

National Research Council

# Building Technology Clusters across Canada



# National Research Council Canada

*Recognized globally for research and innovation, the National Research Council (NRC) is a leader in the development of an innovative, knowledge-based economy for Canada through science and technology.*

*NRC operates world-class research facilities as well as information, technology and innovation support networks from coast to coast.*

*Its outstanding people help turn ideas and knowledge into new products, processes and services, creating value for Canada.*

*NRC works hand in hand with partners from industry, government and universities to help ignite the spark of innovation in communities across the land and to give Canadian companies a competitive edge in today's marketplace.*

## Community Innovation

Stimulating the growth of community-based technology clusters across Canada is an important part of NRC's business. NRC research institutes and networks are central hubs, bringing local and regional interests together with groups of innovative companies around a common area of technology. NRC and its partners are actively expanding research capabilities, building new facilities and augmenting knowledge and industry support networks from coast to coast.

## Excellence in R&D

NRC is Canada's R&D and commercialization powerhouse. Its cutting edge research spans the spectrum of science and engineering, with 20 NRC research institutes and 10 other centres across the country. Each helps transform ideas into new products, services and technologies whether that involves partnering with universities and innovative firms or creating new companies.

## Taking Technology to Market

NRC combines scientific excellence and entrepreneurship in an institution designed to push the envelope and encourage outside-the-box thinking. The result is a surge in new knowledge and commercialization — patents, licensing, new companies — and wealth creation for Canada.

## On the World Stage

NRC is an active player in international research collaborations and partnerships — over 60 formal arrangements with 22 nations along with hundreds of informal alliances. NRC's global reach helps Canada access the world's best S&T talent, facilities and networks and creates opportunities for Canadian companies abroad.

## Outstanding People

Great people. Great minds. NRC is home to nearly 4,000 creative and highly skilled employees. Its people have earned international acclaim for excellence in leading-edge research and innovation. They are held in the highest regard by their peers, colleagues and collaborators. And where else but NRC have employees won a Nobel Prize for science, an Academy Award and helped Canada capture Olympic Gold?

National Research Council: Building  
Technology Clusters across Canada

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# Table of Contents

## ***Building Technology Clusters across Canada***

NRC and Community Technology Clusters .....	4
NRC and Technology Clusters across Canada .....	7
<b>Fuel Cells &amp; Hydrogen Technologies</b> – Vancouver .....	8
<b>Nanotechnology</b> – Edmonton .....	10
<b>Agricultural Biotechnology, Nutraceuticals, and Bio-Products</b> – Saskatoon .....	12
<b>Life Sciences, Medical Devices</b> – Winnipeg .....	14
<b>Photonics</b> – Ottawa .....	16
<b>Aerospace</b> – Montréal .....	18
<b>Life Sciences</b> – Montréal .....	20
<b>Aluminium Technologies</b> – Saguenay Region .....	22
<b>Information Technology – e-Business</b> – New Brunswick .....	24
<b>Wireless Systems</b> – Cape Breton .....	26
<b>Life Sciences</b> – Nova Scotia .....	28
<b>Bioresources</b> – Prince Edward Island .....	30
<b>Ocean Technologies</b> – Newfoundland & Labrador .....	32
For more information on these technology clusters .....	34

National Research Council Canada

## **Building Technology Clusters across Canada**

*It is crucial to focus on research and investment  
in order to make Canada a leader in the new  
technology economy. Our objective is clear:  
to be a true land of innovation.*

– Rt. Hon. Paul Martin  
Prime Minister of Canada

Clustering is a term that economists have borrowed from science to describe the growth and significant concentration of innovative companies around a nucleus of R&D facilities in local communities.



The concept of technology clusters has received great attention in recent years from business leaders, political leaders at all levels of government, and the academic community. This widespread interest is based on the demonstrated economic impact of technology clusters such as California's celebrated Silicon Valley and Taiwan's microelectronics cluster, which commands 55% of the world market in notebook computers, and 75% of the market in DVD drives respectively. Canadian examples of clusters include Montréal, where the biotech sector employs more than 21,000 people and Ottawa where the IT sector remains vital despite earlier downturns.

Technology clusters, because of their potent combination of research expertise, new and established companies, venture capital, etc. can produce significant economic value for regions by attracting highly-qualified personnel and direct foreign investment. These activities help facilitate the commercialization process, create market pull and bring together players from private and public-sector organizations to focus on developing the economic potential of a region.

# NRC and **COMMUNITY TECHNOLOGY CLUSTERS**

## **NRC: Global Reach – Local Touch**

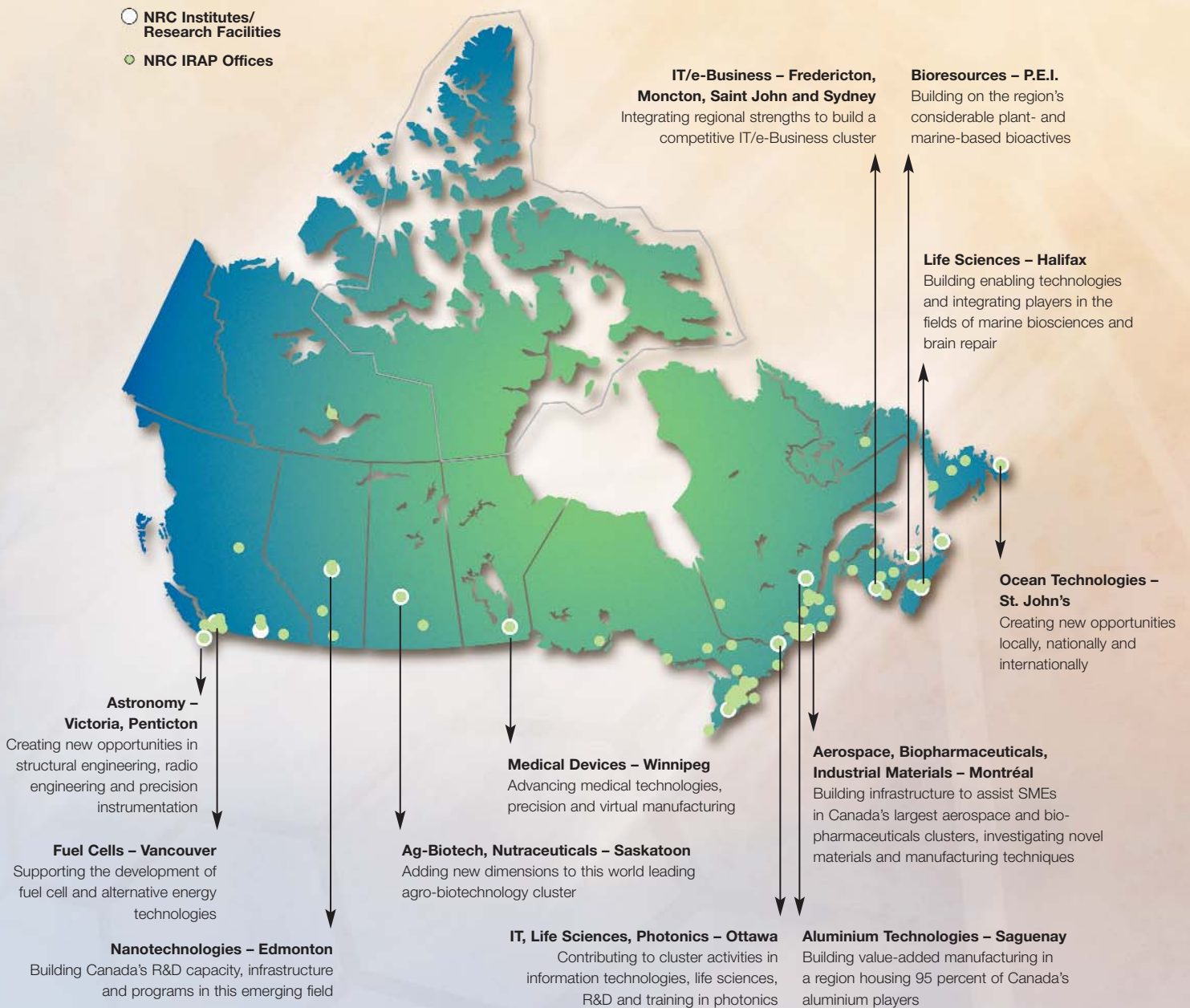
By participating in cluster initiatives, research organizations and private companies gain direct access to NRC's world-class research, its national and international networks, its knowledge resources and industry support programs. With 20 research institutes, several innovation and technology centres, and a wide range of services, NRC provides innovative Canadian companies with access to:

- A world-class workforce of scientists, engineers and technical staff working in leading-edge R&D fields most relevant to industry needs and Canada's economic growth in the knowledge economy.
- Top-notch research facilities and equipment available for collaborative projects that provide a critical hub for community technology clusters development.
- Technology transfer, new company creation and industry partnership facilities.
- Canada's most extensive resources and infrastructure for scientific and technical information.
- Local, national and international networks that link small- and medium-sized firms with key players in the innovation and commercialization system.

Stimulating the growth of technology clusters in communities across Canada is one of NRC's strategic goals. For many years NRC has provided strong local R&D presence, working closely with other research facilities in the area, with university partners as well as with local firms working in a technology sector. This R&D foundation, coupled with high-talent resources, leading-edge facilities and a nucleus of receptor capacity are critical components for the growth of clusters. As one example, in the 1980's the NRC Institute for Microstructural Sciences led an initiative known as the Solid State Optoelectronics Consortium, which brought together research and business interests from Ottawa firms such as Nortel and JDS Uniphase, federal government laboratories including NRC and Communications Research Canada, as well as partners from Carleton University and the University of Ottawa. In a process similar to the roadmapping exercises that are now a common activity in early-stage cluster-building efforts, the team examined existing strengths and made predictions about future developments for the fledging photonics sector that resulted in a number of focused, long-term collaborations that contributed to major employment growth in the Ottawa region.

In addition to R&D capacity, NRC's Industrial Research Assistance Program (NRC-IRAP) provides another set of resources for cluster development, enhancing NRC's role as a catalyst. NRC-IRAP offers significant technical and business expertise and support and has the capacity to put NRC's strengths to work with small- and medium-sized firms.

# NRC Technology Cluster Initiatives across Canada



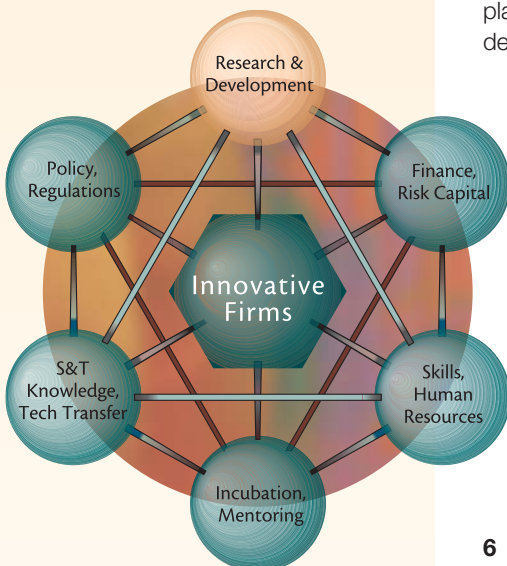
# The NRC Model of **CLUSTER DEVELOPMENT**

## Components of Innovation

A cluster develops when a group of innovative knowledge-based firms acts as a magnet, attracting other firms to invest and locate in the same area. These firms gain strength when supported by strong research institutions, a concentration of capital and business expertise as well as an appropriate environment in which innovation can flourish.

Clustering is a long-term process and several key ingredients must be in place to ensure its ultimate success. The cluster process must be community-driven with a well-defined technology focus, active networks and committed local champions. Importantly, clusters need a science and technology anchor, usually a government research institution or a university, able to work with local companies, transfer technology and spin off new enterprises.

In a few short years, NRC has established itself as an effective catalyst for cluster development, contributing to economic growth in communities across Canada.



