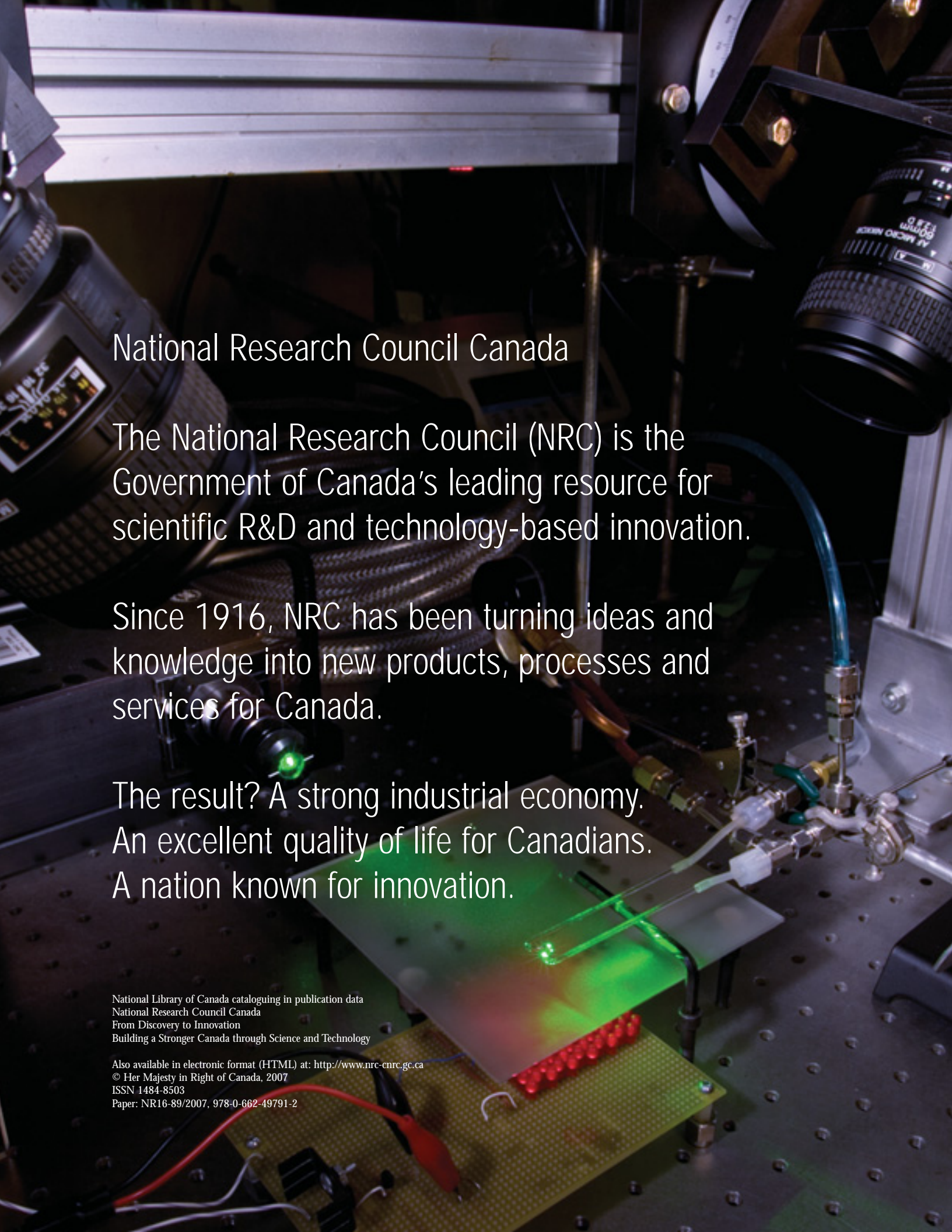
Building a Stronger Canada  
through Science and Technology



National Research  
Council Canada

Conseil national  
de recherches Canada

Canada



## National Research Council Canada

The National Research Council (NRC) is the Government of Canada's leading resource for scientific R&D and technology-based innovation.

Since 1916, NRC has been turning ideas and knowledge into new products, processes and services for Canada.

The result? A strong industrial economy.  
An excellent quality of life for Canadians.  
A nation known for innovation.

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## *A proud history . . .*



*Among our many accomplishments through the decades —*

- > 1920s  
**Paving the Way to Stronger Concrete**  
In the 1920s, NRC scientists developed corrosion-resistant concrete able to stand up to Canada's harsh climate, and launched a field of research to ensure the safety and durability of Canada's buildings and bridges.
- > 1930s  
**Streamlining the Locomotive**  
In the 1930s, NRC redesigned the shape of the steam locomotive, transforming it from a smoky safety hazard into a sleek, streamlined vehicle fit for royalty.
- > 1940s  
**Protecting Our Troops**  
During the Second World War, NRC scientists built Canada's first nuclear reactor, advanced radar technology and developed an all-terrain vehicle tracking system, among many other valuable contributions with long-lasting effects.
- > 1940s  
**Revolutionizing Music**  
By combining scientific knowledge and a passion for music, in 1945 an NRC physicist created the world's first electronic synthesizer – an instrument still used in much of today's popular music.
- > 1970s  
**Pioneering Computer Animation**  
NRC developed key-frame animation software that inspired a generation of computer animators around the world and changed the face of cinematic art.
- > 1970s  
**Foiling Counterfeiters**  
NRC scientists helped prevent counterfeiting by creating the special optical thin-film coatings that are used as security features on Canadian currency, ID cards and driver's licenses.
- > 1980s  
**Launching Canada's Space Program**  
During the "Space fever" of the early 1980s, NRC launched Canadarm and the Canadian Astronaut Program, giant steps in the development of Canadian Space science.
- > 1980s  
**Sniffing out Terrorism**  
A bomb sniffer designed at NRC to chemically sniff out hidden explosives has been used around the world in the fight against international terrorism.
- > 1990s  
**Safeguarding Children's Health**  
Three decades of NRC research resulted in an infant meningitis vaccine that will protect the lives of children around the world.

... a vital future



> 1950s

#### Engineering a Better Quality of Life

Through innovations like the electric wheelchair and the heart pacemaker, NRC research has improved the quality of life of countless Canadians.

> 1950s

#### The First Synthetic Sucrose

An NRC chemist was the world's first to synthesize sucrose, a breakthrough that led to medical developments such as tests for blood typing and vaccines.

> 1950s

#### Creating Canola

NRC researchers and agriculture scientists in Saskatoon, Winnipeg and Ottawa helped build a billion-dollar canola industry by breeding a nutritious made-in-Canada supercrop.

> 1960s

#### Finding Fallen Aircraft Quickly

The Crash Position Indicator was designed by an NRC engineer to help search and rescue teams find crashed aircraft faster, saving the lives of survivors and rescuers alike.

> 1960s

#### Setting Clocks Precisely

Since the 1950s, NRC has been a leader in creating and developing atomic clocks that keep Canada and the world running "on time."

> 1990s

#### Preserving the Environment

NRC researchers developed BioBrite™, an enzyme that dramatically decreases organochlorine discharges from pulp bleaching while saving mills hundreds of thousands of dollars each year.

> 1990s

#### Helping Olympians Compete

NRC helps Canada's speed skaters, skiers, skeleton teams and other Olympic athletes reach the top of their sport by testing and improving their aerodynamics, equipment and clothing.

> 2000s

#### Improving Food and Water Safety

NRC scientists are making our food and water safer by developing ways to eliminate E.coli bacteria and detect water-borne pathogens before they reach humans.

> 2000s

#### Digitally Defining the Mona Lisa

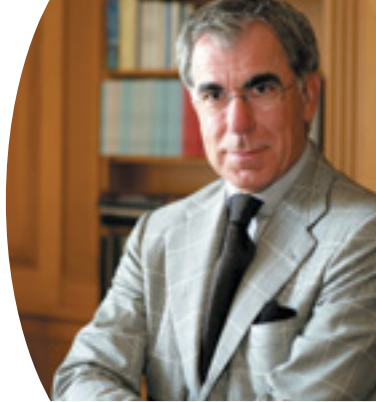
NRC used "virtualizing reality" technology, first developed at NRC in the mid-1980s, to create extremely high-resolution 3D digital records of the Mona Lisa and other historic treasures.

*2006  
NRC celebrates  
90 years of  
discovery and  
innovation.*

Canada's National Research Council has earned a global reputation for excellence in science-based research and development.



## From the President



Over its 90-year history, Canada's National Research Council (NRC) has earned a global reputation as a unique and valued asset for science-based research and development. NRC's innovations have saved lives, transformed industrial processes and helped the environment — its extraordinary discoveries rank among the greatest in modern science.

NRC exemplifies *Science at Work for Canada*, advancing knowledge and generating new technologies in virtually every sphere of science and engineering. Other Canadian R&D organizations may share some of our research goals, but our focus differs from theirs in significant ways.

