NRC·CNRC

From ***Discovery*** *to* ***Innovation...***

NATIONAL RESEARCH COUNCIL CANADA

A Strategic Partner in Canadian Innovation

National Research Council Canada
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Canada

National Research Council Canada (NRC)

NRC is the Government of Canada's leading resource for research, development and technology-based innovation.

For more than 90 years, NRC has helped help turn ideas and knowledge into new products, processes and services that have changed Canadians' lives.

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Canada's National Research Council has earned a global reputation for excellence in leading-edge research and innovation.

Building a Stronger Canada

In today's global marketplace, Canada's economic position depends on its capacity to translate discovery into innovative, technology-driven products and services. Canada faces important challenges on this front. With the launch of its strategy — *Mobilizing Science and Technology to Canada's Advantage* — the Government of Canada has recognized these challenges and made commitments to keep Canada among the world's top innovating nations.

NRC is ideally positioned to help deliver on these commitments. As Canada's leading federal resource for S&T-based research, innovation and commercialization, NRC is taking concerted action to:

- concentrate R&D on developing solutions to national challenges in health and wellness, sustainable energy and the environment;
- focus its programs and resources on key sectors of Canadian industry to help them increase their innovation capacity and compete more effectively in world markets; and
- strengthen Canada's innovation system by increasing technology transfer and commercialization, striking new partnerships with key players, supporting community-based technology clusters, and increasing access to NRC's national infrastructure and networks.

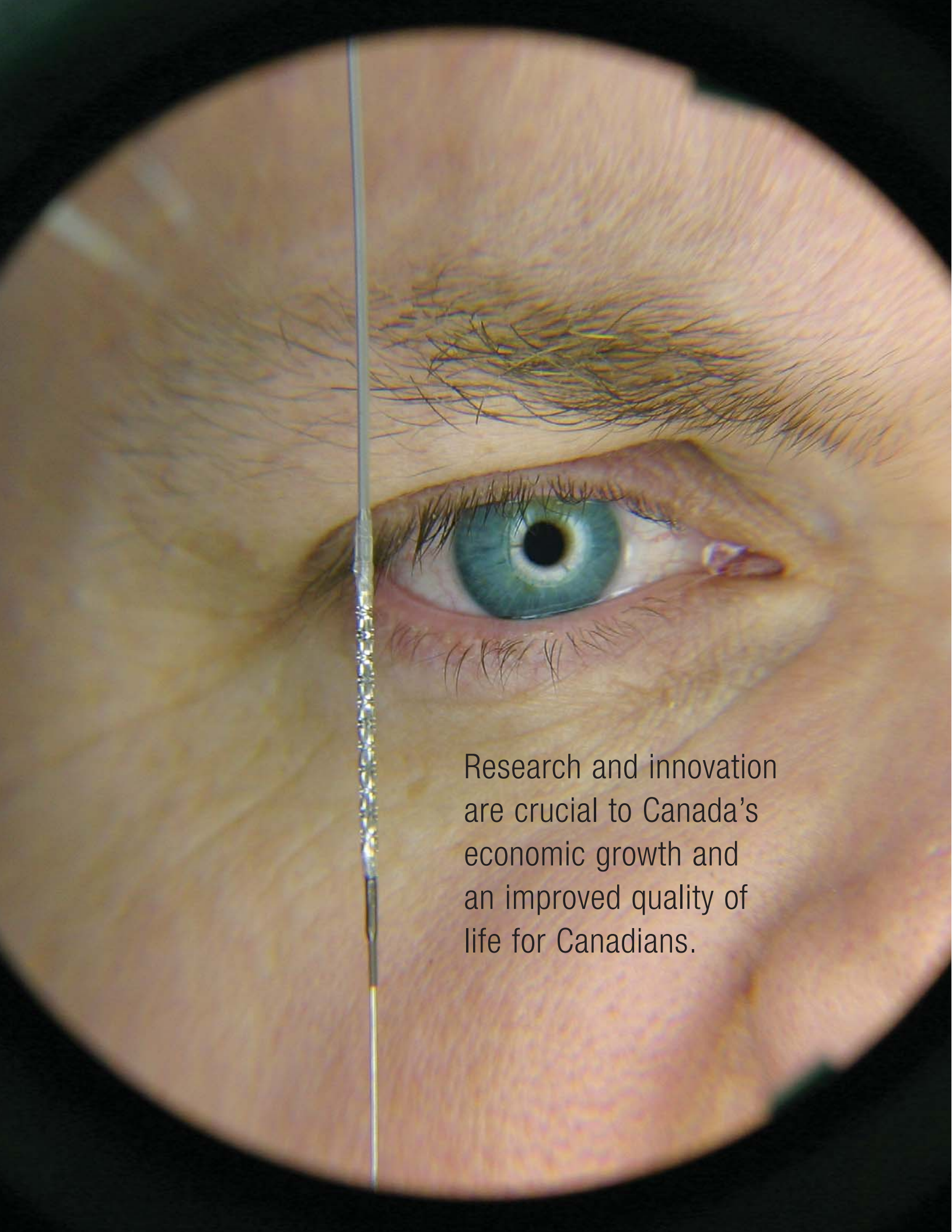
NRC has a long record of success in helping Canadian industry integrate science and engineering advances into their operations. Hundreds of NRC technologies are already at work in aerospace, biotechnology, manufacturing, information technology and other critical sectors of our economy. NRC also has contributed to new fields — photonics, nanotechnology, genomics, advanced materials and fuel cells — helping industry benefit from advances that could drive new economic growth.

NRC supports technology-driven start-ups and small and medium-sized enterprises (SMEs) in unique ways. We provide technical and financial assistance to those with the potential to lead in a new area of technology. We open doors to top research expertise, networks and specialized facilities as well as Canada's best collection of current S&T information. We define national codes and measurement standards. We offer invaluable design, testing and calibration services. We provide business development and commercialization support. We also provide firms with opportunities to co-locate with NRC and work alongside our scientists and engineers in facilities designed to help them develop new technology and prepare for the marketplace.

In all that we do, partnerships are crucial to our success. Through partnerships, NRC is helping to develop, attract and retain the highly skilled workers Canada needs to thrive in today's global economy. NRC works with industry, government and university partners in Canadian communities to stimulate technology-intensive "clusters" of firms in sectors vital to our nation's future. NRC also partners with the research institutes of many countries, advancing knowledge and technology through shared research agendas.

Our enduring commitment is to help build a stronger Canada through science, technology and innovation. This commitment — combined with our research excellence — is what makes NRC such a valuable resource for the nation.

◂ Transmission electron microscope used for cell imaging


Research and innovation
are crucial to Canada's
economic growth and
an improved quality of
life for Canadians.

Responding to National Priorities

Complex, enduring challenges are affecting Canada's economic growth and national well-being. Challenges such as climate change, environmental degradation, the depletion of our natural resources, and the demands and costs of our health system require far-reaching S&T and policy solutions.