*NRC has played a critical role in the development of emerging and mature clusters across Canada such as Ottawa (IT), Montréal (biopharmaceuticals) and Saskatoon (plant biotechnology). NRC has also made commitments to develop emerging technology clusters across Canada, in Vancouver (fuel cells), Winnipeg (medical devices) Saguenay (aluminium), St. John's (ocean technologies), Fredericton (e-Business) and Halifax (life sciences).*

Clusters take decades to mature and throughout their development they require coordinated efforts by all parts of the community – government, academics, industry, the financial sector and others.

Successful clusters are built through teamwork, networks and community commitments. NRC has developed a model that encourages and supports local strengths while leveraging its national and international resources, capabilities, networks and partnerships in support of community development. This model ensures that each cluster in each community can develop according to its unique needs, opportunities and challenges. The key steps in the process are:

### • **Initiate Community Consultation**

Community-level meetings and workshops provide regional stakeholders with the opportunity to define the existing and potential technology base and identify local strengths and weaknesses in the areas of business, financing, research, and infrastructure. In addition to reinforcing existing partnerships, these small gatherings provide an opportunity to establish local and national networks.

### • **Sponsor Community-led Innovation Round Tables**

Attended by community leaders, businesses, government, educators, financial investors and other interest groups, round table events bring all the players together to reach consensus on the best way to capitalize on the community's strengths.

### • **Develop an Action Plan**

Created by and for the community, the action plan is critical to making the cluster a reality. In addition to defining the vision and outlining a strategy and blueprint for growth, the action plan identifies a local champion, establishes objectives to guide long-term development and delegates responsibilities to stakeholders.

### • **Promote Growth**

Once critical steps in the action plan are achieved, cluster members turn their focus toward linking the local community to national and international networks. NRC, with its recognized R&D connections, world-class facilities, knowledge-sharing networks, and infrastructure support systems provides one key portal to S&T players as well as a unique capacity to position local technology clusters in the global arena.

### • **Communicate Success**

Success breeds success. Promoting cluster achievements is critical to raising the cluster's profile and generating new opportunities for sustained growth. It also attracts new partners and new investments, thereby expanding community capacities, core capabilities and making more funds available for future cluster development.



# **NRC Technology Clusters Across Canada**

*If knowledge and innovation are the currencies  
of the new economy, then NRC is Canada's Mint.*

– Dr. Arthur J. Carty  
National Science Advisor

# Fuel Cells & Hydrogen Technologies

## Community Engagement

**1998** – NRC sparks cluster formation with Fuel Cell Implementation Task Force

**1999** – NRC establishes a fuel cell lab at its Vancouver Innovation Centre

**2000** – National industry association Fuel Cells Canada established

**2000** – NRC launches horizontal Fuel Cells Program across six NRC institutes

**2002** – NRC Institute for Fuel Cell Innovation (NRC-IFCI) formed

**2003** – Western Economic Diversification and NRC announce \$1.5M for Hydrogen Technologies Environmental Chamber

**2003** – Canadian government announces \$215M for fuel cell technologies

**2004** – The Hydrogen Highway™ unveiled by the Prime Minister at Globe 2004 conference

**2004** – Federal government announces \$15M for new NRC-IFCI home

## NRC's Major Partners

- Fuel Cells Canada
- Simon Fraser University
- University of British Columbia
- University of Victoria
- Western Economic Diversification
- Natural Resources Canada
- Industry Canada
- Environment Canada
- National Defense Canada
- Transport Canada

*Vancouver is widely considered to have the world's most advanced cluster of companies and organizations focused on fuel cell and hydrogen energy technologies. Anchored by Ballard Power Systems, one of the world's leading fuel cell producers, the Vancouver cluster accounts for more than 70 per cent of the 1,800 people employed in Canada in this growing industry.*

A study by The Freedonia Group of Cleveland predicts that Canadian industry will seize almost 30% of the estimated US\$2.4 billion fuel cell market in 2007. In 2003, Canadian companies generated revenues of over US\$150 million, with Ballard accounting for the lion's share of the total.

While other pockets of fuel cell technology development are visible elsewhere in Canada, particularly Ontario and Quebec, the Vancouver cluster is home to more than half of the 17 sponsoring member organizations of the national industry association Fuel Cells Canada (FCC).

## NRC's role

NRC's efforts to support the growth of the Vancouver fuel cell cluster began in 1998 when it initiated a development strategy and

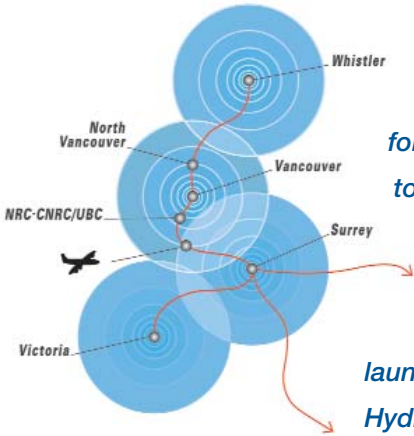
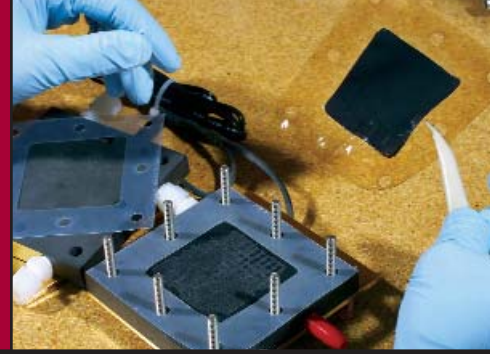
convened a Fuel Cell Implementation Task Force. Those developments sparked the creation of a National Fuel Cell Research Initiative in 1999, followed by the formation of FCC a year later.

As part of this national initiative, in 1999, NRC created a fuel cell research facility at its Vancouver Innovation Centre. A year later, NRC launched a Fuel Cell Program, a horizontal initiative that now involves dozens of researchers at six NRC institutes across Canada. In 2002, NRC significantly enhanced its presence in the cluster with the formation of the NRC Institute for Fuel Cell Innovation (NRC-IFCI), which serves as the focal point for the horizontal initiative.

NRC-IFCI's current strategic plan covers three broad areas that address critical needs within the cluster: the pursuit of research breakthroughs, the operation of a technology centre, and cluster-building activities.



*In late 2004, NRC-IFCI opened HTEC, the only public facility of its kind in North America. This advanced facility allows companies and researchers to test and evaluate hydrogen vehicles and stationary power systems under a wide range of climatic conditions – all in one location. This research is an important step in moving hydrogen and fuel cell products closer to commercialization.*



*The Hydrogen Highway™ is an integral component of British Columbia's new Fuel Cell Strategy, developed for the Premier's Technology Council. The strategy aims to make British Columbia the world's leading hydrogen economy by 2020. The new NRC-IFCI lab will be one of seven nodes on British Columbia's new Hydrogen Highway™ – a demonstration program launched in 2002 by NRC-IFCI in partnership with BC Hydro and Methanex Corporation. Envisioned as a key*

*attraction for the 2010 Winter Olympic Games, the Hydrogen Highway™ will eventually extend north from the Vancouver airport to the Resort Municipality of Whistler. Each node will feature hydrogen fueling infrastructure and a variety of transportation and stationary fuel cell demonstrations.*

Among its targeted research efforts, NRC-IFCI is developing next-generation, low-temperature proton exchange membrane (PEM) fuel cells and high-temperature solid oxide fuel cells (SOFCs) in an effort to help reduce costs and improve fuel cell reliability and durability. NRC-IFCI maintains testing and evaluation facilities including nine hydrogen-ready labs, a membrane electrode assembly facility, a new Hydrogen Technologies Environmental Chamber (HTEC) and an industrial incubator for early stage companies.

As part of its cluster-building role, NRC facilities showcase Canadian technologies and companies, supports networking and provides headquarters for FCC and major demonstration programs such as the Vancouver Fuel Cell Vehicle Program.

## Recent Developments

NRC-IFCI's strategic focus is aligned with Government of Canada priorities announced in October 2003, supported by \$215 million in federal funding, to extend the country's leadership in the emerging hydrogen economy. That initiative centers on early adoption of hydrogen technologies through integrated demonstration projects, improved

performance and cost reductions for hydrogen technologies, and partnership-driven hydrogen infrastructure projects.

Key cluster developments in 2003 included the launch of a Canadian Fuel Cell Commercialization Roadmap. This initiative involved 40 stakeholders working to identify challenges and chart a path for hydrogen and fuel cell technology commercialization. In terms of staffing, NRC-IFCI continued to build a highly-qualified research group, adding 20 senior researchers and training 40 researchers and technologists over the last two years. NRC-IFCI has established partnerships with the University of British Columbia (UBC), Simon Fraser University (SFU) and the University of Victoria, efforts which have resulted in shared research projects and 5 joint faculty positions. NRC-IFCI has also established strong partnerships with industry.

NRC-IFCI's presence in the cluster will be fortified with its future relocation to a new facility to be built on the UBC campus. The \$19 million facility, scheduled for completion March 2006, will be one of Canada's greenest research facilities. It will be powered by a variety of clean energy technologies, including photovoltaic panels, underground heat pumps, and a solid oxide fuel cell.

## FCC's Vancouver-based Sponsoring Members

- Ballard Power Systems Inc
- BC Hydro
- Cellex Power Products Inc
- General Hydrogen Corp
- Methanex Corp
- National Research Council-IFCI
- Noram Engineering and Constructors Ltd
- QuestAir Technologies Inc
- Westport Innovations Inc

## Facts and Figures

**Fuel Cells Market: a 100-fold jump in 14 years to US\$2.6 trillion by 2021**

**Vancouver is home to Canada's biggest fuel cell cluster**

**Hydrogen Highway™ to be fully operational for 2010 Winter Olympics**

**Number of NRC institutes engaged in fuel cell R&D: 6**

# Edmonton Nanotechnology

## Community Engagement

**2001** – Prime Minister and Alberta Premier unveil \$120M plan for NINT

**2001** – NRC, U of A & Alberta government ink MOU for NINT

**2003** – NINT helps create NanoMEMS Edmonton

**2003** – Design plans for NINT unveiled

**2003** – NINT recruits two top nanotech researchers from Purdue University (Indiana)

**2003** – Groundbreaking for Canada's quietest research space

**2004** – NINT hosts Canada's first-ever NanoForum

**2004** – One-of-a-kind transmission electron microscope purchased for NINT

**2005** – NINT hosts Canada's third annual Nano-Medicine Workshop

## NRC's Major Partners

University of Alberta

Alberta Government

NanoMEMS Edmonton

*Having already established a strong base in microsystems technologies, including micro electromechanical systems (MEMS), the Edmonton region is now in the midst of nurturing Canada's foremost cluster in nanotechnology. Nanotechnology, the science of manipulating individual atoms and molecules, is at an early stage of development. Nonetheless, nanoscience has already produced a wide range of consumer products from wrinkle-free pants and self-cleaning windows, to better tennis racquets and lighter, stronger auto parts. According to the U.S. based National Science Foundation, the world-wide market for nanotechnology-derived goods and services could reach US\$1.5 trillion by 2015.*

Edmonton's "small" tech community currently comprises at least 19 commercial organizations with world-renowned expertise in such areas as microfluidics, optical MEMS devices and 3D convergence. The community is now united under a new cluster champion, NanoMEMS Edmonton, formed in 2003.

Cluster leaders include the NRC National Institute for Nanotechnology (NINT), the University of Alberta (U of A), the Alberta Synchrotron Institute, the Centre for Nanoscale Physics, the Centre of Excellence in Integrated Nanotools, the Microsystems Technology Research Institute, and the micromachining and nanofabrication facility. Most of the research infrastructure is located at the University of Alberta, currently home to over 150 nanotechnology researchers in electrical and computer engineering, physics, pharmacy, oncology, chemistry and mechanical engineering.

## NRC's role

As Canada's flagship nanoscale research lab, NINT has become a focal point of Edmonton nanotechnology cluster development. Established in November 2001 as a partnership involving NRC, U of A and the Alberta government, NINT will house 30 world-class principal investigators, collaborating with over 100 scientists from U of A and 120 NRC staff. The goal is to position

NINT as one of the top five nanotechnology research labs in the world by 2010.