Most important, NRC works on behalf of all Canadians. We tackle research that addresses the nation's most critical R&D priorities — issues such as the need for clean, renewable sources of energy and manufacturing processes that will not harm the environment. Finding solutions for these and other challenges will make life better for everyone while helping Canada lead in important new areas of technology.

In addition, NRC helps whole sectors of Canadian industry compete more effectively on the world stage. Hundreds of NRC technologies are currently at work in aerospace, biotechnology, manufacturing,

information technology and other sectors. NRC is also at the leading edge of research in emerging fields that will have a major economic impact in the coming years, helping to create a strong foundation for new industries.

NRC also works with individual firms, providing financial and technical assistance to those with the potential to lead in a new area of technology. We provide access to top research expertise and networks as well as Canada's best collection of current S&T information. We determine Canada's national codes and measurement standards. We offer invaluable design, testing and calibration services. We provide business development and commercialization support, including help with intellectual property. We also offer firms the opportunity to co-locate with NRC in facilities designed to help them develop new technology and prepare for the marketplace.

Finally, NRC strengthens our national innovation and commercialization capacity. For several years, we have worked with industry, government and university partners in Canadian communities to stimulate technology-intensive "clusters" of firms in sectors that are vital to our future.

It is this enduring commitment — to be *Science at Work for Canada* — that makes NRC such a valuable resource for the nation.

A handwritten signature in blue ink, which appears to read "Pierre Coulombe". The signature is written in a cursive style and is positioned above the printed name and title.

**Dr. Pierre Coulombe**  
**President**



Research and innovation  
are crucial to Canada's  
economic growth  
and national quality  
of life.



Research and innovation are crucial to Canada's economic growth and national quality of life. One of Canada's challenges is to ensure that the knowledge developed in organizations like NRC is transformed rapidly into products, services and technologies that will help our nation compete in today's aggressive global marketplace.

Over the years, NRC has consistently foreseen Canada's S&T-based opportunities, adapting its research and industry support programs to address national needs and priorities.

NRC has long been the nation's leading R&D force in biotechnology, aerospace, manufacturing, construction, information and communications, ocean engineering and other areas. To remain at the forefront of research, NRC has also moved into important new fields including genomics, fuel cells, quantum information and computing, bioinformatics, high-performance computing, photonics, nanotechnology, as well as environmental and sustainable development technologies.

NRC's work spans the innovation spectrum, from discoveries at the frontiers of science to the commercialization of new technologies. No other single Canadian organization can match the range and excellence of NRC's R&D programs. No other can offer as much support to help industry develop breakthrough technologies and bring them to market. No other can bring as many highly respected minds from so many disciplines to bear on today's S&T challenges.

As part of our mandate, NRC investigates and determines measurement standards and ensures the standardization and certification of scientific and technical apparatus for

Canada. NRC's role in metrology has become even more crucial to industry as we witness the rapid emergence of revolutionary new materials and technologies that require new means of measurement and certification.

On behalf of the nation, NRC also operates the astronomical observatories established by the Government of Canada and conducts leading-edge research into astrophysics. Our international collaborations are safeguarding Canada's standing as a major player in international astronomy and securing Canada's participation in the next generation of ground- and space-based observatories.

For several decades, NRC has been making valuable contributions to Canadian industry, the growth of our economy and the well-being of Canadians. Enhancing quality of life through S&T-based innovation that drives real economic growth – that's what NRC is all about.

## NRC at a Glance

NRC performs world-class research to give Canadian industry a competitive edge while developing solutions to Canada's national S&T priorities. Through our 25 research institutes and technology centres, we conduct long-term research in virtually every S&T-driven sector of our economy.

### Creating Value for the Nation

NRC's budget of more than \$800 million a year reflects Canada's commitment to innovation. Our scientists, engineers, technicians, advisors and managers are constantly looking to match ambitious Canadian business people with exciting S&T-based commercial opportunities.

In addition to helping Canadian firms innovate, NRC itself spins off new companies to move NRC technologies to market. Since 1995, it has created 67 companies and some 700 jobs while attracting \$462 million in cumulative investment.

In 2005-06 NRC:

- earned \$6.9 million by licensing NRC technologies
- contributed \$73.31 million in research assistance to small and medium-sized enterprises through the NRC Industrial Research Assistance Program (NRC-IRAP)
- supported 1,310 clients through fee-for-service R&D
- fueled the creation of six new companies using NRC technologies
- made important discoveries leading to new technology licensing opportunities
- delivered some 650,000 S&T documents to clients worldwide.

### Critical R&D Facilities for Canada

Industry, university and government partners can benefit from NRC's specialized equipment and facilities in:

- aerospace engineering and manufacturing
- aluminium transformation
- astronomy and astrophysics
- environmental biotechnology



- gas turbine research
- high-throughput screening, DNA sequencing and microarrays
- housing technology
- hydraulics engineering
- industrial materials
- nanoimprint lithography
- marine biosciences and aquaculture
- metrology and certification
- neutron beam research
- nuclear magnetic resonance imaging
- ocean and marine engineering
- photonics
- precision and free-form manufacturing
- surface transportation technology
- ultra-fast lasers
- and more.

### Global Connections

NRC extends Canada's R&D networks and influence through international research collaborations and partnerships. In 2005-06, NRC:

- signed 95 formal research collaboration agreements with international partners for a value of \$32.7 million
- had current international agreements worth \$141.6 million over their lifetime



- organized and/or participated in 184 incoming foreign delegations, and 173 international conferences and workshops
- organized 16 international missions to 13 countries to connect Canadian firms with international sources of technology, technical intelligence and economic opportunity.

### Community-based Innovation

Through its technology cluster initiatives, NRC has brought local interests together with innovative companies to develop specific areas of technology in communities across Canada:

- fuel cells and hydrogen technology — Vancouver
- nanotechnology — Edmonton
- plants for health and wellness — Saskatoon
- sustainable urban infrastructure — Regina
- biomedical technologies — Winnipeg
- photonics — Ottawa
- aluminium transformation — Boucherville and Saguenay region
- life sciences — Halifax
- information technology and e-business — Moncton and Fredericton
- nutrisciences and health — Charlottetown
- ocean technologies — St. John's.

### Great people, great minds

NRC's success lies with the more than 4,200 knowledgeable and creative men and women who give the organization life. Over NRC's 90-year history, our people have earned an international reputation for excellence in research and innovation. They have earned the highest regard of their peers, colleagues and collaborators in a wide range of science and engineering domains. Their honours include a Nobel Prize, an Academy Award and helping Canada capture Olympic Gold.

In 2005-06, NRC researchers:

- published 1,430 articles in refereed journals
- prepared 924 papers for peer-reviewed conferences
- issued 1,515 technical reports
- received 105 external awards
- held 173 positions on editorial boards of scientific publications
- were active in 114 national and international research networks
- collaborated with 1,262 visiting workers
- hosted 262 postdoctoral fellows and 118 research associates.

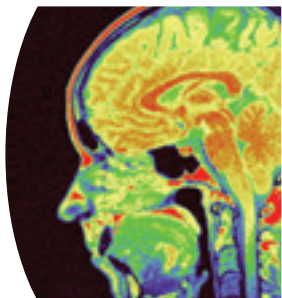


NRC provides the research expertise and facilities needed to help Canada forge ahead in key sectors of the economy.



# A Force for Canadian R&D

## Life Sciences



NRC was established to provide the research, expertise and facilities needed to help Canadian industry grow. It was also mandated to address the nation's most critical issues through R&D, helping Canada forge ahead in key sectors of the economy. Today, NRC has state-of-the-art research facilities

located across Canada. With research focused on life sciences, physical sciences and engineering, NRC translates discoveries and technological advances into value and a better quality of life for Canadians.

### Biotechnologies for health and the environment

In Montréal, NRC performs leading-edge R&D in biochemical engineering and molecular-level biology, serving the pharmaceutical and environmental industries. Our biotechnology research program focuses on new strategies for treating diseases, preventing and cleaning up pollution, and developing new bioprocesses.

### Innovative diagnostic and medical devices

In Winnipeg, NRC develops medical devices and technologies to quickly and accurately diagnose health conditions such as cancer, stroke and cardiovascular disease. We focus primarily on the diagnostic use of magnetic resonance and infrared spectroscopy, and work with university, industry and other partners to commercialize advanced medical devices.

### Therapeutics to combat debilitating diseases

In Ottawa, NRC conducts innovative research in biological sciences to reduce the impact of age-related and infectious diseases. Our research program focuses primarily on neurodegenerative diseases such as stroke, Alzheimer's and Parkinson's, and vaccines and immunotherapies against infectious diseases. We collaborate with industry, universities, hospitals, and other R&D organizations to transfer health-related technology to Canadian and multinational firms.