In response to these challenges, NRC has realigned its resources and is building new partnerships to turn S&T investments into practical applications supporting health, energy and the environment.

The battle for better health

The rising Canadian incidence of cancer, infectious diseases, neurological disorders, and conditions related to obesity and age have made health and medical R&D a national priority.

For several decades, NRC has been conducting health-related research and has achieved a number of world firsts — intraoperative magnetic resonance imaging, a new vaccine against meningitis C, a non-invasive test for colon cancer, and more. NRC is conducting leading-edge R&D to create new technologies in fields including diagnostics, prevention and treatment, medical equipment and nutraceuticals.

To tap into the potential offered by converging fields of science, NRC has broken down long-standing barriers between physics, chemistry, life sciences, engineering, computing and nanotechnology, creating powerful new technology platforms that will improve the care Canadians receive.

Real Results

Better diagnosis for prostate cancer

NRC and the Atlantic Cancer Research Institute in Moncton, New Brunswick, have developed a more accurate method for identifying prostate cancer, a disease that strikes one in seven Canadian men. Current prostate specific antigen screening is only 75 percent accurate for diagnosis, while the new method has a 96 percent accuracy rate. Using data from DNA microarrays to identify the genetic markers of prostate cancer in biopsy samples, the new method requires fewer tests to confirm a diagnosis, promising to reduce patient discomfort, health care costs and ultimately, mortality rates. The team has filed a patent for this technology, which has an estimated global market of US$4.5 billion, and now plans to identify biomarkers for colon and breast cancer as well as some non-cancerous diseases.

Virtual tools for brain surgery

Using software developed at NRC, surgeons-in-training will be able to rehearse delicate brain surgery before participating in real operations. The software creates a 3D virtual neurosurgery environment that provides haptic — or touch — feedback that simulates the pressure of cutting into a patient with a scalpel or scissors. NRC's haptic system is being developed jointly with Montréal-based MPB Communications. Beyond teaching medical students neurosurgical skills, the system will help experienced surgeons keep up with new surgical techniques.

◂ Next-generation angioplasty technology

Real Results

New technology to ease Parkinson's

Scientists at NRC and a London, Ontario, research institute have developed a medical device to help treat people with neurological disorders such as Parkinson's disease. The new technology is already generating awards and recognition for Medtrode, the London company that has licensed it.

The technology, a small implantable device that can simultaneously stimulate parts of the brain and record neuron signals, is designed to support deep brain stimulation (DBS) — the leading treatment for advanced cases of movement disorders. DBS also shows promise for treating diseases such as Tourette's syndrome as well as severe chronic pain, which is often associated with spinal cord injuries.

NRC scientists and engineers have contributed major advances in:

- non-invasive medical devices and techniques for early diagnosis, improved treatment and prognosis of neurodegenerative diseases;
- intelligent technologies for treating blocked blood vessels to the heart, and materials and biological modelling for angioplasty surgery;
- new molecular-level strategies, vaccine technologies and immunotherapies to help prevent and treat infectious diseases;
- marine-based bioactive compounds to treat neurological and obesity-related disorders, control infection and increase immunity; and
- the enhancement of the properties of plants to produce high-quality pharmaceuticals and natural health products.

Sustainable energy solutions

As the world's population increases, the demand for energy grows. The challenge shared by all nations is to reduce energy consumption while developing clean, sustainable energy alternatives that are accessible to all.

To help Canada move to high-efficiency, low-pollution energy technologies, NRC researchers and their partners are studying:

- hydrogen and fuel cell systems, including polymer electrolyte membrane fuel cells, solid oxide fuel cells, and hydrogen fuels;
- advanced materials that will improve the efficiency, safety and longevity of systems designed to deliver energy, e.g. nuclear, and hydrogen storage;
- gas hydrate structures to tap into the methane molecules trapped in permafrost and deep-sea ice deposits — a huge source of potential energy;
- innovative oil-sand separation methods to produce high-grade oil while limiting costs and environmental damage;
- surface waves and tidal currents as potential marine energy resources;
- the efficacy of various wind turbine designs
- porous semiconductor applications of photonics for more efficient solar cells;
- materials for organic solar cells; and
- bioenergy and waste conversion technologies that could help Canadian industry maintain efficiency while reducing dependency on fossil fuels.

Technologies to protect the environment

As concern rises about climate change, toxic landfills, brownfields, and air and water pollution, the call for environmental protection and remediation technologies has never been more urgent.

Real Results

Hydrogen on demand

In partnership with an industry collaborator, NRC has developed a technology to generate hydrogen on demand. The device generates 99.99 percent pure hydrogen and can easily be started and stopped by "throwing a switch." Its purity makes it ideal as a fuel for proton exchange membrane fuel cells and for providing gases to laboratories and industrial processes.

Environmentally friendly hydropower

Calgary-based New Energy Corporation is taking the environmental sting out of small-scale hydropower. It's also making hydropower a viable alternative in locations not previously considered suitable.

The company's EnCurrent in-stream hydro turbine technology allows it to harness the energy of water currents without dams. And the slow movement of the EnCurrent turbine eliminates fish kill, a major disadvantage of other turbine technologies.

This technology emerged from work NRC conducted during the 1980s on a vertical axis hydro turbine. After proving the technical validity of this type of turbine, NRC looked for a firm to take it to market. New Energy Corporation benefited from NRC-IRAP contributions and technical advice to improve the design and performance of the technology, especially in low or restricted flow conditions.

Real Results

Unique bacterial tag team fights pollution

Scientists have long understood that micro-organisms — naturally occurring bacteria — can be used in a process called environmental bioremediation to clean up contaminated sites, particularly those poisoned by chlorinated solvents. But until recently, most bioremediation processes have been either too costly, not entirely effective, or both. Now, NRC has engineered an innovative approach to employing pollution-hungry bacteria that overcomes both the cost and efficacy shortcomings of traditional techniques.

The NRC technology almost completely removes chlorinated solvents from the treated water. NRC has recently licensed the technology to Sanexen Environmental Services, a specialist in PCB management and contaminated site characterization and remediation.

NRC is working closely with government, industry and university partners to help alleviate the environmental impacts of activity in the energy, resources, transportation, construction and agri-food industry sectors.

For example, to reduce fuel consumption and emissions, NRC researchers and their partners are looking at:

- new engine designs and fuel alternatives to discover which perform best in Canada's climate, with the fewest emissions;
- aircraft and truck aerodynamics, and the efficacy of devices or design changes that reduce fuel consumption and greenhouse gas emissions;
- combustion and fluids engineering to develop cleaner, more efficient combustion processes; and
- model energy-efficiency standards for the next generation of buildings.