## Recent Developments

NRC co-hosted an initial cluster development Roundtable in May 2002 aimed at forging linkages between the new NINT and key community stakeholders, including the CEO of Syncrude Canada Ltd. As part of its ongoing collaboration with the community, NINT has representatives on the steering committee of NanoMEMS Edmonton, the advisory board of the Microsystems Technology Research Institute, and the board of directors of InnoCentre Alberta, all major players in fostering new growth and company creation companies around commercially-promising NINT technologies as they develop.





## Facts and Figures

Market for nanotech goods and services to reach \$US1.5 trillion by 2015

Number of nanotech researchers at U of A – over 150

NanoMEMS Edmonton represents 19 commercial small tech organizations

NINT's \$120M investment divided evenly among building, equipment and operations

Nanometre – one billionth of a metre or 1/80,000 the diameter of a human hair

*Of the \$120 million investment in NINT, approximately one-third is earmarked for constructing a research facility to extraordinarily tight tolerances. In fact, NINT's facility will be among the quietest buildings in Canada, offering lab space with ultra-low vibration, and minimal acoustical noise or electromagnetic interference – conditions that are absolutely critical for nanotechnology research and fabrication at the nanoscale level.*

In building research capacity, NINT has adopted a strong collaborative approach with the U of A to build research and development capacity, a key component in successful cluster building. The NRC – U of A partnership serves as a powerful platform for recruiting top-flight nanotechnology researchers from across Canada and internationally. In 2003, four world-leading researchers were attracted to NINT by a unique arrangement that allows them to split their time between teaching at the university and leading NRC nanotech research groups and projects. This also permits incoming principal investigators to bring graduate students and post-doctoral fellows along to ensure that research momentum is maintained.

The plan for the new lab itself is also a magnet for world-leading talent. When completed in the fall of 2005, NINT will be the most advanced research facility in Canada. The six-story, 20,000-m<sup>2</sup> facility, two-thirds of

which is devoted to NINT, will have specialty labs for chemical and biochemical synthesis and analysis of atomic-scale structures, as well as a Class 1000 Clean Room for the production of nanostructured systems. NINT will be furnished with over \$40 million worth of state-of-the-art scientific equipment, including the world's first transmission electron microscope equipped with a cold field emission gun.

***By choosing Edmonton as the home of its flagship nanotech lab, NRC has rightly acknowledged the strength of our community's nascent, but rapidly expanding small tech cluster. Adding NINT to Greater Edmonton's already considerable research infrastructure and established commercial enterprise community will ensure the region attains its goal of becoming one of the leading nanotechnology centres in the world.***

Leigh Hill, Director, NanoMEMS Edmonton

# Saskatoon

## Agricultural Biotechnology, Nutraceuticals, and Bio-Products

### Community Engagement

**1983** – Existing NRC lab renamed to reflect expertise and mandate in plant biotechnology

**2002** – NRC-PBI secures \$10 million for nutraceutical R&D

**2003** – \$15.4 million IPF opens

**2004** – AgBiotech, nutraceutical and bio-product cluster groups amalgamate

### NRC's Major Partners

Agriculture & Agri-Food Canada

Ag-West Bio Inc

Dow AgroSciences Canada Inc.

Saskatchewan Ministry of Industry & Resources

Saskatchewan Research Council

University of Saskatchewan

Western Economic Diversification



*Collaboration with cluster stakeholders like Bioriginal is an integral element of NRC-PBI's business philosophy. The value of its collaborative agreements has increased more than six-fold in less than a decade to about \$33 million annually.*

*Saskatoon is Canada's largest and fastest growing agricultural biotechnology cluster with about 30% of this sector's national activity. Over the past two decades, the city has built the foundation for a strong and prosperous bio-based economy. Today, this cluster is using its strengths to diversify activities into the rapidly expanding markets for functional foods and nutraceuticals and industrial bio-products.*

Saskatoon is home to about 35 companies engaged in agricultural biotechnology R&D, and is recognized as one of the largest clusters of its kind in the world. The community also boasts about 30 nutraceutical and functional food companies, generating annual revenues of \$50 to \$60 million from a global market estimated at over US\$182 billion annually. The cluster's private and public sector organizations employ some 1,100 staff, including more than 400 research and technology professionals. The community is also home to North America's largest legume and cereal microbial inoculant manufacturing centre, and it ranks as the 6<sup>th</sup> most competitive city in the world in food processing.

Among its leading-edge achievements, the Saskatoon cluster produced the world's first genetically modified commercial canola variety and first genetically engineered animal vaccine.

To sustain its world-class reputation in plant and livestock genomics, the Saskatoon cluster is currently investing over \$120 million in genomics research, genome-based services, and sophisticated infrastructure. The genomics expansion involves five leading, bio-centric organizations in the cluster: Agriculture and Agri-Food Canada (AAFC), Saskatchewan Research Council, University of Saskatchewan, Vaccine & Infectious Diseases Organization, and the NRC Plant Biotechnology Institute (NRC-PBI).

### NRC's role

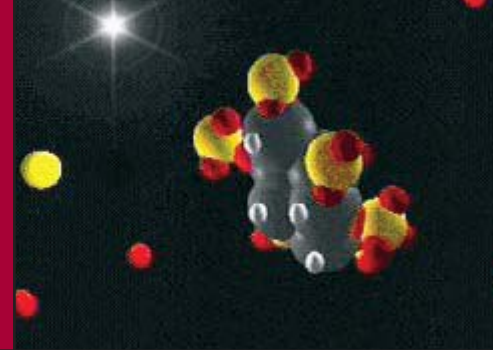
NRC-PBI has been a leading contributor to the development of this cluster through its

*"NRC-PBI has long been considered an anchor for the Saskatoon-based innovation cluster. NRC-PBI's omniscient presence in the cluster and its strategy for collective action in terms of knowledge exchange validates its central positioning within the framework."*

"Clusters Old and New – The Transition to a Knowledge Economy in Canada's Regions", McGill-Queen's University Press

scientific expertise, sophisticated research facilities, and dedicated industry partnership facilities to help technology-intensive firms. At NRC-PBI, researchers access leading-edge genomics equipment, including robotics as well as labs comprising a complete floor of its Industrial Partnership Facility (IPF) devoted to genomics science. The IPF was built at a cost of \$15.4 million and officially opened in March 2003. This new 6,900 m<sup>2</sup> IPF, adjacent to NRC-PBI, is a strategic element in the cluster development effort. It housed six incubating firms by the end of 2003. The IPF also provides access to other companies in the cluster to sophisticated mass spectrometry and high-throughput DNA sequencing facilities, without having to meet the high cost of ownership.

In 2002, the cluster's effort was diversified to encourage development of the emerging nutraceutical industry. In October 2002 the Government of Canada announced \$10 million in funding over five years to augment NRC-PBI efforts in crops for enhanced human health, including the development of enabling technologies required for genetic improvement of nutraceutical plants.



## Facts and Figures

Saskatchewan is home to 30% of Canada's AgBiotech industry

Employment in Saskatoon Cluster: Over 1,100

Saskatoon's investment in genomics: \$120 million

Nutraceutical Market: \$172 million in 2003 (Nutrition Business Journal)

NRC-PBI IPF: 6,900 m<sup>2</sup> houses six tenants, plus labs for non-tenants

The focus on nutraceuticals, functional foods and related molecular farming technologies involves several critical stakeholders, such as Agriculture and Agri-Food Canada, the University of Saskatchewan, POS (Protein Oilseed, Starch Corp), and Ag-West Bio Inc.

Together, partners mapped out a vision framework and plan to guide efforts to develop the agricultural biotechnology cluster through expansion into natural health products.

## Recent Developments

As a result of these initiatives and others, the community has become far more integrated in its cluster efforts. Ag-West Bio, one of the leaders in the cluster, was created in early 2004 when Ag-West Biotech amalgamated with the Saskatchewan Nutraceutical Network and Bio-Products Saskatchewan Inc. The realignment of local industry development interests into a single cluster agency – part of a strategic plan for Ag-West that NRC-PBI helped devise – is consistent with the community's goal of diversifying its bio-based economy.

*“Since its inception in 1983, NRC-PBI has been critical to the success of the bio-economy cluster in Saskatchewan and instrumental in the development and commercialization of innovative technologies.”*

Dr. Ashley O'Sullivan, President & CEO of Ag-West Bio Inc.

To support the cluster's new priorities, NRC-PBI realigned its research programs to focus more sharply on three areas: production of bio-products from plants; production of compounds from plants which have human health benefits; and, genomics research to enhance the performance and market diversity of Canadian crops.

This new research thrust has been coupled with other collaborative undertakings with industry and other partners, including development at NRC-PBI of a strong technology forecasting capacity. For instance, PBI recently teamed up with Bioriginal to complete a technology landscape assessment of producing plant oils with specific health benefits.

## Commercialization Success

In 2004, NRC-PBI signed a partnership agreement with Chicago-based Chromatin Inc. to help test a new plant-breeding technique using canola. NRC-PBI was one of the institutions that originally developed canola, a source of expertise that brings value to the collaboration. The collaboration will also expand NRC-PBI's scientific and technical capabilities in canola improvement and diversification.

## Winnipeg

# Life Sciences, Medical Devices

### Community Engagement

**1992** – NRC IBD opens Winnipeg lab with staff of 25

**1997** – NRC-IBD spin-off, IMRIS, formed to commercialize MRI technology

**2001** – Collaborative research income tops \$1 million at IBD

**2002** – New NRC-CCBT initiative announced

**2003** – Province commits \$2 million to NRC-CCBT

**2004** – BCC unveiled to manage NRC-CCBT

**2005** – NRC-CCBT slated for occupancy

### NRC's Major Partners

University of Manitoba

University of Winnipeg

Health Canada's Canadian Science Centre for Human and Animal Health (National Microbiology Lab)

St Boniface General Hospital/ Research Centre (I.H. Asper Clinical Research Institute)

Health Sciences Centre/Children's Hospital

Health Care Products Association of Manitoba (HCPAM)

Association of Manitoba Incubators

Red River College of Applied Arts, Science and Technology

*Manitoba's life science community is among the fastest growing in Canada and internationally. Total employment in Manitoba's life sciences cluster has increased almost 10-fold to 4,500 positions over the last decade.*

The province currently houses more than 150 health-related companies with sales of over \$440 million annually. According to a recent Ernst and Young report on Canada's biotechnology sector, Manitoba has the third fastest growing life sciences industry in the country.

### NRC's role

Manitoba is also building scientific and industrial capacity in the rapidly-growing field of medical devices, due in part to NRC's increased presence in this field in the community. When NRC created the Winnipeg-based NRC Institute for Biodiagnostics (NRC-IBD) in 1992, it had a staff complement of about 25 while annual research initiatives totaled about \$2 million. Today, NRC-IBD has 200 researchers and staff engaged in about \$15 million worth of R&D and technology transfer in the field of non-invasive medical diagnostics.

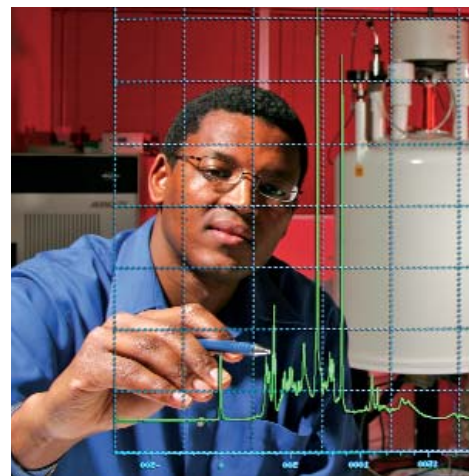
NRC-IBD also has had success in spinning out commercial enterprises from its research, with a total of five spin-off companies being

created that now have an aggregate market value of more than \$50 million. The largest of these is Innovative Magnetic Resonance Imaging Systems (IMRIS) Inc, formed in 1997 to commercialize NRC-developed intraoperative MRI systems.