### Discoveries supporting marine life

In Halifax, NRC is investigating marine life — from the genome to the whole organism. Our multidisciplinary approach targets three core areas: aquaculture, natural marine toxins, and advanced research technologies. Our expertise includes analytical chemistry, bioinformatics, finfish and shellfish health and nutrition, functional genomics, metabolomics and proteomics. Our objective is to help Canada protect and enhance marine life while drawing benefits from it.

### Natural compounds for better health

In Charlottetown, NRC is determining how bioactive compounds found in nature can be used to improve human and animal health. The research program focuses on the role that natural compounds could play in treating neurological disorders, obesity-related disorders, infection and immunity.

### Improved crops and nutraceuticals

In Saskatoon, NRC performs R&D to increase Canada's crop production and improve plant stock for nutraceuticals. Our main objective is to develop disease-resistant, higher-yield varieties of crops that will thrive in Canada's climate and increase revenues for Canadian farmers. Another of our objectives is to help Canada become a world leader in developing plant-based pharmaceuticals and natural health products.

## Physical Sciences



### Exploring the mysteries of the universe

In Victoria and Penticton, NRC operates the astronomical observatories established by the Government of Canada, providing access to the Canadian and international research community. Through NRC, Canada is a partner in the seven-nation Gemini Observatory, the Canada-France-Hawaii Telescope and the James Clerk Maxwell Telescope. NRC has earned an international reputation for its astrophysics research as well as for its development of advanced scientific instrumentation and data management, mining and manipulation technologies.

### Cleaner industrial processes for a healthier environment

In Ottawa, NRC is helping chemistry-intensive industries by developing innovative processes and technologies that make environmentally responsible manufacturing possible. Applying our expertise in computer modeling, material sciences and process technologies, we are developing technologies related to fuel cells, oil sands and bioproducts.

### Information and communications technologies for industry

In Ottawa, Gatineau, Fredericton and Moncton, NRC creates and commercializes software and systems technology to help Canada prosper in the e-business world. Through our research and business services in these locations, we

provide a competitive advantage to myriad industries — from health care and manufacturing, to transportation and entertainment.

### Novel materials and technologies for information processing

In Ottawa, NRC focuses on creating the materials and technologies that will help Canada become a world leader in information processing, transmission, storage and display. Our core competencies include optoelectronics, photonics, semiconductor growth, processes and materials, thin-film technology, nanotechnology and acoustics. We are targeting markets in microelectronics, communication hardware, multimedia, sensors and biotechnology.

### National measurement standards for global trade

In Ottawa, NRC ensures the accuracy, validity and traceability of the physical and chemical measurements used by industry. We also develop internationally recognized techniques, standards and services for measuring emerging technologies and materials — an essential support to firms wishing to exploit them. In addition, we test and certify products before they are marketed. These services are crucial to industry where measurement is a key component in assuring the quality, interoperability and exchangeability of components throughout the world.



#### Nanotechnologies for next-generation firms

In Edmonton, NRC conducts advanced multidisciplinary R&D to support a new generation of nanotechnology firms. Applying the skills of top researchers in physics, chemistry, engineering, biology, informatics, pharmacy and medicine, we are developing molecular-scale devices and sensors and other applications where nanotechnology could be used.

#### Molecular discoveries leading to Canadian innovations

In Ottawa and Chalk River, NRC develops and disseminates knowledge in molecular sciences. The Ottawa teams offer

expertise in chemical synthesis, material characterizations, the chemistry of biological processes, predicting material properties, and using femtosecond lasers in optics and telecommunications research. Our Chalk River facilities house the Canadian Neutron Beam Centre and the National Research Universal (NRU) reactor. Academic and industrial researchers use the NRU reactor to explore materials of all kinds toward developing innovations in therapeutics, diagnostics, advanced electronics, telecommunications, and advanced materials.

The excellence of NRC's metrology and calibration work is recognized worldwide. On behalf of Canada, NRC collaborates with national metrology institutes and international committees to establish a uniform global metrology system.

## Engineering



### New heights in aerospace research and technology

In Ottawa and Montréal, NRC develops the knowledge and offers the skills required to make advances in the aerospace industry. Working with industry partners, NRC fosters innovation in the design, manufacture, performance, use and safety of aerospace vehicles. We also have all the facilities and equipment required to test and certify products for the industry.

### Powering the future through fuel cells and hydrogen

In Vancouver, NRC conducts projects to develop and test hydrogen and fuel cell systems, working closely with universities, government and the private sector to reduce Canada's dependence on fossil fuels. At this facility, NRC focuses on developing polymer electrolyte membrane fuel cells, solid oxide fuel cells, and hydrogen and alternative fuels.

### Advanced processing technologies for key industries

In Boucherville and the Saguenay region, NRC supports Canadian industry by conducting R&D on the processing of materials. NRC works on metals, polymers and several other materials for the aerospace and automotive sectors. We also conduct research on virtual fabrication, advanced instrumentation, environmental technologies, nanomaterials and biomedical materials.

### Integrated technologies for manufacturing

In London, NRC focuses on developing integrated technologies for the manufacture of products and equipment that cannot be created through conventional technologies. Collaborating with partners in government, university and industry, we conduct R&D in system simulation and controls (virtual manufacturing) and novel production processes. At this facility, we serve the aerospace, automotive, tooling, medical devices, and electronics sectors.





### Engineering advances supporting marine industries

In St. John's, NRC finds solutions to engineering challenges that affect Canada's marine industries. We focus on ship and underwater vehicle dynamics, the effects of ice on marine systems, the impacts of mooring and towing, wave-current interaction, wave impact analysis and marine safety systems. Our objective is to improve the performance of marine systems and develop new technologies to help Canada's marine industries compete more effectively.

### Better buildings and systems for the urban environment

In Ottawa and Regina, NRC develops building codes and standards, turning knowledge into practical information for Canada's construction sector. We help develop new technologies to ensure that buildings are safe, energy efficient and sustainable. Researchers at our Ottawa facility provide the National Building Code, conduct fire research, and improve technologies for indoor environments. At our Regina centre, our objective is to develop new technologies and management approaches for water and wastewater systems as well as roads, highways, bridges and other components of civil infrastructure.

### Solutions to coastal and inland water problems

In Ottawa, NRC develops and provides services for studying maritime structures, coastal processes, environmental hydraulics and cold regions engineering. At our hydraulics and coastal engineering laboratory — Canada's largest — we work with other government departments to provide solutions to water-related problems in rivers, lakes, coastal areas and oceans.

### Protecting life through improved transportation

In Ottawa and Calgary, NRC conducts proprietary research, develops technology, and tests vehicles and vehicle systems under contract to the rail and road transport industries, defence departments, and vehicle and equipment manufacturers. We also test vehicles under extreme climate conditions and provide technological solutions for climate-related problems affecting vehicles.



NRC is in the business of helping Canadian companies develop and take new technologies to market.



## A Valued Partner to Industry



NRC is in the business of helping Canadian companies develop and take new technologies to market. Our approach is designed to strengthen the innovation and commercialization capacity of firms while gaining the most leverage from the knowledge

and technologies NRC generates.

### Improving the Odds through Collaborative Research

One of the best ways for NRC to transfer knowledge to industry is to collaborate on research. NRC often teams up with industrial partners to create new technologies or improve existing products or processes. Collaborations range from single-company projects to multi-partner arrangements with small and large firms as well as university partners.

A collaborative research agreement brings distinct advantages. First, sharing the cost of the R&D reduces the firm's investment risk. Second, NRC and the firm's researchers work side by side, increasing the firm's technical expertise and improving the odds for successful commercialization. And, while the firm gains access to NRC's world-class research facilities and R&D support, NRC benefits from an opportunity to jointly develop exciting new applications and technologies.

### Licensing NRC Technologies

While conducting advanced research, NRC sometimes makes a discovery that could pave the way to a valuable new technology. If we see a strong potential application, we develop the new technology and, through licensing, make it available for commercialization. In this way, hundreds of NRC technologies have been put to work for industry in aerospace, biotechnology, manufacturing, information technology and other fields.

If a firm can show it is well positioned and able to exploit an NRC-developed technology, we grant the firm a licence in return for an up-front payment and/or royalties based on sales. If a licensing agreement arises from collaborative research, the terms of the agreement reflect the client or partner's contribution to developing the technology.

NRC's licensing income has grown significantly over the past few years. In one year alone, an NRC vaccine technology generated a single royalty payment of close to \$3 million — the highest individual royalty payment ever made to a federal government organization.

Licensing revenues flow back to the NRC research groups responsible for the initial development and commercialization of the technology. By reinvesting licensing revenue in our research programs, we can sustain the cycle of innovation: from discovery to commercial success.

In 2005-2006, NRC signed 97 new licence agreements worth \$6.9 million. Here are just a few examples.