NRC performs R&D to develop processes and technologies for environmentally responsible manufacturing. In addition, our scientists and engineers are developing:

- bacteria-based technologies to remediate contaminated soil and groundwater;
- ways of re-using and creating value from organic waste;
- innovative construction materials that reduce CO_2 levels; and
- lighter, vegetable-based plastics that biodegrade efficiently.

Real Results

NRC opens a window on energy efficiency

To help Canada's construction industry provide the most energy-efficient windows, NRC studied different window glazing systems to discover how much energy could be saved by changing certain characteristics of the glazing system. The windows with the high solar heat gain value delivered significant annual energy savings when both the heating and cooling seasons were studied.

Strategic national programs

To accelerate research and innovation in important new areas, NRC is establishing strategic national R&D programs. Each national program will draw on the strengths of partners to develop R&D projects spanning the entire innovation chain — from raw materials and basic research to market entry and commercialization.

Launched in 2007 under the joint leadership of NRC and Agriculture and Agri-foods Canada, the first national program focuses on bioproducts.

Bioproducts

The market for bioproducts extends across a wide range of traditional and emerging sectors. With the right R&D strategy, Canada could become a global leader in bioproducts, thanks to our nation's abundant biomass and expertise on bioenergy, biomaterials and biochemicals. Recent developments in biosciences and engineering are creating new opportunities to produce renewable alternatives to fossil fuel resources and improve the environment.

Several NRC research teams will contribute resources and expertise to the Bioproducts National Program while building connections among companies, suppliers, funding agencies, governments and other research organizations.

Bioproducts are commercial or industrial products composed of biological materials (biomass) derived from agriculture, forestry, marine sources, or organic waste.

Real Results

Biodegradable plastics

NRC has been working with the Canadian Biomass Innovation Network and the École Polytechnique de Montréal to make bioplastics, using the starch in peas, rice and wheat. The team has been aiming to develop an alternative for the synthetic petroleum-based polymers used in throw-away products like packaging. NRC researchers have now characterized selected types of starch, assessed the availability and suitability of various feedstocks, and blended thermoplastic starch with a variety of other polymers. Their blends are very stretchable, opening the way for manufacturing plastic films for use in the thermoformed trays used in packaging. The blends could also be injection-molded in simple parts, opening the way for their use in injectable thermoplastics. Finally, the blends were also found to be foamable with carbon dioxide, which could lead to lower density packaging foams.

Real Results

Showcasing Canada's fuel cell technologies

Although Canadian fuel cell products are available for various applications, greater efforts are needed to demonstrate, test and promote the industry's capabilities and expertise. This is the role of the Hydrogen and Fuel Cell Gateway, a technology demonstration and exhibit centre located at NRC's facility in Vancouver. The Gateway is a partnership between NRC, Natural Resources Canada, Industry Canada, the Government of British Columbia, and Hydrogen & Fuel Cells Canada — a national industry association. The Gateway aims to increase visibility, international sales and strategic research collaborations for Canada's hydrogen and fuel cell sector. It features static and video displays, along with commercially available hydrogen and fuel cell technologies.

Fuel cell and hydrogen technologies

Plans are underway to launch a second national R&D program, on fuel cell and hydrogen technologies. More than 100 NRC researchers across several disciplines are already engaged in the NRC Fuel Cell and Hydrogen Program at various locations across Canada. NRC is opening the doors to partnerships that will bring its strengths together with those of other Canadian R&D organizations and industry.

From 2008 to 2011, NRC will explore the possibility of launching other national R&D programs that support Canada's federal S&T strategy.

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

Focusing on Key Industry Sectors

While stepping up R&D activities to address priorities in health, energy and the environment, NRC is also realigning its programs to boost innovation in key sectors of Canada's economy:

aerospace
agriculture
automotive
biopharmaceuticals
chemicals
construction
electronic instruments
information and communication
manufacturing and materials

These sectors have been chosen not for their past contribution to Canada's economy, but for their future potential. Because these sectors are technology intensive and depend on innovation for their growth and competitive edge, they will benefit most strongly from the resources and knowledge NRC can provide. To help these sectors advance, NRC is establishing programs to develop integrated technology platforms for each sector and working with industry, universities and government to maximize resource use and results.

A primary goal of NRC's strategy is to contribute to the global competitiveness of key sectors of Canadian industry. NRC is focusing its capabilities on nine sectors to help Canada's most promising industries move Canadian technology quickly into the marketplace.

Real Results

NRC facilitates tech advantage for aerospace industry

In early 2008, the McGill Aerospace Materials and Alloy Development Centre opened at NRC facilities in Boucherville, Quebec. A collaborative initiative between NRC and McGill University, the aerospace research and development centre was created to develop a new generation of highly resistant materials, surface treatments and manufacturing processes designed to meet the extreme requirements of the aerospace industry.

NRC and GE Aviation have also built a new outdoor facility for icing certification tests on large engines at Montréal's Mirabel International Airport. A facility like this one gives companies a way to meet their business needs, while NRC can use it to conduct critical research for the aerospace sector.

This sector approach will connect industry to the full breadth of NRC expertise more closely than ever before. It will also build on NRC's community-based technology and innovation initiatives to stimulate the growth of world-class clusters of technology-intensive firms across Canada.

Aerospace is the first of NRC's nine key sector initiatives. Supporting more than 700 Canadian firms serving the aerospace industry, NRC will integrate the research and technology development efforts of its nationwide network of facilities. Advanced manufacturing technologies, materials characterization and performance, quantum and photonic devices, alternative propulsion systems, aerodynamics, flight mechanics and avionics are just some of the fields of aerospace-related research and technology development in which NRC has world-renowned expertise.

◂ Smoke reveals air flow during wind tunnel tests

NRC works hand-in-hand with partners from industry, government and universities to help ignite the spark of innovation in communities across the land.

Sparking Innovation in Canadian Communities

NRC works with university, industry and government partners in Canadian communities to stimulate the growth of clusters of firms specializing in specific areas of technology. These innovation initiatives are helping Canadian companies better prepare to compete and capture a larger share of world markets. They are also helping to generate economic opportunities and develop a highly skilled workforce in select Canadian communities.

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.

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 cluster initiatives across Canada, positioning its own research, industry assistance services and other strengths where communities and partners can best use them. Today NRC supports early-stage clustering efforts 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.

Technology clusters across Canada

NRC's Clusters Initiative is accelerating the commercialization of new technologies produced by small and medium-sized firms, and building regional S&T capacity in key sectors and industries across Canada.

Vancouver — Fuel Cell and Hydrogen Technologies

Vancouver's technology cluster is the world's fastest growing and most sophisticated group of companies and organizations working 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 helped prime the Vancouver cluster to take a significant market share.