### Recent Developments

NRC-IBD's economic impact on Winnipeg, estimated at roughly \$30 million annually, is being augmented with the new NRC Centre for the Commercialization of Biotechnology (NRC-CCBT) – an \$11.2 million industrial partnership commercialization facility adjacent to NRC-IBD, slated to open in September 2005. The provincial government contributed \$2 million toward the 5,100-m<sup>2</sup> facility and, in partnership with a national not-for-profit organization, Biomedical Commercialization Canada (BCC), is supporting the NRC-CCBT in a bid to further accelerate Manitoba's life sciences cluster.

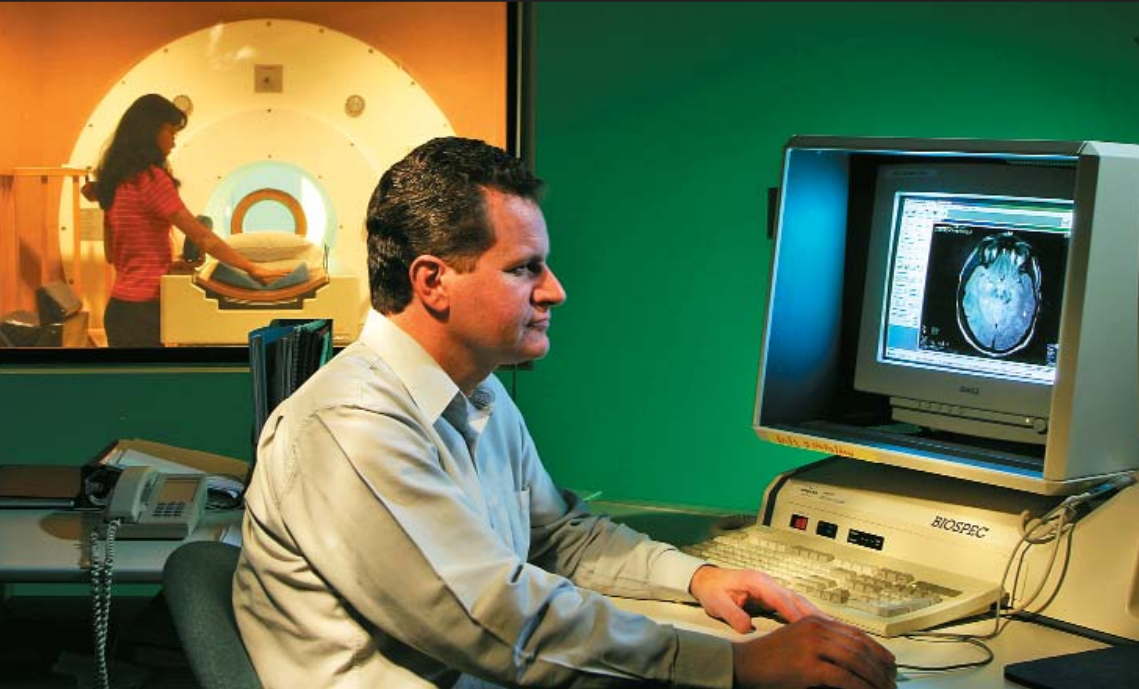
At this new facility, NRC and BCC will help design and oversee commercialization programs and services and build community



*“Since 1990 when the Health Care Products Association of Manitoba (HCPAM) was first incorporated with a membership of four companies to the present year 2005 with a membership of 80 companies we have experienced first hand the dynamic growth of the industry in Manitoba. NRC-IBD is a major player providing industry with access to scientific expertise and business development skills that are an important element to the growth of the life sciences cluster that is rapidly forming in the Province.”*

Marguerite Laramee, HCPAM Executive Director





## Facts and Figures

Winnipeg: Canada's third largest industrial life sciences cluster

Manitoba jobs in life sciences soared 960% between 1989 and 2004

Provincial count: 4% of Canada's population; 15% of industrial biotech jobs

New NRC \$11.2M commercialization facility to house 40+ organizations

NRC-IBD has \$30 million impact on Winnipeg economy

NRC-IBD spin-offs worth a combined \$50 million

*An important measure of NRC's cluster success is the ever-growing rate of collaboration between NRC-IBD and other research and training organizations in Winnipeg's life sciences community. NRC-IBD's revenues from collaborative research in this area have been growing at an average annual rate of more than 30%.*

*To further enhance the Winnipeg cluster, stakeholders are now coalescing around the concept of a "BioMed City" located near the Canadian Science Centre for Human and Animal Health, not far from the NRC facilities. The recommendation for "BioMed City" was tabled from a task force attached to the new International Centre for Infectious Diseases (ICID), one of two new Canadian centres for national disease control located in Winnipeg.*

and industrial leadership to support the growth of the medical devices cluster. Once completed, NRC-CCBT will provide research facilities, technical information and innovation services, notably those of NRC-CISTI and NRC-IRAP to as many as 40 companies and technology organizations. Commercialization services will include technology and business planning, market strategy assessment, national and international missions and partnering support, regulatory procedures, technology law and intellectual property protection services, skills assessment and

development, investment networking and advice, as well as business mentoring.

On a related front, NRC-IBD personnel are teaming up with NRC-CISTI specialists and NRC-IRAP industrial technology advisors to link medical imaging/devices companies to expertise within Canada's public sector research organizations. The multi-disciplinary group has produced an industry report on the medical imaging sector and has launched a new publication to network life science and medical device clusters across the country.

***"This investment (in NRC-CCBT) demonstrates our ongoing efforts to make Manitoba a national Centre for medical innovation...."***

Gary Doer, Premier of Manitoba

# Ottawa Photonics

## Community Engagement

**1988** – NRC leads creation of Solid-State Optoelectronics Consortium

**2001** – NRC-IMS inks MOU with Photonics Research Ontario

**2002** – Funding of \$43 million announced for CPFC

**2004** – NRC-CPFC operational

**2004** – OPC stages first-ever Photonics North conference in Ottawa – tour and special event at NRC-CPFC part of the agenda

## NRC's Major Partners

Carleton University

Ontario Government

Photonics Research Ontario

Agile All-Photonics Network

Canadian Photonics Consortium

Canadian Optoelectronic Packaging and Assembly Consortium

Ottawa Photonics Cluster

Advanced Bio-photonics Consortium

Ottawa Life Sciences Council

Ottawa Centre for Research & Innovation

Ottawa Photonics Research Alliance

National Capital Institute for Telecommunications

Canadian Institute for Photonics Innovation

Canadian Microelectronics Corporation

Canadian Association of Physicists

*Canada is home to five significant photonics clusters, the most active being in Ottawa. The community counts almost 100 companies, government, and university labs in its emerging photonics cluster.*

On a global scale, Ottawa is considered to be among the top five photonics clusters in the world. Much of its scale is attributable to earlier investments by two large industrial anchors, JDS Uniphase and Nortel Networks. These information technology giants helped propel Canada to the forefront of photonics, with a 41% share of the world market for optical components at the zenith of the optical telecommunications boom in 2000.

In the wake of the major shakeout of the telecommunications industry after 2000, Ottawa's photonics industry landscape changed with major players reducing their presence and remaining community of small and medium-sized enterprises becoming far more focused on the growing field of non-telecom applications for photonics technologies. With the convergence of scientific disciplines, photonics has been recognized as an enabling technology, of use in a variety of sectors such as biotechnology and nanotechnology. Potential markets range from life sciences and manufacturing, to security and solar power.

## NRC's role

The initial players in the development of this photonics cluster came together in 1988, when the NRC Institute for Microstructural Sciences (NRC-IMS), in cooperation with Bell-Northern Research other technology businesses, universities and government labs, spearheaded the creation of the Solid State Optoelectronics Consortium (SSOC).

***Photonics clusters and consortia become even more important given a landscape of many small and emerging companies. Cluster activities promote networking and facilitate partnerships.***

Putting Light to Work, a CPC discussion paper, November 2004

SSOC was established in direct response to industry needs. Similar needs led NRC-IMS and its partners, in 2002, to formally create the NRC Canadian Photonics Fabrication Centre (NRC-CPFC) – a \$43 million partnership that answers industry's call for a photonics prototyping facility and a place where the highly-skilled workers of the future can obtain training.

NRC-CPFC represents an important partnership between the federal government, which has committed \$30 million to the Centre for its first five years of operation, and Ontario which supplied \$13.1 million. Built as part of NRC's Ottawa complex of research facilities, NRC-CPFC consists of a 500 m<sup>2</sup> wafer fabrication facility and a three-story office wing. The custom-designed three-story building will house NRC-CPFC staff, conference rooms, device design and test labs, space for students and visitors, and an approximately 1200 m<sup>2</sup> bay and chase type wafer fabrication facility (40% class 100, 60% class 1000).

In shaping the activities for NRC-CPFC, NRC has collaborated closely with Photonics Research Ontario (PRO), a provincial Centre of Excellence, under a memorandum of understanding the two parties reached in May of 2001. The MOU allowed PRO to establish a research presence at CPFC as part of an effort to ensure that the Centre achieves scientific critical mass.

## Recent Developments

In addition to partnering with PRO, three NRC Institutes are active players in the Photonics Cluster effort – the group includes the NRC Steacie Institute for Molecular Sciences (NRC-SIMS) and the NRC Institute for Information Technology (NRC-IIT).



*Operational in the fall of 2004, NRC-CPFC includes a multi-wafer reactor; contact lithography, an I-line stepper; a suite of dielectric and metal deposition instruments, and advanced dry and wet etching tools.*

The marriage of life sciences and photonics is already evident in the changing mix of projects at NRC-IMS, where there are now five projects with biotechnology components and a sixth that will address medical imaging challenges. Additionally, NRC is exploring opportunities for inter-institute collaboration involving four other NRC institutes in addition to the ones listed above.

Outside of these internal developments, NRC-IMS continues to collaborate on several fronts of interest to the cluster. NRC-IMS is a founding partner in the Agile All-Photonic Networks Research Network, carries out collaborative R&D with the National Capital Institute for Telecommunications, and is developing chemical and biophotonic sensor expertise through a major collaborative project funded by the Chemical, Biological, Radiological and Nuclear Research and Technology Initiative.

Work by NRC-IMS also extends beyond the Ottawa cluster. For example, it serves

on the Research Program Committees of the Canadian Institute for Photonics Innovation, the Ontario Photonics Consortium, and the Canadian Photonics Consortium. By participating in both local and national photonics interest groups, NRC-IMS is helping ensure that national priorities are effectively synchronized with the needs of community technology clusters.

***The photonics industry is changing rapidly. We have arrived at a juncture where convergence with other technologies creates new opportunities if we can assemble the requisite collaborative, interdisciplinary teams. As a multi-disciplinary organization with decades of understanding about collaboration and technology convergence, NRC is poised to shine, and will continue to make meaningful and lasting contributions to Ottawa's Photonics cluster.***

Ray Novokowsky, President & CEO, EcoVu Analytics

# Montréal

## Aerospace

### Community Engagement

1996 – Aerospace Technology Road Map

1998 – NRC-IAR proposes NRC-IAR/AMTC in Strategic Plan

2001 – Funding approved for NRC-IAR/AMTC

2004 – New facility ready for staff & equipment

2004 – NRC-IAR/AMTC Open Doors Days for SMEs and R&D organizations

### NRC's Major Partners

Quebec Aerospace Association (AQA)

Canada Economic Development for Quebec Regions (DEC)

Consortium for Aerospace Research and Innovation in Quebec (CRIAQ)

Université de Montréal

Concordia University

École Polytechnique

McGill University

École de technologie supérieure (ETS)

Canada Foundation for Innovation

*As Quebec's leading export industry with over \$10 billion in annual shipments, the aerospace sector is among the province's most valuable economic assets. Clustered mainly in Greater Montréal, home to about 95% of Quebec's aerospace activity and over 55% of Canada's total, the industry encompasses some 170 enterprises employing over 35,000.*

Montréal is home to the fourth-largest aerospace cluster in North America. It is also one of the few places in the world where all the components necessary to build an aircraft can be found within a single metropolitan area, a remarkable capacity considering the thousands of parts and components required to manufacture aircraft. The community is also the best in North America in terms of overall business operating cost performance, according to the 2004 KPMG Competitive Alternatives Study.