- In the field of industrial materials, NRC licensed technologies for plastic, composite and metal-powder based products. They are now being used in new truck parts, new manufacturing processes and other applications.
- In the field of surface transportation, NRC licensed a new elastomeric pad that improves the performance of railcar bogies — wheel trucks — to the largest North American bogie manufacturer.
- In the field of astrophysics, NRC has developed a new generation of extremely sensitive Band 3 receivers and special cryogenic amplifiers for these instruments. A Canadian company now has the licence to produce these amplifiers and will further develop and use the technology in its own product lines.
- In the field of biological sciences, NRC has licensed its patented archaeosome adjuvant technology to a company that will use it to develop vaccines against pathogens and cancer.



### Helping Canadian Companies Innovate

Canada is home to hundreds of thousands of small and medium-sized enterprises on the cutting edge of the nation's economic development. When these firms succeed in bringing novel materials, processes and technologies to market, Canada reaps the benefits.

Most of these enterprises don't have the resources and connections to develop and commercialize an innovation based on an advanced new technology. Nor can they assume the risk, alone. That's where NRC steps in.

### Assisting with Industrial Research

The NRC Industrial Research Assistance Program (NRC-IRAP) is the Government of Canada's premier innovation and technology assistance program. Regarded worldwide as one of the best programs of its kind, NRC-IRAP helps innovative companies make the leap from concept to commercial success.

NRC-IRAP links promising firms to NRC's diverse networks, programs and infrastructure to help them refine and exploit new technologies.

NRC delivers the program through 260 technical advisors and business development professionals in more than 100 communities across Canada. By providing financial assistance as well as business and technical support, NRC-IRAP helps innovative companies move through various stages of development of a particular product, process or service.

NRC-IRAP provides advice and customized solutions to more than 12,000 small and medium-sized enterprises each year. The program also facilitates international connections through technology trade missions to regions such as Europe, Indonesia and China.

### Access to scientific and technical information

A good idea starts with good information. NRC is one of the world's leading providers of information in science, technology, engineering and medicine. NRC Research Press is our publishing arm, with 15 international journals of research plus dozens of books and conference proceedings.

NRC serves industry, universities, government and the public, helping to transfer knowledge rapidly to the private sector. Our document delivery service is among the fastest and most reliable of its kind. Users have access to the

When NRC develops a technology with a high potential commercial value, it applies for a patent. Once the technology is patented, NRC looks for a Canadian industry partner with the right capacity to fully exploit the technology.

NRC collection — one of the most comprehensive in North America — and can obtain virtually any document from anywhere in the world.

NRC serves thousands of researchers and libraries and responds to almost one million requests for information each year. On an annual basis, we help over 6,500 industrial clients, providing quick access to essential technical information for their business ventures.

NRC can provide essential information to the small and medium-sized enterprises associated with our technology cluster initiatives or industrial research assistance programs. Thanks to the detailed analysis of technological trends that NRC can provide, these businesses can position themselves better to maximize results from their R&D investments.

### Industry Partnership Facilities — A place for companies to grow

Companies preparing to exploit an advanced technology need a place to work through the early stages while they iron out R&D issues or their business strategy. Filling this need, NRC offers companies the chance to “incubate” at its world-class Industry Partnership Facilities (IPFs) across the country.

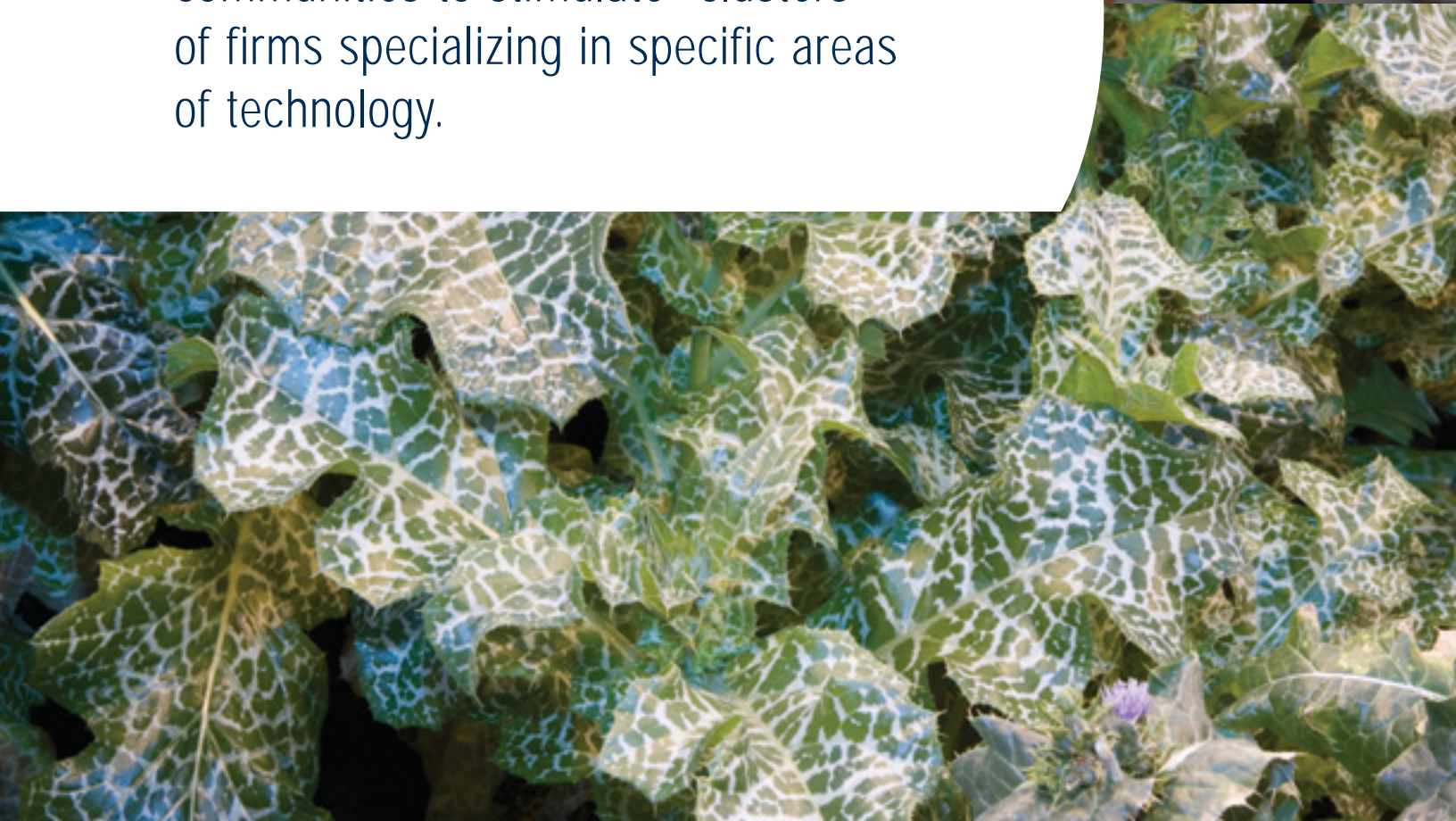
NRC provides R&D expertise, design and prototyping services, technical information and business planning services through these partnership facilities.

Incubating companies are far more than just tenants; in many cases they pursue research collaborations with NRC. These companies benefit from a stable environment in which to grow, while gaining access to important networking opportunities within Canada and beyond our borders.

Thanks to NRC’s Industry Partnership Facilities across Canada, many young companies have entered the commercial market on far stronger footing. The proof is in the pudding — 95 percent of the companies that have “graduated” from NRC’s facilities are still in business.



NRC works with partners in Canadian communities to stimulate “clusters” of firms specializing in specific areas of technology.



# Sparking Innovation in Canadian Communities



In the year 2000, NRC began working with university, industry and government partners in Canadian communities to stimulate “clusters” of firms specializing in specific areas of technology. NRC’s technology cluster initiatives are helping Canadian companies prepare to

capture a larger share of world markets.

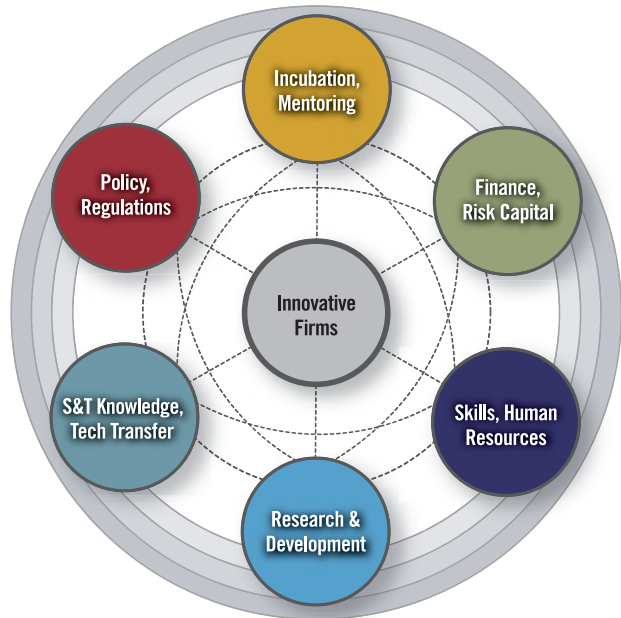
## The NRC Cluster Model

“Clustering” is the term economists have borrowed from science to describe the significant concentration of innovative companies around a nucleus of R&D facilities in a single locale – the ideal environment for innovation to flourish.