To meet the needs of the cluster, in 2006 NRC relocated its research operations to a new $19 million facility on the grounds of the University of British Columbia. At this location, NRC focuses on developing polymer electrolyte membrane fuel cells, solid oxide fuel cells, and hydrogen and alternative fuels — working closely with universities, government and the private sector. More than 100 NRC researchers from various disciplines and locations across Canada participate in NRC's fuel cell and hydrogen research program, which spans the spectrum from initial discovery to prototype development. In addition, NRC has been supporting the R&D and pre-commercialization efforts of most of the fuel cell companies in the province.

◂ Specialized equipment sorts a thousand cells per second

Real Results

Planning the renewal of aging water systems

Canadian municipalities face a daunting multibillion-dollar bill to upgrade water treatment, supply and distribution systems across the country. However, new software developed by NRC researchers will make it easier for planners to decide which water pipes are most in need of replacement and help municipalities plan and manage the renewal of water mains. The software analyzes patterns of historical breakage rates of water mains, projects future breakage rates, computes life-cycle costs, and generates planning scenarios.

Edmonton — Nanotechnology

The state-of-the-art $120 million nanotechnology research facility built jointly by NRC, the Province and the University of Alberta has helped Canada secure its position at the vanguard of nanotechnology research worldwide. This Edmonton facility houses some 30 senior investigators who collaborate with more than 100 university scientists and 120 NRC researchers and staff to produce revolutionary products and create new processes that will change the way we make everything from transistors to skyscrapers.

In Edmonton, Ottawa and other locations, 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, metrology, pharmacy and medicine, NRC is developing molecular-scale sensors, nanoscale materials and devices where nanotechnology holds promise for new technologies.

NRC is working with the Canadian Nano Business Alliance to develop a network to help companies commercialize innovative products based on nanotechnology.

Regina — Sustainable Urban Infrastructure

In Regina, NRC is spurring the growth of a cluster dedicated to making urban infrastructure more sustainable. NRC is working with local firms to create new technologies, processes and infrastructure management methodologies that can be transferred to other Canadian communities and the rest of the world, creating new business opportunities for Canadian firms.

This urban infrastructure initiative also takes advantage of an array of relevant NRC competencies and capabilities. With partners, NRC provides the National Building Code, conducts fire research and improves technologies for indoor environments, helping industry ensure that buildings are safe, energy efficient and durable. It also develops new approaches and technologies for managing drinking water and wastewater systems, as well as bridges and other components of civil infrastructure. Using modelling, simulation and novel production processes, NRC also supports the manufacture of innovative construction materials.

Saskatoon — Plants for Health and Wellness

NRC's plant biotechnology research facility is the R&D hub for the region's agricultural biotech, nutraceuticals and "functional foods" cluster. Having grown from a small industrial community to a global player providing more than 1,000 local jobs, the cluster demonstrates the leverage that vision, planning, research and partnerships can create.

In Saskatoon, NRC focuses on developing disease-resistant, higher-yield varieties of crops that will thrive in Canada's climate and increase revenues for Canadian farmers. The objective is to help Canadian industry lead the world in developing and selling plant-based pharmaceuticals and natural health products with stable, measurable nutritional compounds.

Real Results

A genetic boost for canola

NRC plant scientists have found a gene that boosts the productivity and resilience of canola. They created "transgenic" plants by introducing a modified gene that would produce higher levels of the steroid protein than normal plants. The average yield of oil from each transgenic canola plant was increased by about 23 percent, with no decrease in the quality of the oil. The discovery may ultimately help canola growers increase oil production to meet the growing demand for biodiesel fuel — and thereby lower Canada's greenhouse gas emissions.

New firm thrives on a prairie flower

The NRC industry partnership facility in Saskatoon is home to Saponin Inc., a new company that recently secured $2.2 million in venture capital to commercialize a technology developed by NRC. This technology involves the use of saponins from Prairie Carnation, also known as Saponaria or soapwort. Saponins are used in everything from shampoos to fire extinguishers and ore separation. They are now being tested as adjuvants for vaccines and are also being investigated for their potential in treating cancer.

Winnipeg — Biomedical Technologies

Winnipeg's biomedical technologies cluster is one of the fastest-growing concentrations of medical devices and life sciences industries in Canada. The health-related companies and organizations associated with this life sciences cluster employ 3,500 people and generate sales of more than $400 million a year — a figure that continues to grow. In 2005, NRC opened a commercialization centre in Winnipeg that is helping companies bring pioneering biomedical innovations and technologies to market.

Supporting the Winnipeg cluster, 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.

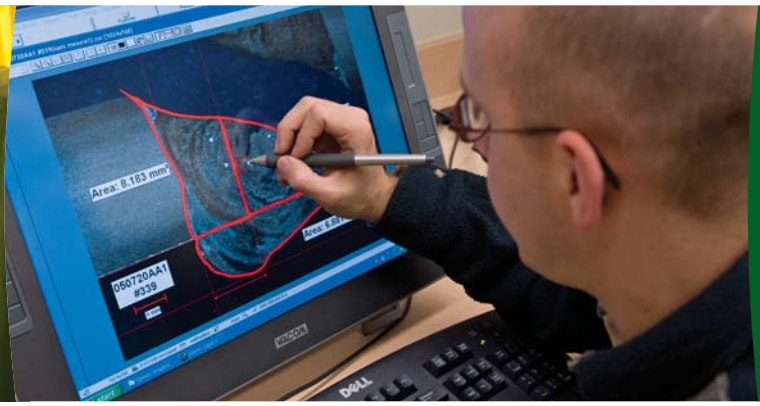
Real Results

Excellence in technology transfer

NRC, IMRIS Inc. and the Seaman Family MR Research Centre jointly won a 2007 Federal Partners in Technology Transfer award for the successful development, transfer and commercialization of a mobile Magnetic Resonance Imaging (MRI) system for neurosurgical operations. The mobile system, a world first, is saving lives while reducing post-surgical complications, patient wait times and overall health costs.

Developed by NRC in Winnipeg, the intraoperative system is designed so that the retractable magnet can be moved over a patient at any time before, during or immediately after surgery. IMRIS Inc., a Winnipeg-based start-up created in 1998 to commercialize the system, now employs 84 highly skilled people, and expects to add more than 40 jobs by 2008.

In 2007, IMRIS successfully raised $40 million in an initial public offering (IPO) on the Toronto Stock Exchange (TSX), one of the largest medical device IPOs in TSX history.



Ottawa — Photonics

Since photonics became one of the hot disciplines in the late 1980s, NRC has helped mobilize partners and resources to seize the potential of photonics in nanotechnology, biotechnology, and communications. At our Ottawa facility, NRC creates the materials and technologies that will help Canada become a world leader in information processing, transmission, storage and display. Today, Ottawa has the most vibrant photonics cluster in Canada; it stands among the top five in the world.

Our core competencies include optoelectronics, photonics, semiconductor growth, processes and materials, thin-film technology, nanotechnology and acoustics. We are helping industry partners target markets in microelectronics, communication hardware, multimedia, sensors and biotechnology. The new $43 million Canadian Photonics Fabrication Centre — the result of a visionary partnership between NRC, Carleton University and the Province of Ontario — provides companies with simulation, design, fabrication, testing and prototyping services that help them reduce time to market for new products.