To meet the growing needs of Montréal's aerospace cluster and its bid to remain globally competitive NRC had to significantly increase its involvement in the community. Until recently, NRC served the Montréal aerospace cluster primarily through the NRC Institute for Aerospace Research (NRC-IAR), with its specialized capabilities and facilities located in Ottawa. After extensive research and consultation, NRC determined that the

cluster's greatest need, which could not be satisfied by existing NRC-IAR capabilities and facilities, was in the area of manufacturing technologies. Today, that need is being addressed by NRC-IAR's new, world-class Aerospace Manufacturing Technology Centre (NRC-IAR/AMTC), located on the campus of the University of Montréal.

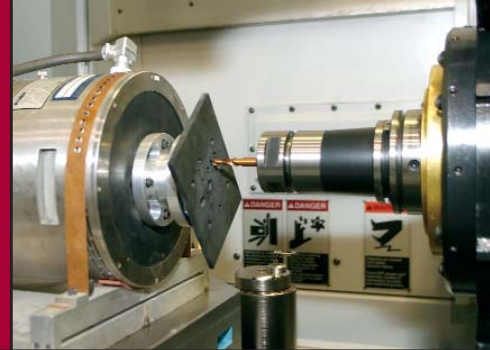
### NRC's role

Opened in early 2004, NRC-IAR/AMTC was originally proposed as a key response to a 1996 Aerospace Technology Road Map. That exercise, along with other industry and government sponsored studies, called for the Canadian aerospace industry, and particularly its supplier base, to be more innovative in manufacturing to remain competitive internationally.

NRC-IAR/AMTC's mission is to aid small and medium-sized companies with the transition to next-generation manufacturing. Based on needs expressed by the industry, NRC-IAR/AMTC concentrates on four key challenges: manufacturing and life-cycle costs; environmentally compliant materials, processes, and systems; strategic intelligence and information management systems; and, human resources development. The research program at the Centre covers four main thrusts: automation, robotics and intelligent manufacturing systems; forming and joining of metallic structures; fabrication and joining of composite structures; and, material removal (machining).

In identifying the research thrusts, NRC-IAR/AMTC worked closely with the community, especially the lead cluster agency, the Quebec Aerospace Association (AQA),





## NRC's Major Industrial Collaborators

- Bombardier Aerospace
- Bell Helicopter Textron Canada
- CAE Electronics
- Canadian Marconi
- General Electric Canada
- Héroux Devtek
- Messier Dowty
- Pratt & Whitney
- Rolls-Royce Canada

## Facts and Figures

Montréal Aerospace Cluster is fourth largest in North America

Quebec's leading export industry with over \$10 billion in annual shipments

Over 170 organizations with combined employment of more than 35,000

Federal investment in NRC-IAR/AMTC: \$46.5 million

*Co-financed by NRC (\$21.5 million) and Canada Economic Development (\$25 million), NRC-IAR/AMTC is a 6,500 m<sup>2</sup> facility that can accommodate up to 100 research staff and guest workers. To date, more than 40 staff have been hired and over \$12 million invested in sophisticated research equipment.*

in which NRC is an associate member. In partnership with AQA, NRC-IAR/AMTC took the lead in developing a survey of the industry's research and technology imperatives in high-speed machining as well as the formation of a related Special Interest Group.

The high-speed machining forum is one of three Special Interest Groups that NRC-IAR/AMTC has promoted. The others are in the emerging technology fields of directionally solidified and single crystal turbine blade repair, and liquid composite moulding fabrication.

In addition to its strong relationship with AQA, NRC-IAR/AMTC is an active participant in the Consortium for Aerospace Research and Innovation in Quebec (CRIAQ), a provincial network of industry, universities and public research institutions. NRC-IAR/AMTC is engaged in three CRIAQ projects, one on metal product fabrication, and two others in the area of composite product manufacturing.

Participation in CRIAQ helps reinforce linkages between NRC-IAR/AMTC and Montréal's lead universities with aerospace programs, including Concordia, École Polytechnique, McGill and École de technologie supérieure. The ties are

further strengthened by NRC-IAR/AMTC researchers who serve as adjunct professors at local universities.

With NRC-IAR/AMTC as a partner, some of the Montréal universities are building stronger business cases for new aerospace-related infrastructure projects, eligible for funding from the Canada Foundation for Innovation (CFI). NRC-IAR/AMTC has backed two CFI proposals, including a plan by École Polytechnique on resin transfer moulding for composite material components, and a McGill initiative in the area of aerospace materials and processes.

***Montréal's aerospace cluster has the scale, breadth, and excellence to compete against the top aircraft manufacturing centres in the world. With the addition of NRC-IAR's new Aerospace Manufacturing Technology Centre, the Montréal cluster now has a well-equipped focal point for the adoption of cutting-edge fabrication technologies. The NRC Centre further fortifies Montréal's competitive edge as the location of choice for aerospace industrial innovation.***

Sue Dabrowski, Executive Director, Quebec Aerospace Association

# Montréal Life Sciences

## Community Engagement

1987 – NRC-BRI officially opens

1996 – Montréal International cluster agency created

1998 – Industrial Partnership Facility opens NRC-BRI

2003 – DSM Biologics unveils \$150M investment next to NRC-BRI

2005 – 10<sup>th</sup> Annual Crossroad Conference held at BRI

## NRC's Major Partners

Montréal International

The City of Montréal

Université de Montréal

McGill University

Quebec Gene Therapy Association

Génome Québec

*NRC-BRI's partnerships with organizations in the cluster have steadily expanded since it was officially opened in 1987. In fiscal 2004, for example, NRC-BRI inked 11 formal collaborative agreements, valued at over \$7.3 million. In financial terms, that represented more than a six-fold increase over the previous year.*

*With the largest concentration of biotech R&D in Canada, Montréal ranks as one of the world's leading clusters in the rapidly evolving domain of life sciences. The community's life sciences cluster boasts 540 companies employing more than 37,000 people, 125 research centres, and employment growth of over 2,000 jobs annually. The Montréal life science cluster has garnered more than \$400 million in investment over the last three years, and is home to largest number of biotechnology start-ups in Canada.*

Montréal's critical mass of life science activity is reinforced by the presence of dozens of large, transnational pharmaceutical companies, including such industry giants as Abbott Laboratories, Bristol-Myers Squibb, and Merck Frosst. The community's scientific capacity is underpinned by a number of world-class research organizations, including the Montréal Neurological Institute, the Clinical Research Institute of Montréal, the research arm of the University of Montréal Hospital, the Montréal Heart Institute, the Armand-Frappier Institute and the NRC Biotechnology Research Institute (NRC-BRI). Together, these labs have helped the Montréal life sciences cluster assume a leadership position in cardiovascular diseases, epidemiology, immunology, neurology, neurobiology, oncology, and virology.

## NRC's role

For almost 20 years, NRC-BRI has been an active participant in Montréal's biotechnology cluster, helping lift the community to an impressive fifth place ranking in life science concentrations in the world.

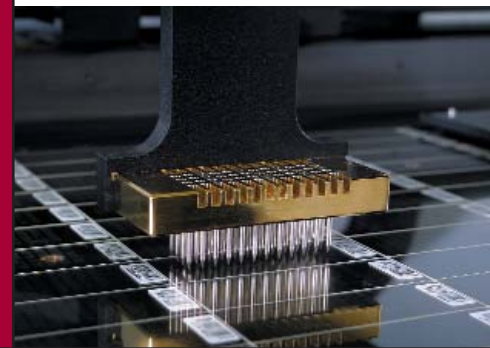
From a research perspective, NRC-BRI focuses on discovery and design of new compounds for infectious diseases and cancer under its health research program. Additionally, it also offers significant expertise in bioprocesses (microbial fermentation, cell culture, and recombinant protein and viral vector production), as well as new environmental biotechnology applications and processes related to pollution monitoring,

prevention and treatment as well as eco-efficient industrial production.

NRC-BRI also offers contract R&D services, and it licenses technology to, and conducts collaborative research with many of the university, industry, government and other stakeholders in the Montréal cluster. This technology transfer, a function critically important to the cluster's vitality, is bolstered by NRC-BRI's 9,800-m<sup>2</sup> Industrial Partnership Facility (IPF), geared to nurturing biotech start-ups in the Montréal cluster. NRC-BRI has NRC's largest IPF.

## Recent Developments

One NRC-BRI's major partners is Laborium Biopharma Inc, a Montréal-based private company being engaged in specialized activities for preclinical and clinical biomanufacturing. With NRC-BRI's bioprocessing expertise and facilities close at hand, Laborium built a strong business case for an investment of over \$40 million in a new biopharmaceutical manufacturing facility adjacent to NRC-BRI. Additionally, it has been planned that the BRI-NRC should elaborate and build a practical training center, upon reception of the appropriate financing, as well as additional R&D facilities that will work in synergy with the innovation capacity of the present and future industrial partners. Complementary collaboration agreements are expected in a near future, and will be prepared to consolidate the strategic initiative for cGMP biomanufacturing



## Facts and Figures

Montréal is now home the eighth largest life science cluster in the world

Life sciences employment is over 37,000, with 2,000 new jobs added annually

More than \$400 million in new investment over three years in the cluster

NRC-BRI IPF – NRC's largest – houses 14 companies

Community profile: 125 research centres and over 540 life science companies

within the Montréal Metropolitan area. With such an agreement, great expectations can be made to short-term position the Greater Montréal area as one of the five World leading geographical zones for cGMP biomanufacturing.

The Laborium investment is just one of the recent outcomes of NRC-BRI's participation in the Montréal biotechnology cluster. Each year, NRC-BRI also takes a lead role in organizing and hosting the Crossroad of Biotechnology, an international symposium attracting over 500 participants from around the world. This unique event, where business meets science, bridges the biotechnology and pharmaceutical industries.

Other recent events hosted by NRC-BRI include the 6<sup>th</sup> colloquium of the Quebec Association of Gene Therapy, and the 3<sup>rd</sup> Edition of the Montréal MicroArray Symposium. The latter event coincided with an expansion of NRC-BRI's MicroArray lab, which recently penned an agreement to become the official Custom Bio-Chip service provider to McGill University and Génome Québec.

NRC-BRI also participates in several grassroots initiatives aimed at boosting

the Montréal biotechnology cluster. The NRC institute is represented on the Life Sciences committee of Montréal International, has participated in Bio-Quebec's strategy to assemble Canadian and American venture capitalists and has been actively involved in the municipality's plan to develop and promote Montréal as a "City of Knowledge."

Other recent collaborative cluster developments include a new 10-year agreement with Montréal Centre for Experimental Therapeutics in Cancer, involving viral production for gene therapy applications. That the Montréal Centre held its first two annual meetings at NRC-BRI is clear evidence of value the community attaches to the Institute.

***"The Government of Canada has worked closely with the Province of Québec and the City of Montréal to support DSM Biologics' investment and expansion in Montréal. DSM Biologics' decision to choose Montréal is a clear indicator that Canada has all the strengths and attributes required to attract forward-looking global biotechnology companies and internationally renowned scientists."***

Dr. Francis Bellido, CEO, SGF Santé

## Commercialization Success

NRC-BRI and Montréal-based Biophage Pharma recently renewed an ongoing collaboration aimed at commercializing NRC-developed technology for quick and accurate biosensors. The patent-pending technology has applications in Biodefence, environmental monitoring (air, water and food) and biomedical diagnosis of antibiotic resistant bacterial infections.