A key ingredient is the presence of a science and technology anchor, usually a government research organization or a university able to work with local companies, transfer technology and spin off new enterprises.

When innovative S&T firms come together to work on common goals, they act as a magnet. Over time, other firms with technical and business expertise relocate and invest in the area, building a critical mass of skilled people with the entrepreneurial drive and the capacity to attract capital investment.

NRC has served as the catalyst and S&T anchor for 11 clusters, with its own research facilities at the hub. Today Canada has early-stage clusters in nanotechnology, fuel cells, biomedical devices, ocean technologies, IT and e-business, nutraceuticals, aluminium transformation, photonics and other sectors vital to our future. NRC has played a big role in these initiatives by bringing its networks, facilities, research expertise, and industry support to the table.

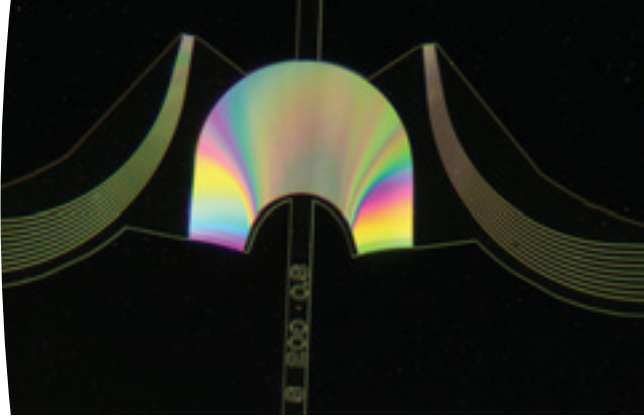


The NRC Industrial Research Assistance Program (NRC-IRAP) is a critical component of Canada’s strategy to strengthen our economy through technology clusters. Not only does NRC-IRAP identify emerging opportunities for local industry, it also links firms to technology clusters to ensure research relevance and increase the flow of knowledge and technologies to firms. NRC-IRAP collaborates with organizations inside and outside government, especially those with programs that could help industry commercialize a new technology.

## Technology Clusters across Canada

### Vancouver — Fuel Cells and Hydrogen Technologies

NRC’s Vancouver-based technology cluster is the world’s fastest growing and most sophisticated group of companies and organizations focused on fuel cell and hydrogen-energy technologies. By 2017, when experts say the global industry will be worth trillions of dollars annually, NRC’s early strategic investments will have primed the Vancouver cluster for a significant market share.



### Edmonton — Nanotechnology

NRC's bold decision to construct a state-of-the-art \$120 million nanotechnology research facility in collaboration with the province and the University of Alberta has secured Canada's position at the vanguard of nanotechnology research worldwide. This facility can house up to 30 principal investigators who will collaborate with more than 100 university scientists and 120 NRC researchers and staff to produce revolutionary products and processes that could alter the way we make everything from transistors to skyscrapers.

### Regina — Sustainable Urban Infrastructure

Canadian communities depend on the services and systems that provide electricity, communications and drinking water, and maintain roads, highways and bridges. In Regina, NRC is spurring the growth of a technology cluster dedicated to making urban infrastructure more sustainable. NRC is working with local firms at its Regina research centre to turn new technologies and methodologies into business opportunities, and then transfer them to other Canadian communities and the rest of the world.

### Saskatoon — Plants for Health and Wellness

For more than 20 years, NRC has been a catalyst for Saskatoon's spectacular cluster growth. NRC's plant biotechnology research facility is the hub of R&D on agricultural biotech for crop improvement and the production of nutraceuticals and "functional foods." The evolution of this cluster from a small industrial community to a global player providing more than 1,100 local jobs shows how visionary thinking and careful planning can turn federally funded research into marketable products.

### Winnipeg — Biomedical Technologies

NRC's biomedical technology cluster is one of the fastest-growing concentrations of medical devices and life sciences industries in Canada. The 150 health-related companies and organizations associated with this life sciences cluster employ 4,200 people and generate sales of more than \$440 million a year — a figure that grows annually. In 2005, NRC opened a commercialization centre in Winnipeg to help companies and technology organizations bring pioneering biomedical innovations to market.



### Ottawa — Photonics

Since photonics became one of the hot disciplines in the late 1980s, NRC has mobilized the partners and the resources to seize the potential of photonics in nanotechnology, biotechnology and other fields. Today, Ottawa has the most vibrant photonics cluster in Canada; it stands among the top five in the world for innovation. NRC's new photonics facility allows companies to use simulation, design, fabrication, testing and prototyping services to help reduce time to market for their products.

### Saguenay — Aluminium Transformation

In the late 1990s, NRC targeted Saguenay — the nation's top aluminium producing region — as Canada's most promising investment site for pioneering R&D in aluminium transformation. In 2002, NRC built a state-of-the-art aluminium technology centre for the region's most enterprising researchers. Thanks to the resources offered and the key industry partnerships NRC has cultivated there, the Saguenay cluster is conducting groundbreaking research into the most profitable ways of transforming aluminium into durable, lightweight components for a host of industries.

### Nova Scotia — Life Sciences

With more than 50 companies hard at work on life sciences R&D, Halifax has rapidly built its capacity to produce leading-edge and lucrative life sciences products. NRC's marine biosciences research facility is the hub of this cluster where major industry players have joined together to pursue shared research goals. To support emerging companies through the risky start-up years, NRC has built a \$4.2 million Industry Partnership Facility that can incubate 12 small and medium-sized enterprises, giving them access to research expertise and commercial opportunities.

### New Brunswick — Information Technology and e-Business

Since 2000, NRC has brought key players in New Brunswick's e-business technology cluster together to pursue a common objective: seize a sizeable share of the global e-business market where sales have reached \$8.5 trillion. Using the NRC information technology facility as the hub, NRC is helping leading-edge firms turn federally funded research into marketable products.

### Prince Edward Island — Nutrisciences and Health

Prince Edward Island has become a Canadian R&D centre for using bioresources – renewable, naturally occurring land- and sea-based resources – to produce new pharmaceuticals, nutraceuticals and dietary supplements. In 2001, NRC began uniting PEI's expertise in bioresources into a cluster of industry and university partners who together could capitalize on a global nutrition market valued at well over \$100 billion. In 2006, NRC strengthened the cluster by building a nutrisciences and health research facility that now attracts top talent from the worldwide bioresources community. Scientists from NRC, Agriculture and Agri-Food Canada (AAFC) and the University of Prince Edward Island (UPEI) will share space, resources and ideas at the facility, located on UPEI's campus.

### Newfoundland and Labrador — Ocean Technologies

NRC is nurturing a vibrant cluster of organizations in Newfoundland and Labrador to capture a sizeable portion of a \$1.8 trillion global ocean technology market. By positioning NRC as the hub of the community's groundbreaking R&D activities, NRC encourages key players to work collaboratively toward common goals. Marine-based oil and gas services, energy-efficient marine transportation, eco-sensitive ocean harvesting, and climate and ocean monitoring are just some of the areas in which this cluster is conducting R&D.



The capacity to demonstrate S&T strength to the world determines Canada's ability to compete for skilled workers and investment capital.



## NRC at Work on the World Stage

The capacity to demonstrate S&T strength to the world is important for Canada. It determines our ability to compete for skilled workers – an increasingly mobile population – and for investment capital. It also opens the door to global knowledge-sharing networks that operate on the leading edge of science and technology.

The international scientific research community has always cooperated across borders. Most of this cooperation occurs informally, between researchers. Given the enormous benefits generated by these informal partnerships, NRC actively pursues international research alliances on behalf of Canada.

Through its missions abroad, NRC helps Canadian firms connect with international programs, sources of technology and technical intelligence. These efforts have produced significant results for all sectors of the Canadian economy.

As of 2005-2006, NRC had current international agreements worth \$141.6 million over their lifetime. During the year, NRC also signed 95 new research collaboration agreements with international partners for a value of \$32.7 million.

To continue building its strategic alliances, in 2005-2006 NRC employees received 184 incoming foreign delegations, and organized or attended 173 international conferences and workshops.

### International Opportunities for Canadian Companies

The NRC Industrial Research Assistance Program (NRC-IRAP) plays a key role in connecting Canadian small and medium-sized firms to opportunities in emerging markets.