Saguenay — Aluminium Transformation

In the late 1990s, NRC and its partners 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 to support 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.

Supporting this cluster, NRC's industrial materials research facility in Montréal conducts R&D on the processing of various metals, polymers and other materials for the aerospace, automotive and other manufacturing sectors.

Real Results

New tool for cancer detection

In the human body, a cell's genes exhibit different characteristics if they are diseased than if they are healthy. Certain combinations of these characteristics — called biomarkers — are indicators of risk for various types of cancer. However, the presence of 30,000 human genes in any one tissue makes analysis difficult and costly. To address this challenge, NRC researchers and cancer specialists in New Brunswick have created a new biomarker discovery technology that will translate into improved cancer detection and treatment regimes.

Halifax — 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 situated at the hub of this cluster where major industry players have joined together to pursue shared research goals. This facility supports the life sciences cluster by investigating the potential of marine-derived bioproducts to protect and enhance health and wellness. Using a multidisciplinary approach, NRC undertakes research to identify and characterize biotoxins as well as to develop bioactives, functional foods and nutraceuticals.

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. By giving them access to NRC's life science research expertise and other innovation and technology support services, NRC is helping them tap into real commercial opportunities.

NRC has played a critical role in the development of clusters, working with partners to catalyze technological progress and economic growth in every region of Canada.

Fredericton/Moncton — Information Technology and e-Business

Since 2000, NRC has brought key players in New Brunswick's information technology and e-business cluster together to pursue a common objective: seize a sizeable share of the global e-business market.

Supporting this cluster through its facilities in Ottawa, Gatineau, Fredericton and Moncton, NRC creates and commercializes software and systems technology to help Canada prosper in the world of information technology. Through our research and business services, we provide a competitive advantage to myriad industries — ranging from health care and manufacturing to transportation and entertainment.

Real Results

A 3D future for Canadian industry

In late 2006, media around the world broadcast surprising information about Leonardo Da Vinci's world famous Mona Lisa portrait. For the first time, unseen details within layers of the painting were visible through the remarkable 3D scanning technologies developed by NRC. But this wasn't the first time that NRC's 3D technologies have made headlines. For more than ten years, NRC has enjoyed a well-earned reputation as the world's top heritage imaging resource.

NRC has licensed its 3D technologies to nine Canadian firms, which have injected an estimated $50 million annually into the Canadian economy and created more than 300 jobs. The full potential of these technologies is only starting to be felt.

Charlottetown — 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 health and wellness products. In 2001, NRC worked with industry, government and other partners to integrate the Island's expertise in bioresources and nurture the growth of a cluster of firms that, together, could capitalize on a global nutrition market valued at well over $100 billion.

At the hub of this cluster is the NRC Charlottetown facility, where NRC researchers are determining the role that natural marine- and land-based compounds could play in treating neurological and obesity-related disorders, inflammation, infection and reduced immunity. In 2006, NRC built a nutrisciences and health research facility in Charlottetown that has attracted top talent from the worldwide bioresources community. Scientists from NRC, Agriculture and Agri-Food Canada and the University of Prince Edward Island are sharing space, resources and ideas at the facility.

NRC partners with the PEI BioAlliance to offer customized business advisory services to local bioresources companies. Emerging companies receive support in developing a business model, getting through regulatory processes, executing business plans and making valuable connections with established industrial partners.

In 2007, NRC hosted "BioProspecting for Neuroprotectants," an international symposium on bioactives-based solutions for neurological disorders that promoted the PEI bioscience cluster's capabilities. It brought more than 200 national and international speakers and nutrisciences and health researchers to the Island.

St. John's — Ocean Technologies

Working with partners in St. John's, Newfoundland, NRC is helping to develop a vibrant cluster of organizations and companies that could tap into the $1.8 trillion global ocean technologies market. 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 NRC is focusing its R&D to help Canadian firms grow.

At its research facility in St. John's, NRC finds solutions to the engineering challenges faced by Canada's ocean 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 ocean industries compete more effectively.


NRC Aerospace offers
unique facilities including
wind tunnels and specialized
research aircraft.

Providing National Science and Innovation Infrastructure

NRC plays a vital role in Canada's innovation system by providing critical national infrastructure that underpins innovation. Through NRC, Canadian firms can access a wide array of national facilities and programs designed to help them take new products and technology innovations to market.

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
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.

Real Results

NRC houses Canada's most powerful research magnet

In June 2006, the Government of Canada, in partnership with the University of Ottawa and the provinces of Quebec and Ontario, officially opened the $15 million W.G. Schneider Building at NRC's Ottawa campus, home to a critical mass of five spectrometers. Canadian scientists and industry now have access to a multimillion dollar 900 MHz (21.1 Tesla) spectrometer, Canada's most powerful magnet. This unique tool will help scientists develop new battery composites, nanomaterials for electronics, plastic polymers for vehicles, glasses for more sensitive sensors and faster computer processors, new materials for hydrogen storage, as well as health-enhancing antibiotics.

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 new products and processes.

◂ Inside NRC's largest wind tunnel

Gemini Observatory/AURA

National facilities for astronomy and astrophysics

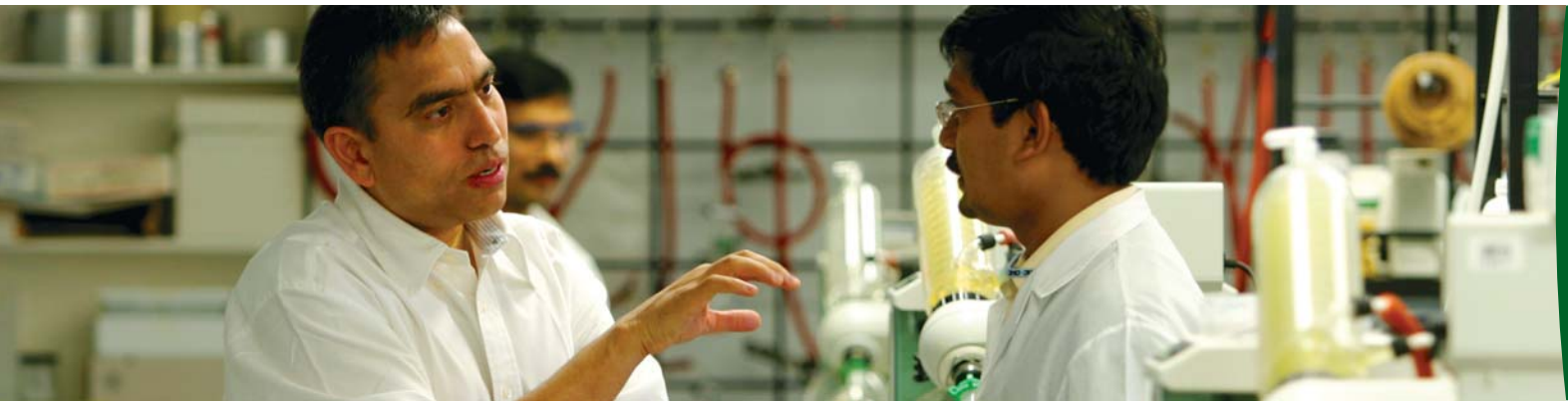
In Victoria and Penticton, NRC operates the Government of Canada's astronomical observatories. NRC also represents Canada in partnerships including the seven-nation Gemini Observatory, the Canada-France-Hawaii Telescope and the James Clerk Maxwell Telescope. NRC has also contributed significantly to the Atacama Large Millimeter Array (ALMA) world observatory in Chile, helping Canada win an international reputation for leading-edge astrophysics research.