# Saguenay Region

## Aluminium Technologies

### Community Engagement

- 2000 – Aluminium Industry Technology Roadmap completed
- 2001 – NRC commits to NRC-ATC for Saguenay region
- 2002 – Design plans for NRC-ATC unveiled
- 2003 – ATC becomes operational
- 2004 – Official inauguration of NRC-ATC

### NRC's Major Partners

- Alcan Inc.
- Canada Economic Development
- General Motors Canada
- Quebec Centre for Aluminum R&D (CQRDA)
- REGAL : regroupement université / organismes en R&D-aluminium
- SVA (Société de la vallée de l'aluminium)
- Trans-Al Network
- Université du Québec à Chicoutimi (UQAC)
- University of Waterloo

*With roughly 15% of world exports, Canada is the second largest exporter of primary aluminium after Russia. But when it comes to adding value to aluminium, Canada is a net importer of semi-finished and finished products – a trade imbalance that could be remedied if Canadian companies were encouraged to transform Canadian aluminium ingots into value-added offerings.*

In Canada, a large aluminium industry cluster has emerged centered around the Quebec Saguenay region known as the “Aluminium Valley”. – (90% of the Canadian aluminium production is located within a radius of 500 kms of the NRC-ATC). A key challenge for the region is to move from aluminium production to aluminium transformation. To address these challenges and capitalize on the heavy concentration of aluminium industry stakeholders in the region, the NRC Industrial Materials Institute (NRC-IMI) established the new NRC Aluminium Technology Centre (NRC-ATC) on the campus of the University of Quebec at Chicoutimi. The \$57 million facility, entailing investments of \$25 million and \$32 million from Canada Economic Development Quebec and NRC, respectively, will provide

***“This (ATC) Centre is a prime example of what can be accomplished when the region pulls together to work toward a common goal. It ensures the region of the kind of environment that is conducive to aluminium transformation.”***

Michel Belley, Rector, UQAC

Canadian industry with the technical support, expertise and facilities required to develop value-added aluminium products and processes.

Officially inaugurated in November 2004, the 6,000-m<sup>2</sup> NRC-ATC will have some 60 NRC staff and 20 invited researchers from other aluminium R&D organizations. In addition,







## Facts and Figures

Canada is the world's second largest exporter of primary aluminium

Quebec accounts for 90% of Canadian exports

Canada is a net importer of semi-finished and finished aluminium parts

Quantity of aluminium used in cars increasing 5% annually

about 20 young scientists will receive advanced training at the Centre each year – helping to build the skilled talent Canada needs to transform this important industry.

The R&D thrust of NRC-ATC is grouped under two broad areas: advanced forming technologies, and joining/assembly technologies. In the first area, NRC-ATC offers expertise and facilities for die casting (including semi-solid technologies), hydroforming and other solid aluminium deformation processes. The second R&D thrust involves laser and friction-stir welding, adhesive bonding, as well as the mechanical assembly of aluminium parts. NRC-ATC supports these activities with expertise in computer modeling of aluminium processing and materials analysis using in-house state of the art instrumentation.

As in other technology clusters across Canada, partnerships with local stakeholders play a critical role in NRC-ATC's efforts to stimulate research, diffuse new knowledge and commercialize promising developments. In the aluminium cluster, NRC-ATC has strong ties to a number of private and public

stakeholders, including Alcan Inc., the Quebec Centre for Aluminium R&D (CQRDA), the Trans-Al network (an association of aluminium parts manufacturers), the "Société de la vallée de l'aluminium" (a business development organization funded by the Quebec government) and the Université du Québec à Chicoutimi (UQAC) along with "REGAL," a Quebec university aluminium research network headquartered at UQAC.

While the NRC-ATC has been operational for less than a year, it has already signed collaborative R&D partnerships with several local small and medium-sized enterprises as well as with industry giants such as Alcan and General Motors. The Alcan arrangement, which amounts to \$10.5 million over five years, is focussed on a breakthrough manufacturing processes geared to aluminium parts for the enormous worldwide automotive market. Collaborative agreements have also been signed with other Canadian universities, in particular with the University of Waterloo and the University of Toronto (with General Motors Canada as the industrial partner) and with the Université Laval (with Alcoa and Alutrec as industrial partners).



# New Brunswick Information Technology – e-Business

## Community Engagement

- 2000 – Announcement of N.B. site and ACOA/Province funding
- 2001 – Moncton Roundtable to establish broad research agenda for NB
- 2001 – Ground breaking for NRC-IIT – e-Business building in Fredericton
- 2002 – Saint John Forum
- 2002 – e-Health Forum in Fredericton
- 2002 – Stakeholder consultation on e-Government research agenda in Fredericton
- 2003 – Official opening of Fredericton labs
- 2003 – e-Government workshop in Fredericton
- 2003 – First Atlantic Canada Human Computer Interaction Workshop
- 2004 – Personal Health Record (PHR) MOU inked
- 2004 – \$11-million NB/P.E.I. Research Grid Unveiled
- 2004 – International Learning Objects Summit in NB
- 2004 – National e-Health workshop on PHR in NB

## NRC's Major Partners

- Atlantic Canada Opportunities Agency (ACOA)
- Province of New Brunswick
- University of New Brunswick (Fredericton and Saint John)
- Université de Moncton
- New Brunswick Community Colleges
- Centre international pour le développement de l'infrastructure en français (CIDIF)
- Atlantic Health Sciences Corporation (AHSC)

*Over the past four years, New Brunswick has strengthened its position in the digital economy through the initiation of technology cluster development in the rapidly expanding e-Business sector. During that time, the New Brunswick e-Business cluster has evolved quickly, yielding impacts that are not only regional, but also national and even international in scope.*

At stake for New Brunswick's more than 200 information technology firms is a red-hot, global e-business market. According to the US-based Gartner group, the global e-Business market could reach US\$8.5 trillion in 2005, up almost 20-fold from US\$446 million in 2000.

## NRC's role

The New Brunswick cluster initiative is funded with a total of \$37.5 million over five years, and is anchored by three new labs, established in consultation and collaboration with universities, local businesses, the provincial government, and the Atlantic Canada Opportunities Agency (ACOA). The province-wide cluster is headquartered at the NRC Institute for Information Technology-e-Business (NRC-IIT – e-Business) on the

*NRC's presence in New Brunswick will help improve the innovation capacity of the Province, which in turn will contribute to a higher standard of living, more jobs and a better quality of life for all New Brunswickers.*

**Bernard Lord, Premier of New Brunswick**

campus of the University of New Brunswick (UNB) in Fredericton, whose research mission encompasses Human Web, Internet Logic, e-Government/e-Citizen, and Privacy, Security and Trust solutions. NRC-IIT – e-Business labs at UNB in Saint John, and the Université de Moncton specialize in e-Health and e-Learning, respectively.

Community engagement has formed a major element in NRC activities, beginning with a January 2001 Round Table in Moncton which included well over 100 leaders from the private, public and academic sectors. Since then, community stakeholders have played significant roles in defining the cluster's strategic direction and shaping NRC's entire research agenda. In the first 18 months of operation alone, NRC-IIT – e-Business convened more than 150 industry meetings and inked 24 Memoranda of Understanding.

Overall, NRC-IIT – e-Business has signed more than 50 R&D agreements of various kinds, supported by an increase in staff from 14 in November 2001 to 80 in January 2004. And the leverage associated with these agreements is considerable – in a snapshot taken at June 2003, for every dollar that NRC contributed to externally funded R&D projects, partners provided or attracted six dollars.





## Facts and Figures

Global e-Business market explosion: from US\$443 million in 2000 to US\$8.5 trillion by 2005 (Gartner Group Research)

Investment in New Brunswick e-Business cluster: \$37.5 million over five years

Leverage on sample of externally funded R&D project in NB: \$6 for every \$1 invested by NRC

Number of R&D agreements signed by NRC-IIT – e-B: 50 in less than 3 years

Over 200 firms in New Brunswick's IT sector

75% are small enterprises, employing fewer than 20 people

## Recent Developments

Community-building exercises seen at the outset of clustering efforts have continued and have focused on defining specific research directions and creating links to other resources outside the region. For example, the community has organized a number of other national and international gatherings, including: an e-Government/e-Citizen workshop in October 2003; the first Atlantic Canada workshop on human-computer interaction in November 2003; a two-day International Learning Objects Summit; and a one-day workshop on e-Health Strategies for the 21<sup>st</sup> century.

A critical piece of infrastructure for future cluster development was unveiled at NRC-IIT – e-Business in February 2004 – the \$11 million NB/PEI Research Grid. The Grid, to which NRC-IIT – e-Business is a leading contributor, has provided a highly reliable research network backbone to Atlantic Canada. NRC's contribution was to facilitate an unusual

partnership and to provide expertise towards the design of the shared infrastructure. The Grid provides research, industry and academic communities in both provinces with access to one of the world's most advanced broadband networks, CA\*net 4, which is managed by CANARIE (Canada's most advanced Internet development organization).

From a university perspective, the Grid increases the bandwidth available to researchers by more than 30 times. The new infrastructure will be a major factor in attracting and retaining high quality researchers, students and businesses to New Brunswick, thereby ensuring that expansion of the IT-e-Business cluster continues well into the future.

**Unlike most bureaucratic institutions which are cursed with excessive paperwork and lengthy approval processes, the NRC-IIT is nimble, fast and progressive.**

Atlantic Business magazine

*The head of NRC's New Brunswick cluster initiative received the most nominations among the Top 50 CEOs in Atlantic Canada as chosen in 2004 by Atlantic Business magazine. The publication also described NRC-IIT – e-Business as "nimble, fast and progressive." The same Director was also named Industry Person of Year at KIRA 2004, the "Oscars" of IT in New Brunswick. Both awards underline the fact that industry recognizes this government organization and its management as peers.*

# Cape Breton Wireless Systems

## Community Engagement

**2000** – Cape Breton Round Table to establish Sydney research agenda

**2000** – NRC-IRAP and UCCB launch student internship program

**2001** – NRC-IIT Wireless Systems commence operations at UCCB

**2001** – First interns hired in Cape Breton

**2003** – AIF funding for the \$7.8 million UCCB-led PAWS project announced

**2004** – Stakeholders meet to discuss cluster strategy

## NRC's Major Partners

University College of Cape Breton

Enterprise Cape Breton Corporation

Cape Breton Growth Fund

InNOVAcorp

*The economy of Cape Breton, once dominated by coal mines and steel mills, is gradually transitioning towards knowledge-based goods and services, particularly in the information technology sector.*

This cluster builds on strong capabilities in Cape Breton and Atlantic Canada. The Sydney area has a number of emerging innovative start-ups that seek to make novel use of wireless technologies, including wireless sensor networks. Nova Scotia boasts a number of highly successful companies that manufacture radios and sensors for remote sensing applications, while a number of companies in the other Atlantic Provinces have significant success in producing and selling a wide variety of wireless sensor devices.

The region also leads in research, development and innovation in a number of relevant application sectors, such as environmental monitoring, aquaculture, forestry, and petroleum. All these areas can benefit significantly from advances in information technology, particularly in geolocation technologies, as well as remote data collection, transmission, and processing.

## NRC's role

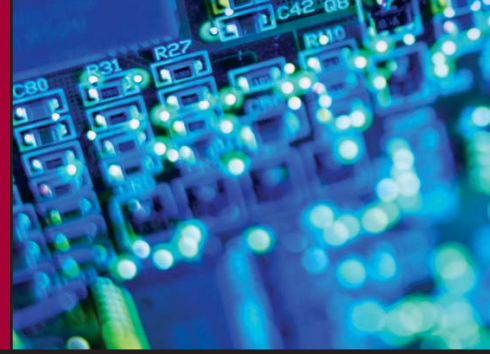
Against this backdrop, the NRC Institute for Information Technology (NRC-IIT) has been actively collaborating with local business,

government and academic stakeholders for several years to develop a sustainable wireless systems technology cluster in Sydney. NRC-IIT seeks to develop new wireless sensor technologies and to help companies exploit advances in wireless sensor networks to give Canadian firms a competitive advantage in world markets.

NRC-IIT began engaging the community at a Sydney Round Table in September 2000 aimed at establishing the cluster-forming process. The session included representatives from 26 public and private sector organizations who established a broad research agenda for the Cape Breton cluster.