In 2005-2006, NRC-IRAP undertook technology missions with 75 Canadian firms to 16 countries on three continents. All these missions helped the Canadian firms identify potential new technology alliance opportunities, partners and collaborators.

### Measuring Up to Improve International Trade

Fair and open trade depends on countries having accurate, consistent and easily comparable measurement standards. To remove technical trade barriers for Canada and other countries, NRC is working with national metrology institutes around the world to establish internationally accepted standards and measurements.

NRC develops new instruments and measurement methods; maintains primary standards and certified reference materials, comparing them with those of other countries; and provides specialized services including calibration technical assessments to Canadian firms. NRC represents Canada on more than 150 international metrology and standards committees and is a leader in international comparisons. As a result of this work, Canada's standards are now recognized by all our trading partners, helping to increase Canadian exports.

### Major Science Initiatives — a Global Advantage

In various ways, NRC supports the following large-scale science initiatives. Each one makes a unique contribution to the Canadian and global science community.

- National Research Universal (NRU) reactor for materials research
- Tri-University Meson Facility (TRIUMF), Canada's national laboratory for particle and nuclear physics
- Canadian Light Source (CLS), Canada's synchrotron, helping scientists understand molecules and materials
- Sudbury Neutrino Observatory (SNO), a deep underground heavy-water Cherenkov detector designed to detect neutrinos produced by the sun
- International telescopes – Gemini North (Hawaii), Gemini South (Chile) and several other international astronomy projects

Canadian researchers from universities, industry and government are invited to join forces with international collaborators at all these facilities.

NRC aims to solve real problems, such as the need to develop clean, sustainable forms of energy.



### Discoveries that Make a Difference



NRC actively seeks solutions to national challenges in health, climate change, the environment, clean energy and other fields, helping to lay the foundation of knowledge that will fuel Canada's growth. The focus is on solving real problems — those with the potential to save lives,

improve the environment and quality of life, or create new technologies and industries where Canada can be a world leader.

Many of the research successes NRC reports today are the result of long years at the bench, yielding incremental steps toward sought-after solutions.

#### Medical Diagnostics and Treatments

**Toward a new vaccine** — 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 lipopolysaccharide-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.

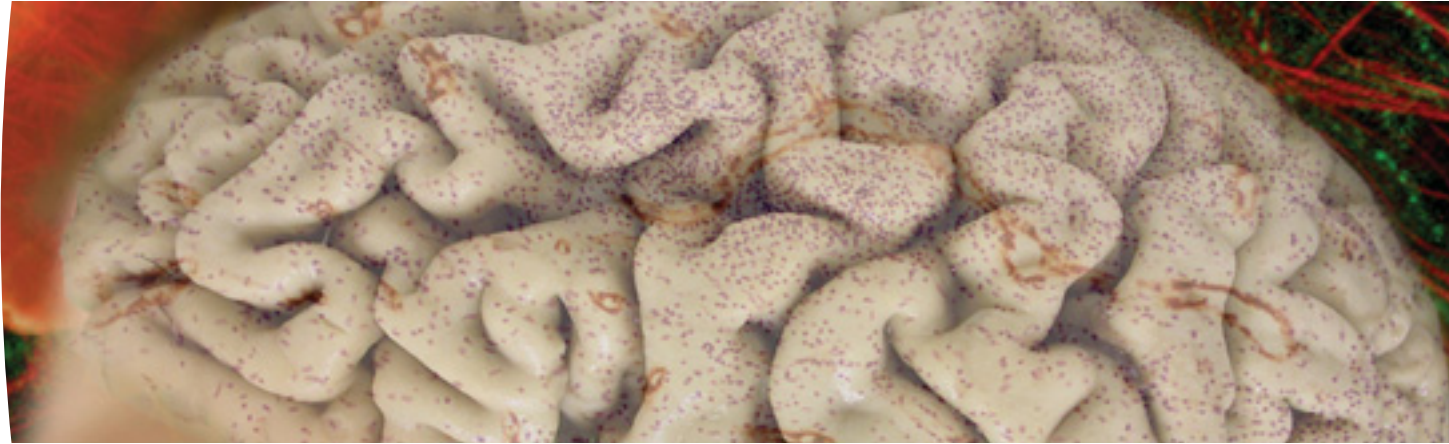
**Alternatives to antibiotics** — Antibiotic resistance, a major threat to our ability to control bacterial infections, is driving the search for alternatives to reduce the risk of food-related disease caused by pathogens. In collaboration with Dow AgroSciences Canada, NRC researchers have focused their research on reducing the threat of *Campylobacter jejuni*, the leading bacterial cause of food-borne disease in North America. The research team is progressing well towards an antibody-based decolonization strategy to reduce the bacterial load in animals. This achievement will help develop a new generation of feed-based products that will combat bacterial infection without antibiotics.

**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.

**An eye drop against blindness** — Protein glycation is one of the major pathways implicated in the development of cataracts, the leading cause of blindness worldwide. Following an extensive data search on protein-glycation inhibiting compounds already used in approved drugs, NRC selected isoproterenol — considered safe for humans and easily absorbed into the eye without reducing internal eye pressure. Its prodrug, prepared as an eye drop and applied to diabetic rats, significantly delayed the initiation of the diabetic cataract. If testing in humans reveals the same result, this simple eye drop could become a cost-effective approach to prevent or treat cataracts.

**Understanding how heart cells respond to hormonal signals** — Thanks to breakthrough research, NRC scientists can now visualize and quantify the nanoscale receptor clusters in heart cells. Using a specialized optical microscopy technique, scientists have revealed how receptors on the heart muscle cells respond to hormonal signals from their environment. Essentially, the new imaging technique improves understanding of how these receptors — transducers of the “fight or flight” response — accelerate the heart rate. This understanding could ultimately lead to novel therapeutics for regulating heart arrhythmias.

**Revealing the secrets of brain adaptation and regeneration** — NRC scientists have discovered the molecules (angiogenesis-modulating peptides) that could help reduce the burden of Alzheimer's disease or enhance brain recovery after stroke-induced damage. These discoveries have resulted



in two patent applications, publications and the award of a Heart and Stroke Foundation grant for further research and development.

### Nanotechnology

#### **Nanotechnology-enhanced construction materials** —

NRC has been exploring how nanotechnology could enhance products for the building industry. The addition of nanoscale particles to concrete has shown promise in improving the control of concrete microstructure beyond what is possible with existing technologies. Programming the time-release of chemical admixtures will also provide maximum effectiveness at the construction site, while reinforcing cement binders with carbon nanotubes may produce cement-based products that resist cracking. The goal is to develop higher-quality materials leading to longer-lasting structures.

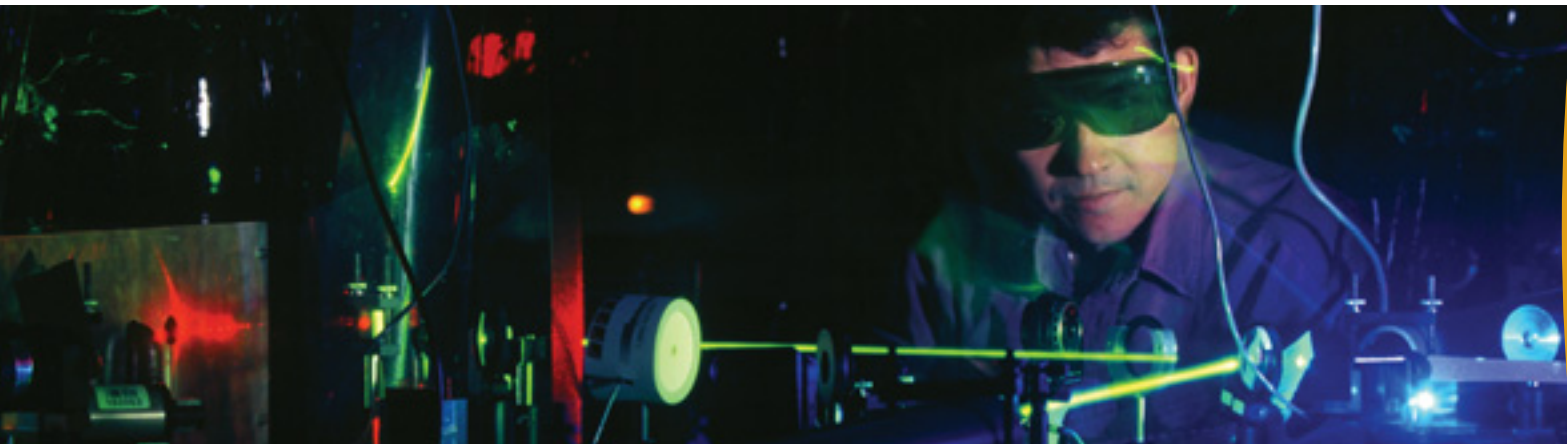
#### **Nanobiosensors for rapid detection of bacteria** —

Nanobiotechnology couples biological elements and electronics to create powerful nanoscale biosensors for use in screening drugs, diagnosing illnesses, and monitoring toxins in water, air, soil and food. In collaboration with Biophage Pharma Inc., NRC has developed a new class of nanobiosensors. They use Electric Cell-Substrate Impedance Sensing (ECIS) to rapidly detect and identify microorganisms in water, food and biological fluids with far greater sensitivity than existing technologies. These nanobiosensors will have wide applications in environmental monitoring, quality assurance of foods and beverages, and biomedical diagnosis of antibiotic-resistant bacterial infections.