Partnerships in international facilities ensure that the Canadian scientific community has access to world-class research equipment. Canada's astronomy programs help attract and retain leading researchers and provide training and collaboration opportunities for young scientists. Beyond research, astronomy partnerships provide opportunities for Canadian companies to pursue large-scale industrial contracts for astronomy facilities as well as to be a partner in the commercialization of Canadian technologies.

Real Results

Astrophysics goes to market

A radio receiver designed to capture the faintest whispers from the cosmos is finding earthly application in the hands of a Canadian company. Nanowave Technologies of Etobicoke, Ontario, has licensed a component of the Band 3 receivers developed by NRC for the Atacama Large Millimeter Array (ALMA) — a system of 66 radio dishes being built in the high-altitude desert of northern Chile. The component of interest to Nanowave is a cryogenic amplifier that boosts the weak radio signals from distant stars and galaxies without adding unwanted noise. Apart from radio astronomy, this amplifier could have great value for telecommunication systems, solid-state physics research, materials research and low-temperature physics research.



Advanced research in molecular sciences

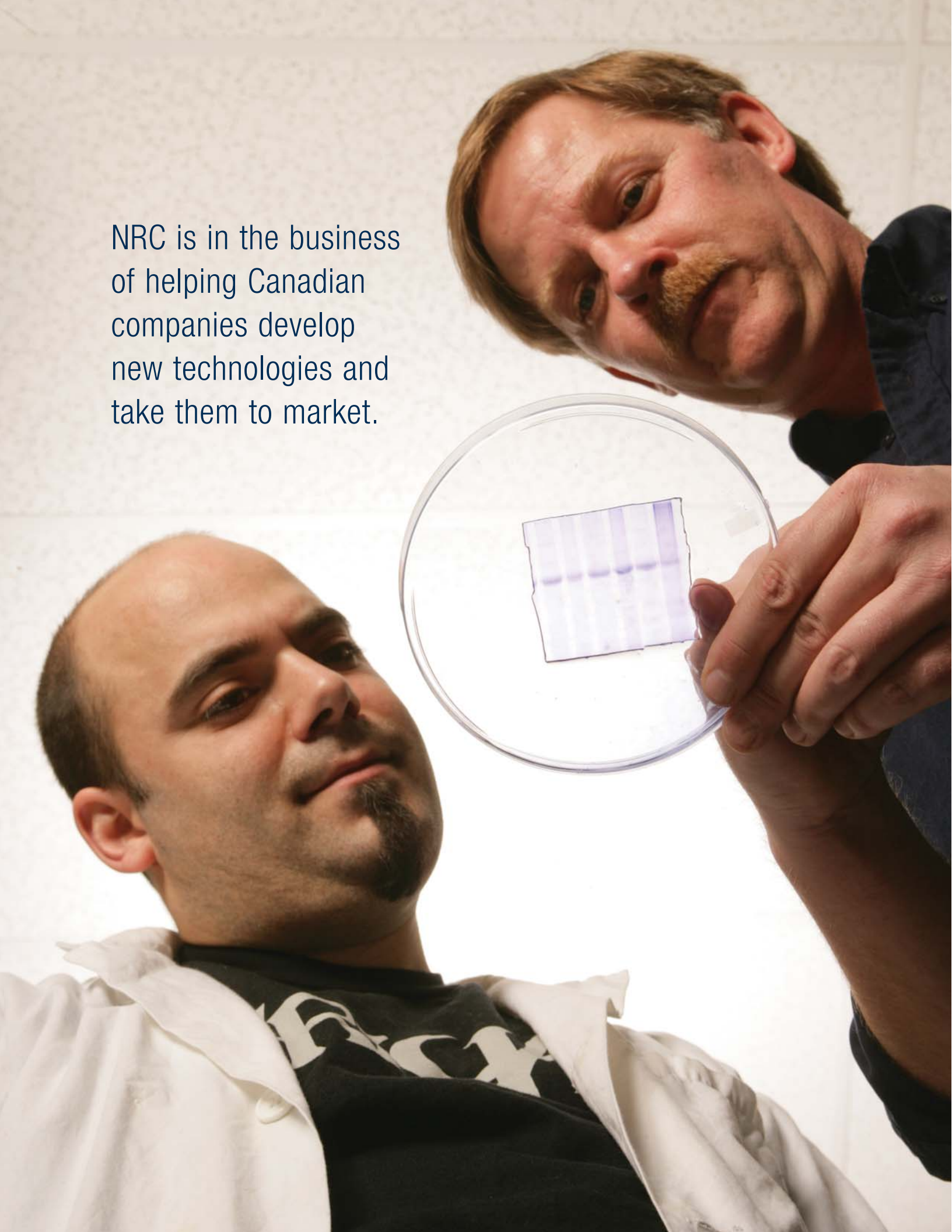
In Ottawa, NRC develops and disseminates advanced knowledge in molecular sciences in collaboration with the Canadian and international scientific communities. Applying competencies ranging from cell chemistry to attosecond science and nanomaterials, NRC investigates topics in molecular sciences that have the potential to generate and transform the technologies of the future.

At Chalk River, Ontario, NRC operates the Canadian Neutron Beam Centre using neutrons produced by the National Research Universal reactor. Academic and industrial researchers use this reactor to explore the properties of different materials with the goal of developing innovations in therapeutics, diagnostics, electronics, telecommunications and materials.

National measurement standards and technologies

Internationally recognized measurement standards and technologies are a key requirement for the commercialization and manufacturing of all products and services. In Ottawa, NRC ensures the accuracy, validity and traceability of the physical and chemical measurements used by industry — a service vital to reducing technical barriers to trade. NRC also develops internationally recognized techniques, standards and services for measuring emerging technologies and materials — an essential support to firms wishing to exploit them. In addition, NRC tests products so they can be certified before being 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.

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.