Shortly afterwards, NRC established a research team at the University College of Cape Breton (UCCB). The group collaborates with students and faculty at the school to develop core competencies in software engineering for real-time control and embedded systems, and for short-range, low power dynamically re-configurable wireless networks. In early 2004, the group filed its first patent for a novel encryption protocol that is suitable for low power, battery-operated devices such as wireless sensor nodes.





*This investment has tremendous impact for the UCCB community. The (PAWS) project positions us to do important global strategic research with other institutions and industry partners.*

**Dr. Keith Brown, Dean and Managing Director Economic and Technological Innovation, UCCB**

## Recent Developments

Relative to its small presence in the community, NRC has made its mark in advancing Cape Breton's nascent wireless systems cluster. For example, NRC-IIT played a key role in securing support from the Atlantic Innovation Fund for a five-year, \$7.8 million Petroleum Applications of Wireless (PAWS) project announced in September 2003.

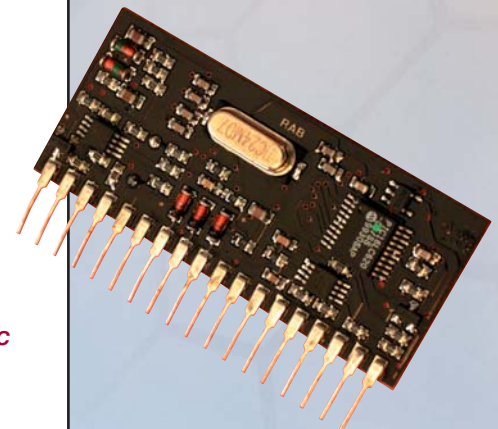
Spearheaded by UCCB, PAWS is a pan-Atlantic initiative involving researchers from NRC, UCCB's Information Technology Innovation Centre (ITIC) and Centre of Excellence in Petroleum Development, as well as teams from New Brunswick, Newfoundland and Labrador. With support from industrial partners, the PAWS teams plan to develop and commercialize wireless smart sensor systems that will replace wired technology in offshore platforms and land-based refineries. Among its many advantages over wired technology, the wireless sensor network will allow a larger number of data

collection points to be monitored with greater ease of installation. This type of technology can apply to a wide range of industries.

NRC-IIT has encouraged UCCB in its plan to implement a graduate program in engineering in support of the Wireless initiative, and is committed to help UCCB deliver the program. NRC-IIT has assisted with advice on a Canada Research Chair for UCCB. These elements contribute to increase the innovation capacity of the Cape Breton cluster.

***The National Research Council presence (here) is a key element to growing a sustainable knowledge-based sector in Cape Breton over the long-term. The NRC will act as an anchor to the developing cluster and promote knowledge transfer to the Cape Breton academic and business communities.***

Cape Breton Growth Fund, Knowledge-Based Sector Strategy



# Nova Scotia

## Life Sciences

### Community Engagement

2000 – Halifax Round Table

2001 – Incorporation of Life Sciences Development Association (LSDA) – NRC is founding partner

2002 – NRC announces research presence at the N.S. Brain Repair Centre (BRC) and plans for advanced MRI equipment

2002 – BRC begins construction of facility for advanced MRI

2002 – Construction begins on NRC Industry Partnership Facility (IPF)

2003 – MRI at Brain Repair Centre officially commissioned

2004 – NRC IPF officially opens

2004 – Action plan developed for new Life Science Research Institute

### NRC's Major Partners

Government of Nova Scotia

Atlantic Canada Opportunities Agency

Genome Atlantic

Life Sciences Development Association

Greater Halifax Partnership

Dalhousie University

Queen Elizabeth II Health Services Centre

Capital District Health Authority

IWK Health Centre

InNOVAcorp

BioNova

Ocean Nutrition Canada Ltd.

*Nova Scotia has joined a growing number of regions around the world in targeting life sciences for future economic growth. The province's up-and-coming life sciences cluster now invests over \$100 million annually in research, boasts more than 60 core companies, and is expanding at an impressive rate.*

Over the past four years, a vigorous and cohesive life sciences cluster has emerged in the Greater Halifax region, home to about three-quarters of the province's life sciences companies. These enterprises are eyeing a life science market estimated at \$500 billion and growing 20% annually.

### NRC's role

The cluster owes much to NRC's leadership in mobilizing the community behind an integrated and visionary sector development strategy. NRC launched the process in September 2000 with a Halifax Round Table. Organized in cooperation with the Greater Halifax Partnership, the event convened 80 major representative stakeholders from Nova Scotia's life sciences sector as a first step toward a cluster action plan.

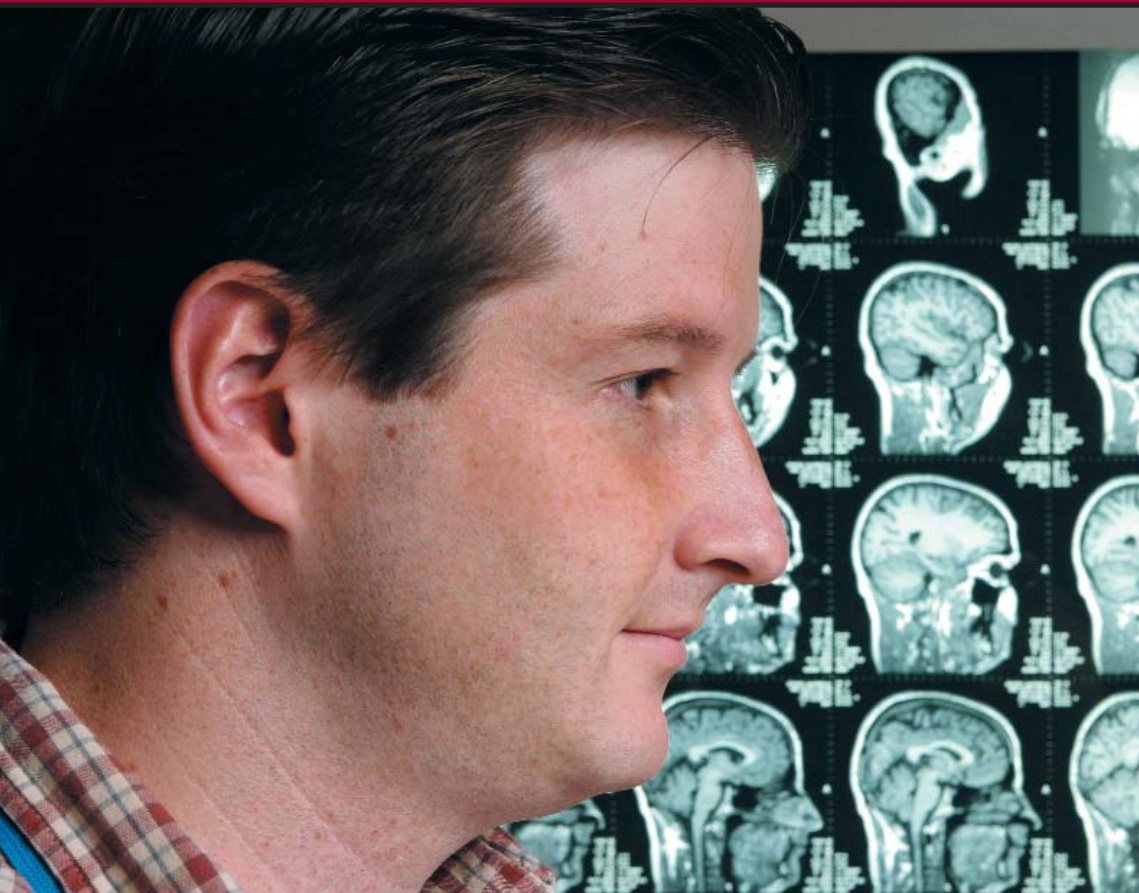
Shortly after the Round Table, members of the Halifax life sciences community assembled to create a body that would champion future development of the cluster. The Life

*The lab (NRC-IBD-Atlantic) is already attracting top-flight researchers to our growing life sciences sector – a brain gain that, over time, will create a broad range of health and economic benefits for the province.*

John Hamm, Premier of Nova Scotia

Sciences Development Association (LSDA) was incorporated in January 2001 as a non-profit society, and includes representation from NRC, all levels of government, health-care providers, academia and local industry. The group's first action plan was developed within six months, underlining the urgency that stakeholders attach to fostering a globally competitive cluster. More recently, plans for a new Life Sciences Research Institute that will house discovery, incubation and commercialization activities geared to new life science companies was completed by Halifax's life sciences community. In fiscal 2003, the cluster invested \$11 million in 8,547 m<sup>2</sup> of new and renovated life sciences research infrastructure.

*To further aid Halifax in the development of a dynamic life sciences cluster, NRC is providing \$8.45 million over five years to the BRC located at Dalhousie University. The investment a \$4.2-million magnetic resonance imaging (MRI) system, a powerful tool that provides researchers and neurosurgeons with unprecedented, real-time views of the brain in action. The MRI system is supported by NRC-IBD (Atlantic), a recently formed satellite to the NRC Institute for Biodiagnostics (NRC-IBD) headquartered in Winnipeg. Research is focused on such neurological disorders as Parkinson's, Huntington's and Alzheimer's diseases, multiple sclerosis, epilepsy, cancer, spinal cord injury, vision disorders, and serious mental illness.*



## Facts and Figures

Nova Scotia Life Science R&D base – over \$100 million annually

Over 60 core companies in the cluster

Global market for life sciences is \$500 billion and growing at 20% annually

Total new NRC commitment to research and support – \$25 million/ 5 years

Research enhancements and new facilities at NRC-IMB – \$15 million

NRC investment in research team and equipment for BRC – \$8.45 million

NRC-IMB – over 120 NRC skilled professionals, 35-50 guest workers

Signed seven collaborative agreements with cluster partners (2002-2004)

New \$4.2 million Industry Partnership Facility can house up to 12 SMEs

## Recent Developments

NRC has been a major contributor to the cluster's infrastructure through a five-year, \$25 million commitment under its Atlantic Initiative. The new spending covers expanded research programs and facilities at the NRC Institute for Marine Biosciences (NRC-IMB), new equipment and research expertise for the Nova Scotia Brain Repair Centre (BRC), and measures to boost NRC's knowledge and industry support capacity in Nova Scotia.

At NRC-IMB, the investment has expanded research expertise in such areas as enhanced proteomics, micro-array capacity, bio-informatics, functional genomics, and metabolomics. The new funding has also provided support for a High Performance Molecular Separation and Mass Spectrometry Centre that has attracted leading industry partners and has helped establish a high-throughput DNA sequencing facility (one of the largest

of its kind in Eastern Canada) in partnership with Genome Atlantic.

Along with those developments, construction was recently completed on a new \$4.2 million Industry Partnership Facility (IPF) at NRC-IMB. Officially opened in September 2004, the 2,787 m<sup>2</sup> wing is designed to incubate up to 12 small- and medium-sized enterprises, which will have ready access to NRC's expanded research programs. The businesses will also benefit from close proximity to Genome Atlantic.

*I am proud to report that an exceptional partnership has developed in a very short time... Speaking with a united voice for the future of life sciences in the region, we have mobilized significant support, including generous funding, to move forward...*

Colin Latham, Chair, LSDA

# Prince Edward Island Bioresources

## Community Engagement

**2001** – Formation of Bioresources Technology Cluster Roadmap (BTCRM) Steering Committee

**2002** – Steering Committee releases BTCRM summary and recommendations

**2002** – Research area refined with recommendation for focus on nutritional genomics

**2002** – Facility exploration committee releases findings

**2003** – Federal and provincial governments announce \$31.5 million in funding for NRC-INH

**2003** – NRC-INH hosts Inaugural Research Forum in Charlottetown

**2004** – NRC-INH research program begins to take shape in space leased from CFIA, Charlottetown

**2004** – Construction begins on NRC-INH facility

**2004** – NRC-INH begins science outreach program *“like science?”*

## NRC's Major Partners

Atlantic Canada Opportunities Agency

Province of PEI (Technology PEI)

University of PEI

Canadian Food Inspection Agency

Agriculture and Agri-Food Canada

*Prince Edward Island (PEI), is taking big steps to develop a cluster in bioresources technologies, including nutritional advances and discoveries to optimize human and animal health. Building on its traditional economic strengths in primary resources, PEI intends to develop a sustainable bioresources technology cluster that will capitalize on the region's considerable plant- and marine-based bioactives.*

PEI has a solid R&D base, with know-how in veterinary and human medicine, agriculture, fisheries, food quality and safety. Established research organizations include: UPEI (including Atlantic Veterinary College – AVC); PEI Food Technology Centre; Agriculture and Agri-Food Canada Crops and Livestock Research Station; Canadian Food Inspection Agency (CFIA); Centre for Animal and Plant Health; along with numerous private-sector companies – critical underpinnings to the commercial success of PEI's potato, cattle, swine and seafood industries.