#### **Single-atom tip for use in scanning tunneling**

**microscope** — NRC and University of Alberta researchers have developed the sharpest tip ever known for use as a

NRC is helping Canada become a nation of innovators, a nation known for scientific and technical advances that make a significant difference to the world.



sensing probe in scanning tunneling microscopy (STM). A single atom wide, the new probe provides the smallest electron point source ever for STM. Along with STM, the probe has potential applications in atomic force microscopy and could also be used as a physical probe for nanoscale manipulation or for nanoscale point contacts with metals and semiconductors. The probe could also serve as a very precise source for electron beams and provide stronger image magnification for scanning electron microscopy and transmission electron microscopy. NRC has filed an application to patent this technology.

### Alternative Fuels

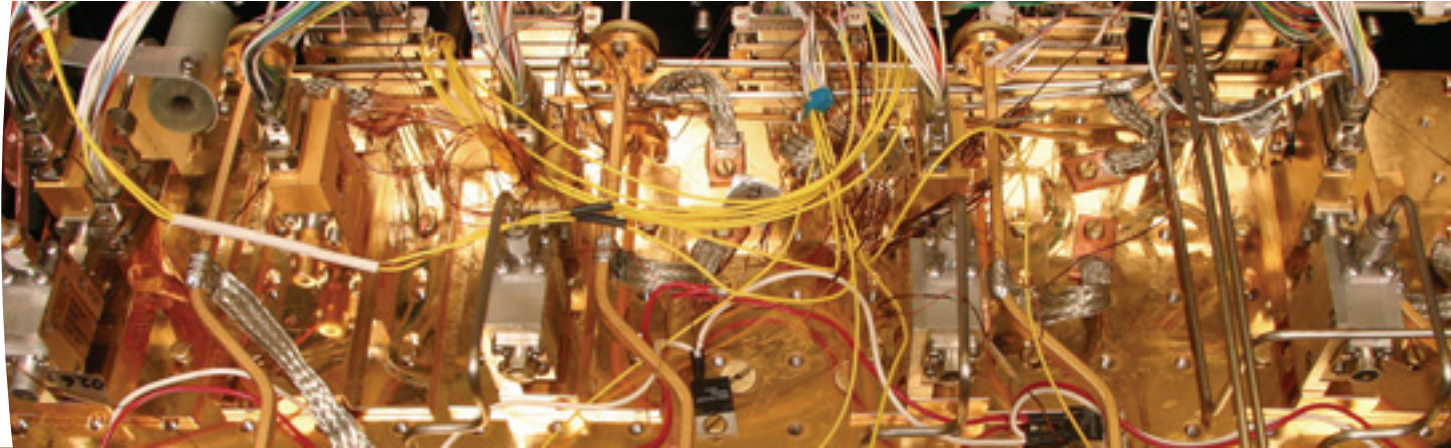
**Great strides in hydrogen storage** — Finding a safe way to compress and store hydrogen is one of the biggest challenges in making hydrogen a viable source of energy. An international team led by NRC has shown that, by adding a touch of stabilizer, twice as much hydrogen can be stored in the gas hydrate framework. Hydrates are ice-like substances found offshore on the continental margins and in permafrost all over the globe. They form when gas comes into contact with water under the right temperature and pressure conditions. Gas hydrates, an excellent source of hydrogen, are being considered as an alternative to fossil fuels. They are one of the world's largest untapped reservoirs of energy and, according to some estimates, have the potential to meet global energy needs for the next thousand years.

### Plant Biotechnology

**Bigger canola with better oil yield** — Since 2003, NRC has been laying the genetic foundation for a new generation of canola varieties. Using genomics techniques, NRC researchers have identified more than 10,000 unique canola genes. They've also built a world-leading library of more than 250,000 Expressed Sequence Tags. An NRC researcher has recently identified a gene that regulates steroid hormone production which in turn affects the rate of plant growth. Once genes are identified, the next challenge is to be able to manipulate them to produce the desired seed characteristics.

### Molecular Sciences

**“Filming” chemical reactions in real time** — An international research team led by NRC has, for the first time, “filmed” a chemical reaction in real time from the molecule's point of view. No technology previously existed that could visually capture a chemical reaction completed within a millionth of a millionth of a second. Fortunately, ultrashort laser pulses — measured in femtoseconds — are even faster than this. With one femtosecond laser pulse used as a starter's pistol, a second laser pulse, delayed, clocks the chemical reaction as it occurs. In this technique, a “picture” of what the molecule is doing at a particular instant is obtained by using the second laser pulse to knock off an electron. Using a combination of techniques, scientists can analyze this



emitted electron in great detail and obtain new information about the chemical process. This approach will lead to new thinking about the design of active materials for “molecular electronics” and a more detailed understanding of biological processes such as vision and photosynthesis.

### Microstructural Sciences

#### **Building blocks for quantum information technology** —

In 2002, NRC announced its success in demonstrating that a single electron could be isolated by purely electrostatic means in a nanoscale field effect transistor (FET), and its spin controlled by applying voltages. This development led to such devices being considered attractive candidates for quantum bits, the operational element of a quantum computer, since the coupling of one or more electrons could be controlled by rapidly switching the applied voltages. In 2005-06, NRC achieved yet another first, demonstrating coupling, control and manipulation of up of three quantum bits in a FET device. This advance has led to the possibility of building quantum processors based on micro-electronic technologies.

### The Science of Measurement

**New light measurement standards for UV-dependent technologies** — Throughout the world, new technologies are being created that require new measurement standards

before they can be manufactured and traded on global markets. NRC, Canada's national metrology organization, develops standards and methods of measurement that have a direct impact on the ease with which Canadian firms can trade internationally. As an example, an ultra high-temperature blackbody – a rare physics tool now being integrated into a new measurement facility at NRC – will soon be one of the world's most accurate ways to measure ultraviolet (UV) light. This innovative tool will reduce calibration uncertainties up to tenfold, providing valuable opportunities for Canadian industries now developing UV-dependent technologies.

### Construction Standards

#### **New objective-based national construction codes** —

NRC partners with the provinces and territories to prepare the National Building Code, National Fire Code and National Plumbing Code of Canada, setting out the health, safety and accessibility requirements for new buildings and those undergoing major renovation. In 2005, NRC published the National Construction Codes in a new objective-based format that makes the codes clearer. Users have a better understanding of the intent behind each requirement, more information to evaluate alternative approaches, greater flexibility to adapt to innovation, and more. Industry reaction has been very positive.





### Astrophysics Instrumentation

#### Highly sensitive instruments for radio astronomy —

NRC scientists have been refining electronic components that could dramatically increase our understanding of deep space and the origins of our universe. A new generation of Band 3 receivers, of unprecedented sensitivity, will play a critical part in the Atacama Large Millimetre Array (ALMA) — a powerful facility being constructed in northern Chile's high-altitude desert. ALMA will incorporate dozens of radio antennas to function as a single observing platform. This telescope will take in light with wavelengths on the boundary of the microwave and infrared parts of the electromagnetic spectrum. The cold gases of deep space emit this kind of radiation, which astronomers expect will offer unprecedented insights about the complex molecules found in these recesses of the universe, along with clues to how planets, stars and whole galaxies are formed.

## Building R&D and Commercialization Capacity

In today's global economy, the competitive position of nations depends on their capacity to innovate. In Canada, NRC supports home-grown innovation by sharing its research, its state-of-the-art laboratories, and its commercialization capacity with companies and communities across the nation.

Each year, NRC invests in programs, partnerships and facilities to prototype, test and commercialize new technologies. In 2005-06, NRC helped build capacity in several locations.