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

Giving Companies a Head Start

Improving the odds through collaborative research

NRC is in the business of helping Canadian entrepreneurs develop and successfully bring new technologies to market. Our approach is designed to strengthen the innovation and commercialization capacity of firms while gaining maximum leverage from the knowledge and technologies NRC generates.

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 promising 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 a technology developed by NRC, we grant the firm a licence. 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 entered into 102 new licence agreements in 2006-2007 and IP licensing revenue was $5.0 million.

As a world leader in the field of radiation therapy dosimetry, NRC continues to benefit from the licensing of its Monte Carlo Code for Electron Beam Calculations to MDS Nordion. The Canadian company sold its oncology software portfolio to an international firm, Nucletron® B.V. in 2003 with a five-year licence extension to December 2012.

Real Results

Smarter search tool hits the market

Information searches just got smarter with a new NRC technology that wades through oceans of digital information to find just the facts you need. "Factor" is a search tool that detects the nature of words and how they relate to each other, returning a strategically narrowed-down list of meaningful results. The technology has already found a home in the private sector with Nstein Technologies Inc. The Montréal-based company has licensed Factor to magnify its text mining and text analytics technology for the e-publishing and other sectors. NRC and Nstein have signed a ten-year technology license agreement and a three-year collaborative research agreement to continue developing Factor for Nstein's markets. This technology and research partnership is valued at more than $7.5 million.

◂ Working with industry to develop new vaccines

Real Results

Canada's national game gets high-tech goalie masks

NHL goalies playing this year may be more comfortable with their new head gear. With help from NRC, a Canadian firm has created a lightweight goalie mask made from advanced materials. Manufactured by the Montréal-based Marquez Transtech on behalf of ITECH of Kirkland, Quebec, the new mask is the first made from advanced "thermoplastic" composites. The state-of-the-art mask is composed of a continuous fibre fabric embedded in a thermoplastic matrix for increased strength and impact resistance. NRC helped Marquez resolve a key challenge in the molding process so there was good bonding between the thermoplastic composite and the surface finish.

Helping Canadian companies innovate

Canada is home to hundreds of thousands of small and medium-sized enterprises that drive the nation's economic growth. When these firms succeed in bringing novel materials, processes and technologies to market, Canadians reap the benefits.

Most of these SMEs, by themselves, don't have the resources and connections to develop and commercialize an innovation based on an advanced technology. Nor can they assume the risk, alone.

That's where NRC comes in.

NRC technologies fuel the creation of new companies, year after year. Since 1995, 68 new companies have been formed, accounting for more than 600 full-time jobs for highly qualified people, and more than $437 million in cumulative investment.

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 as one of the best programs of its kind in the world, NRC-IRAP helps innovative companies make the leap from concept to commercial success.

NRC-IRAP provides advice and customized solutions to more than 9,000 small and medium-sized enterprises each year. It also links promising firms to our diverse networks, programs and infrastructure to help them refine and exploit new technologies.

NRC delivers this 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.

Timely access to S&T information

The NRC Canada Institute for Scientific and Technical Information (NRC-CISTI) is Canada's national science library and one of the world's leading providers of information in science, technology, engineering and medicine. NRC Research Press publishes 16 international research journals, 15 client journals as well as books and conference proceedings.

NRC-CISTI serves industry, universities, government and the public, transferring information rapidly to users from its extensive collection or from other libraries around the world.

NRC-CISTI provides market analysis, competitive technical intelligence and other information to take research out of the lab and into commercial applications.

Industry partnership facilities — A place for companies to grow

Companies preparing to exploit an advanced technology need a place to work through developmental stages while they iron out R&D issues or their business and marketing strategies. To help fill this need, NRC provides companies with the chance to "incubate" at its world-class industry partnership facilities (IPFs) across the country.

SMEs can access R&D expertise, design and prototyping services, technical information and business planning services through these partnership facilities.

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

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.

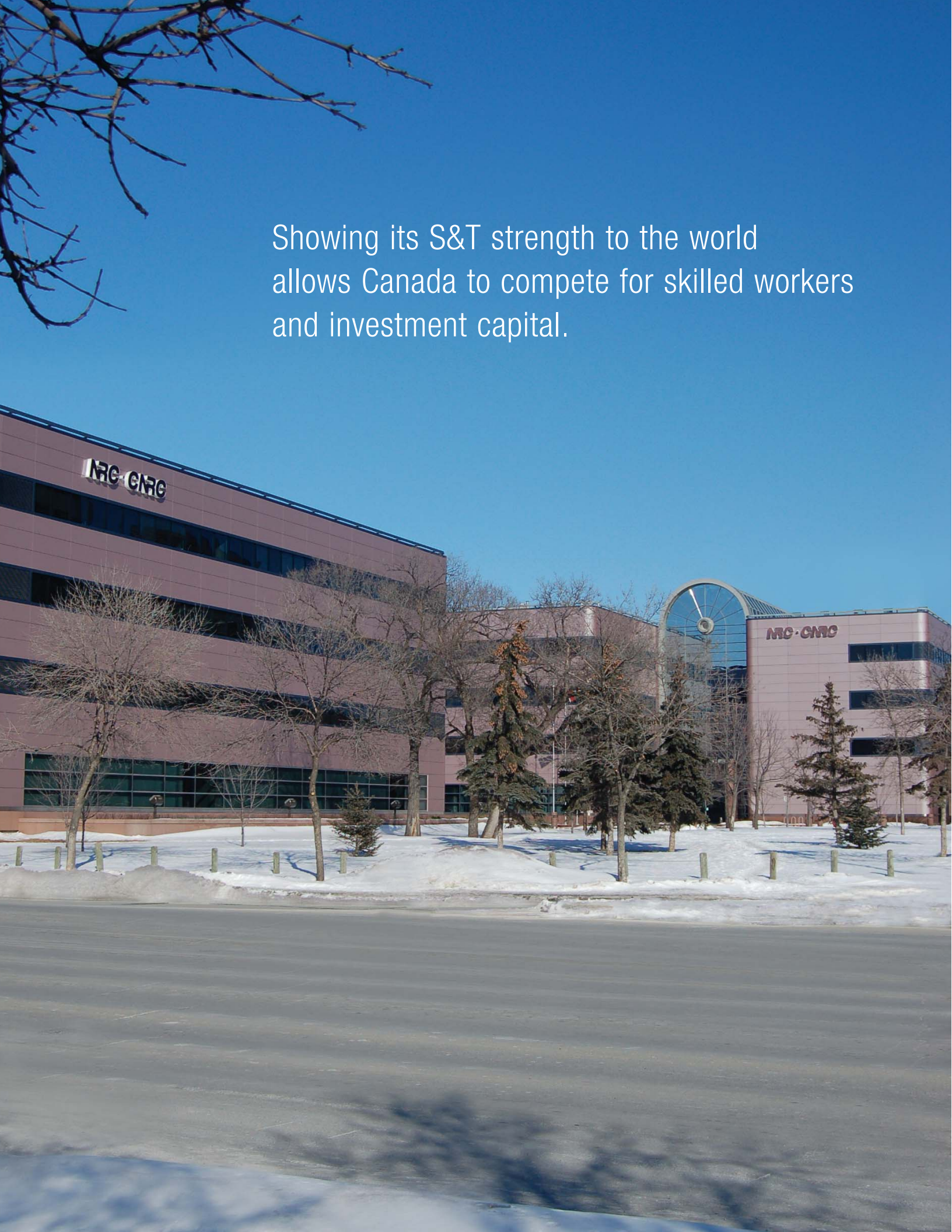
Thanks to NRC's industry partnership facilities across Canada, many young companies have entered the commercial market on far stronger footing. The proof: more than 90 percent of the companies that have "graduated" from NRC's facilities are still in business.