- In Winnipeg, NRC opened a new centre for the commercialization of biomedical technology in partnership with governments, academia and the private sector. The centre is a key element of BioMed City, a community-driven effort to establish Winnipeg as Canada's community of excellence for public health research and innovation.
- In Ottawa, NRC opened its photonics fabrication facility and hosted Canada's first photonics commercialization symposium. Only five weeks after its official opening, the centre delivered its first significant shipment of photonic wafers to one of the world's largest laser manufacturers.
- In Fredericton, NRC opened five IT and e-business research labs in addition to the Advanced Collaborative Environment Lab in Moncton. Both facilities provide invaluable incubation space and mentoring services to the firms developing products and services on site.
- NRC partnered with the PEI BioAlliance to offer customized business advisory services to local bioresources companies. The team running the pilot program will offer emerging companies critical support for business model development, regulatory processes and business execution. They will also pair large "anchor" companies with small businesses that need established industrial partners and sophisticated infrastructure.
- In St. John's, the NRC Ocean Technology Enterprise Centre housed nine companies that worked on developing new technologies with NRC support. During the year, three companies "graduated" from the centre, including one from the Young Entrepreneurs Program.
- NRC has progressed strongly in putting its nanoimprint platform and strategy in place, banking on the idea that nanoimprint lithography — a way of inexpensively manufacturing miniature devices — could become a critical part of future production processes in information technology, medicine and environmental science. NRC has acquired several pieces of leading-edge equipment for its planned nanoimprint lithography prototyping facility. It has also struck a strategic partnership with the Canadian Nano Business Alliance, a key step in developing the network that will help companies commercialize innovative products based on this technology.

In 2005-2006, NRC technologies fueled the creation of six new companies. Since 1995, 67 new companies have been created, accounting for approximately 700 full-time jobs and \$462 million in cumulative investment.

## Moving Technologies to Market



In the course of its research, NRC often develops technologies with strong market potential. It then looks for a company with the required “receptor capacity.” But in many cases there is no Canadian company able to fully exploit a new technology. NRC’s approach is to help establish new companies with commercialization in mind. The venture can be either a spin-off formed by NRC employees or a start-up company led by individuals outside NRC.

In 2005-2006, NRC technologies fueled the creation of six new companies:

**Virtual Marine Technology (VMT)** – A spin-off from NRC, this platform technology provider specializes in marine-based simulation solutions designed to increase safety at sea.

**Qbiotyx Ltd.** – In response to the demand for customized antibodies, this NRC spin-off is using a unique, innovative pentobody technology that can provide antibodies against cells from cancer tumours.

**MAGI Control Inc.** – This new company resulted from an NRC-McGill University research collaboration. Formed to commercialize an automatic controller for thermoforming that reduces energy costs by 20% and material wastes by 50%, the company is installing its first industrial setup in Quebec.

**Methusala Microcell** – This company has the licence to exploit a technology developed at NRC. The technology relates to a method of fabricating micro fuel cells and membrane electrode assemblies that minimizes materials and production costs and is particularly suitable for low-power battery replacement applications.

**AgaPharm** – The AgaPharm team, including an NRC biotechnology researcher, has developed a safe, low-cost prescription eye drop that could potentially replace high-cost, high-risk surgery — now the only treatment option for people whose blindness has been caused by diabetes.

**Saponin Inc.** – This company was created to commercialize the many useful chemicals derived from the plant *Saponaria vaccaria*, also known as cow cockle. NRC conducted the research to characterize Saponaria’s chemical constituents and the work to make a proper breeding line at its Saskatoon facilities.

NRC has always made  
a head start on the next  
generation of technologies  
to help our nation prosper.



# The Way Forward – NRC’s Roadmap for 2007-2011

Over the years, NRC has foreseen opportunities in the worldwide S&T landscape and adapted its R&D programs and industry support services to turn these opportunities into advantages for Canada. Our top concern is to do this job even better.

In 2005-2006, we conducted in-depth studies and consultations to identify critical developments in science and technology, key trends in the global economy, and major challenges and opportunities for Canadian industry in the coming years. We then analysed these developments, trends and opportunities against the resources and strengths of NRC. The five-year strategy that has emerged, *Science at Work for Canada*, presents the measures NRC will take to become an even stronger force for Canadian innovation.

## Our Goals

- Contribute to the global competitiveness of Canadian industry in key sectors, and to the economic viability of communities
- Strengthen Canada’s innovation system
- 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 R&D 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

## Key Outcomes

- Increased flow of technologies into high-impact and emerging sectors of the economy
- NRC providing national access to integrated R&D and innovation support to industry
- NRC programs aligned to effectively address enduring issues of the nation

## Creating a Vital Future

NRC has always made a head start on the next generation of technologies and innovations that could help our nation prosper. Much of our success has come from the effectiveness of our partnerships, networks, collaborations, and the national and international committees in which NRC participates.

In the years to come, NRC will continue delivering the programs and activities that have generated economic and social benefits and improved the global competitiveness of Canadian firms. Forging research partnerships with Canadian companies, transferring NRC technologies to industry, and sparking innovation in Canadian communities through our research cluster initiatives — these are just a few of the ways in which NRC helps Canadian companies innovate and successfully commercialize new products and services.

Our objective is to see NRC become the “go to” national resource for S&T-based innovation in Canada. With the right capabilities and resources to do the job, NRC will deliver on its promise — a promise made to industry, government and all Canadians — to be *Science at Work for Canada*.

# Governance

## NRC Council Members

March 31, 2006

**Dr. Patricia Béretta**  
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Elmira, Ontario

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Institute  
Montréal, Quebec

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National Research Council Canada

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Geotechnical Engineer  
Golder Associates Ltd.  
Saskatoon, Saskatchewan

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Yeast and Fermentation Scientist  
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President  
Brandon University  
Brandon, Manitoba

**Mr. Jean-Claude Villiard**<sup>1,3</sup>  
Special Advisor, Privy Council Office  
Government of Canada  
Ottawa, Ontario

<sup>1</sup> Member, Executive Committee

<sup>2</sup> Member, Human Resources Committee

<sup>3</sup> Member, Audit Committee

## NRC Executive Officers

December 2006

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President

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Vice-President  
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**Sherif Barakat**  
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Corporate Services

**Mary McLaren**  
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Human Resources

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**Richard Normandin**  
Vice-President  
Physical Sciences

**Patricia Mortimer**  
Vice-President  
Technology and Industry Support

**Daniel Gosselin**  
Chief Financial Officer  
Finance Branch

# NRC Research Institutes, Programs and Technology Centres

**NRC Biotechnology Research Institute (NRC-BRI)**  
Montréal 514-496-6100

**NRC Canada Institute for Scientific and Technical Information (NRC-CISTI)**  
Canada and U.S. Toll free 1-800-668-1222  
Outside North America 613-998-8544

**NRC Canadian Hydraulics Centre (NRC-CHC)**  
Ottawa 613-993-9381

**NRC Centre for Surface Transportation Technology (NRC-CSTT)**  
Ottawa 613-998-9639

**NRC Herzberg Institute of Astrophysics (NRC-HIA)**  
Victoria 250-363-0001  
Penticton 250-493-2277

**NRC Industrial Materials Institute (NRC-IMI)**  
Boucherville 450-641-5000  
Saguenay 418-545-5545

**NRC Industrial Research Assistance Program (NRC-IRAP)**  
Toll free 1-877-994-4727

**NRC Institute for Aerospace Research (NRC-IAR)**  
Ottawa 613-991-5738  
Montréal 514-283-9408

**NRC Institute for Biodiagnostics (NRC-IBD)**  
Winnipeg 204-983-7692  
Calgary 403-221-3221  
Halifax 902-473-1850

**NRC Institute for Biological Sciences (NRC-IBS)**  
Ottawa 613-993-5812

**NRC Institute for Chemical Process and Environmental Technology (NRC-ICPET)**  
Ottawa 613-993-3692

**NRC Institute for Fuel Cell Innovation (NRC-IFCI)**  
Vancouver 604-221-3000

**NRC Institute for Information Technology (NRC-IIT)**  
Fredericton 506-444-0544  
Gatineau 819-934-2602  
Moncton 506-861-0950  
Ottawa 613-993-3320

**NRC Institute for Marine Biosciences (NRC-IMB)**  
Halifax 902-426-6095

**NRC Institute for Microstructural Sciences (NRC-IMS)**  
Ottawa 613-993-4583

**NRC Institute for National Measurement Standards (NRC-INMS)**  
Ottawa 613-993-7666

**NRC Institute for Nutrisciences and Health (NRC-INH)**  
Charlottetown 902-566-7465

**NRC Institute for Ocean Technology (NRC-IOT)**  
St. John's 709-772-4939, 709-772-6001

**NRC Institute for Research in Construction (NRC-IRC)**  
Ottawa 613-993-2607  
Regina 306-780-3208

**NRC Integrated Manufacturing Technologies Institute (NRC-IMTI)**  
London 519-430-7079

**NRC National Institute for Nanotechnology (NRC-NINT)**  
Edmonton 780-641-1600

**NRC Plant Biotechnology Institute (NRC-PBI)**  
Saskatoon 306-975-5571

**NRC Steacie Institute for Molecular Sciences (NRC-SIMS)**  
Ottawa 613-991-5419  
Chalk River 613-584-3311, ext. 6274

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