Real Results

NRC spin-offs a good bet

Despite weathering a high-tech slump and a lengthy downturn in venture capital markets, NRC spin-off companies are proving they're here to stay. Over the past five years, dozens of new firms created from NRC science and technology have continued to attract investment while adding to the bottom line of the Canadian economy.

In 2006, 35 NRC spin-offs combined to earn over $96 million in revenue — a healthy $160,000 per employee — up 29 percent from about $75 million in 2005.


Showing its S&T strength to the world
allows Canada to compete for skilled workers
and investment capital.
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Building Powerful Partnerships

Over the years, NRC has established dynamic, long-term partnerships with industry groups, businesses, universities, government, research funding agencies and economic development organizations, turning individual strengths into powerful collective action.

There is no single model for a successful partnership. Some are simple partnerships between NRC and a firm intent on taking a new technology to market. Others involve multiple players pursuing a shared goal of developing community-based clusters of firms specializing in a single area of technology. And, there are partnerships based on collaborative research agreements, research and service contracts, technology transfer agreements, as well as contributions of funding, laboratory space and equipment, and property for new buildings.

For example, to increase the momentum of fuel cell discovery in Vancouver, NRC has partnered with industry, Canada Research Chairs, the University of British Columbia, Simon Fraser University and the University of Victoria. Several other partners — Hydrogen and Fuel Cells Canada, Natural Resources Canada and the Vancouver Fuel Cell Vehicle Program — are co-located in the NRC fuel cells research facility. Together they draw on university research through cross-appointed professors; the private sector through collaborative agreements and joint research and testing programs; other NRC institutes; other federal departments; and private firms working locally in fuel cell development.

Going beyond traditional collaborative approaches, NRC has recently struck a partnership with the research institute of the McGill University Health Centre (MUHC). MUHC laboratories have been moved into the NRC biotechnology research facilities in Montréal where researchers from both organizations will collaborate on joint health projects. MUHC researchers will benefit from NRC's ultramodern facilities and expertise in health biotechnologies, technology transfer and intellectual property management, as well as greater interaction with pharmaceutical and biopharmaceutical companies.

In Prince Edward Island, NRC has helped launch another successful partnership. NRC, the University of Prince Edward Island and Agriculture and Agri-food Canada have partnered to support the creation of the Centre for Bioresources and Health.

Working together with incubating companies at this centre, partners can integrate their research, education, scientists, equipment and infrastructure. Through shared resources and collaborative R&D projects, they can achieve results no single partner can achieve single-handedly.

Creating globally competitive technology clusters — concentrations of technology intensive firms focused on specific sectors — is one of the best strategies for fostering a nation's economic growth.

◂ NRC Centre for Commercialization of Biomedical Technology, in Winnipeg

Advanced vertical-axis wind turbine design

Partnering across borders

Through its international network of technical and scientific intelligence, NRC is working to enhance Canada's innovation performance. Given the clear benefits generated by partnerships, NRC pursues international research alliances with countries that share Canada's S&T and innovation goals.

Real Results

New centre helps entrepreneurs

The NRC Centre for the Commercialization of Biomedical Technology in Winnipeg 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. Its programs and services help entrepreneurs and small Canadian firms grow and successfully commercialize biomedical technology and reach markets around the world.

Today, NRC enjoys research partnerships with equivalent organizations in several countries:

- France — Centre National de la Recherche Scientifique (CNRS)
- Germany — Hermann Von Helmholtz-Gemeinschaft Deutscher Foschungszentren
- Spain — Consejo Superior de Investigaciones Cientificas (CSIC)
- Taiwan — National Science Council of Taipei (NSC)
- India — Department of Biotechnology of the Government of India

Other types of international agreements involve NRC and two or more international partners, for example the Canada-France-Hawaii Telescope. NRC and partner countries also benefit from many other agreements established between public and private R&D institutes. Each of these agreements brings together the top minds and technology resources of other countries, helping partners progress on shared research and innovation agendas.

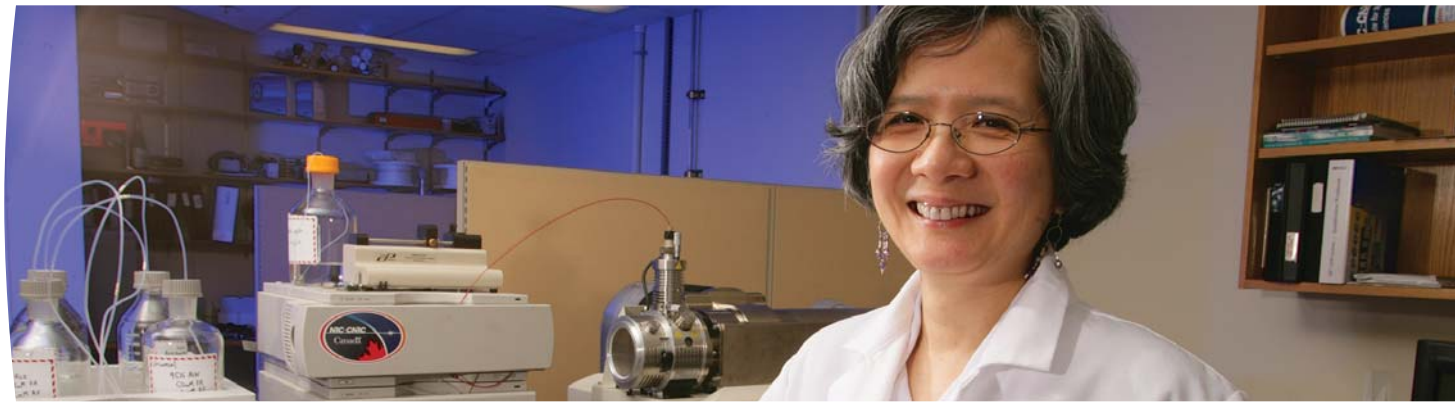
Creating a Vital Future

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 support important technology sectors and increase the global competitiveness of Canadian firms. Forging research partnerships with 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.”

Contact Us



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