PEI's bioresource technologies cluster will target a global nutrition market valued at more than US\$182 million, according to Nutrition Business Journal. In advanced economies, the nutrition market is growing at more than 8% annually, while in emerging economies, the annual rate of growth exceeds 12%.



*This initiative has come about through a remarkable and sustained collaboration of the whole community, combining private sector, government and the university, with top level leadership and broad-based enthusiasm. This is an essential ingredient for a successful cluster.*

Wade MacLauchlan, President and Vice-Chancellor, UPEI

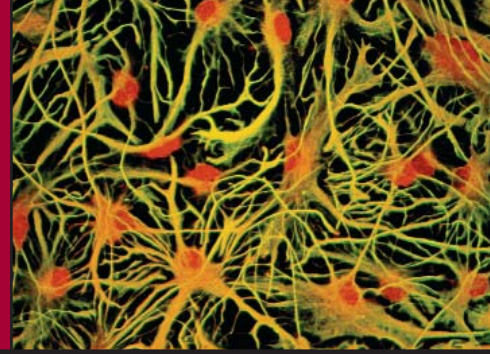
## NRC's role

NRC will anchor the cluster through the establishment of the NRC Institute for Nutrisciences and Health (NRC-INH), involving a combined federal and provincial investment of \$31.5 million. Unveiled in July 2003, the plan to build and operate a new NRC Institute in PEI represents a major step in a productive and ongoing cluster-building exercise.

When the process began four years ago, NRC committed to establishing a research presence in the province on the understanding that community stakeholders would help shape the R&D investment. It also pledged a new innovation centre on the campus of the University of PEI (UPEI) that would house and expand services of NRC-IRAP and NRC-CISTI.

After that, NRC began working with federal and provincial agencies, UPEI, and local companies on the development of a Bioresources Technology Cluster Roadmap – a needs-driven, long-term technology planning process to help industry seize growing market opportunities. Buy-in from the private sector was secured from the outset with the





## Facts and Figures

Value of North American nutritional products market in 2000: over \$27 billion

Value of global nutritional products market in 2000: up to \$100 billion

PEI research organizations with life sciences expertise: UPEI; PEI Food Technology Centre; Canadian Food Inspection Agency, Centre for Animal and Plant Health; Agriculture and Agri-Food Canada, Crops and Livestock Research Station along with numerous private sector companies

Facility for NRC-INH: four-stories, 5,127 m<sup>2</sup>, can house 100 people, business incubation space, located on UPEI campus, opening early 2006

***The importance of science and research cannot be overstated. There is much to be gained from having a facility of this type, both in terms of knowledge investment and potential commercialization.***

Pat Binns, Premier of Prince Edward Island

participation of many local companies. During the exercise, more than 100 experts were consulted from across North America and nearly 100 potential opportunities identified.

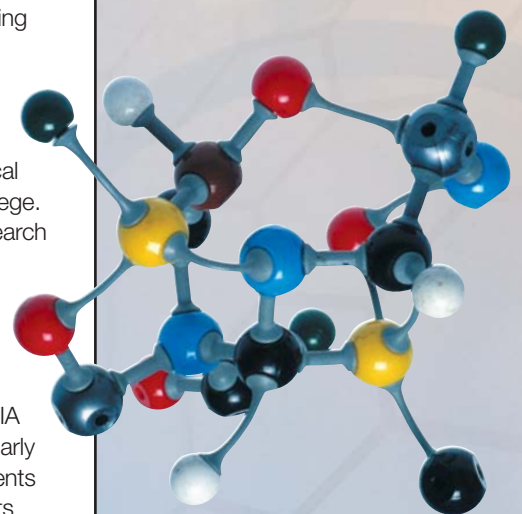
After the roadmapping exercise, NRC successfully obtained funding from the federal government for a new institute in PEI (NRC-INH) focusing on the discovery and commercialization of bioactives from renewable plant and marine bioresources in the region. NRC is investing up to \$20 million over five years for staff, equipment and research projects. The Atlantic Canada Opportunities Agency is assigning \$8 million and the provincial government is supplying a further \$3.5 million towards construction of the four-storey, 5,127m<sup>2</sup> building, including space for business incubation. Slated for occupancy in early 2006, the new NRC institute will accommodate up to 100 people, including scientists, technicians, graduate students, fellows, visiting researchers, and research support.

## Recent Developments

Researchers at NRC-INH will explore the impact of nutraceuticals and bioactives on neurologic-, obesity-related disorders, and infection and immunity. NRC-INH has already been credited with several published scientific papers and received its first research grant (with a UPEI scientist as co-investigator).

NRC-INH held its inaugural research forum in mid-November 2003. The event showcased three internationally renowned experts in nutritional science and health research and helped elevate the province's stature as a promising cluster for bioresources technologies.

Local linkages are growing quickly. The lead scientist at NRC-INH has been cross-appointed as professor of biomedical sciences at UPEI's Atlantic Veterinary College. NRC-INH has also recently hired four research officers, several technical officers and graduate students as well as numerous research support staff. In spring 2005, over 20 people will be on staff at NRC-INH. The research program is well underway in space leased by NRC from the CFIA facility in Charlottetown. NRC-INH is regularly represented at public speaking engagements and events throughout the province and its scientists are invited to present at international research symposiums.



# Newfoundland & Labrador Ocean Technologies

## Community Engagement

**2000** – NRC and Industry Canada launch Technology Roadmap exercise

**2001** – St. John's Round Table attracts 85 participants from industry, academia and government

**2001** – \$20 million new federal funding for NRC-IOT and related programs

**2002** – Oceans Advance private-public cluster partnership begins operations

**2002** – Creation of \$60 million Ocean Partners Investment Fund and trade mission to Ireland

**2002** – Technology Roadmap exercise completed

**2003** – Official Opening of NRC-IOT's Industry Partnership Facility (IPF)

**2003** – NRC-IRAP leads follow-up trade mission to Ireland

**2004** – BioSeas Partnership officially announced

## NRC's Major Partners

Province of Newfoundland & Labrador

City of St. John's

St. John's Board of Trade

Oceans Advance

Memorial University of Newfoundland

Newfoundland & Labrador Association of Technology Industries (NATI)

Newfoundland Ocean Industries Association (NOIA)

Petroleum Research Atlantic Canada

Canadian Centre for Marine Communications (CCMC)

C-CORE

*Newfoundland & Labrador is rapidly emerging as a hotbed for ocean and marine technology industries thanks to a determined effort to develop a strong and sustainable ocean technology cluster in the province.*

In the St. John's region, there are now more than 40 knowledge-intensive, small- and medium-sized enterprises (SMEs) that have developed innovative ocean technologies, products and services – many of which enhance the competitiveness of the province's more traditional industries, such as offshore oil & gas production, fisheries and marine transportation.

The momentum behind Newfoundland & Labrador's world-class ocean technology cluster stems from a growing array of broad-based collaborative initiatives involving NRC, federal, provincial and municipal organizations, local businesses and industry groups, as well as Memorial University of Newfoundland. As one of the lead players, NRC is investing \$20 million over five years in the ocean technology cluster as part of its Atlantic Initiative.

## NRC's role

NRC led the cluster-building process four years ago with a St. John's Round Table that attracted 85 participants from industry, government, and academia – an important first step toward community integration. Out of that session, the community began working on a cluster action plan and embraced the challenge of making St. John's an international location of choice in ocean technology.

To help realize the challenge, the various stakeholders (led by businesses) created a new cluster initiative, called Oceans Advance. Governed by a 17-member advisory board, Oceans Advance's mandate is to facilitate industry collaboration, build R&D capacity, expand business and export opportunities, and identify investment prospects. To promote networking among technical and business members of the cluster, it organizes cluster events and a speaker series.

*Collaborative R&D aimed at commercialization is a pivotal aspect of NRC-IOT's role as a technology cornerstone in the cluster. In fiscal 2004, the value of the institute's formal collaborative agreements with cluster partners jumped more than three-fold to almost \$9.7 million.*

Oceans Advance is reinforced with all NRC resources in the province. The NRC Institute for Ocean Technology (NRC-IOT), NRC-IRAP, and the Canadian Technology Network are promoting cooperation among public sector research organizations and aiding in the creation of research consortia to develop joint industry projects in ocean technology.

Local government is also playing a critical role in nurturing the cluster. The City of St. John's runs a nation-wide ad campaign to brand the community as Canada's "Centre of Ocean Excellence" for training, research and development in oceans engineering, transportation and harsh environment technologies.

## Recent Developments

In 2003, the City of St. John's declared and launched an annual "Ocean Industries Week" in partnership with the St. John's Board of Trade.

The occasion also marked the official opening of a new \$6.5 million, 3,500 m<sup>2</sup>, Industry Partnership Facility (IPF) at NRC-IOT in St. John's. The IPF is considered a vital piece of infrastructure for building productive collaboration within the cluster and technology receptor capacity in the local industry. The facility now houses nine companies in its Ocean Technology Enterprise Centre (OTEC),



## Facts and Figures

Ocean industries contribute \$20 billion and 350,000 jobs to the Canadian economy annually

St. John's is home to more than 40 ocean technology companies

Estimated value of world ocean market: \$1.8 trillion and growing at 2.5% annually

Facilities/equipment at NRC Institute for Ocean Technology (NRC-IOT): offshore engineering basin, towing tank, ice tank, cold rooms, cavitation tunnels, marine dynamic test facility, yacht dynamometer

NRC-IOT's \$6.5 million Industry Partnership Facility houses 11 companies (as of Oct/04)

## Commercialization Success

As a result of a long-term research collaboration with NRC-IOT, Vancouver naval architect Robert Allen Limited (RAL) recently won major design contracts with several clients for a new class of escort tugs. NRC expertise and research facilities were used to help produce the new tug designs which have a competitive advantage over larger, more expensive vessels. RAL signed a contract with clients in the United Arab Emirates for a fleet of these vessels for oil operations in the Middle East. As well, a new tug for Norwegian owners is now under construction in shipyards in Spain.

an expanded NRC Information Centre for scientific and technical information, as well as the offices of NRC-IRAP Newfoundland, Oceans Advance, and Petroleum Research Atlantic Canada.

OTEC operates an incubator through its Young Entrepreneurs Program and a co-location facility for established companies. The former provides access to expert advice from NRC-IOT researchers and test facilities at the Institute, funds from NRC-IRAP, and business guidance from Memorial University's Genesis Centre and P.J. Gardiner Institute. It is currently fostering 11 companies, and four of them come under the Young Entrepreneurs Program.

NRC-IOT's overall research program has become more strategically connected to the cluster, and has benefited from additional funding for 25 new research and technical positions. Increased emphasis is being placed on ships and structures in ice, performance evaluation, underwater vehicles, deep water operations and safety.

The research mission aligns with opportunities identified in the Marine and Ocean Industries Technology Roadmap exercise, led by NRC and Industry Canada in consultation with community stakeholders.

The cluster's growing strength in ocean technologies is evident from new international linkages. In July 2003, a visit to St. John's by an Irish delegation led to creation of the BioSeas Partnership, involving NRC, the Newfoundland Association of Technical Industries (NATI), Memorial University of Newfoundland, AquaFund, the St. John's Board of Trade and the City of St. John's. BioSeas will identify research, technology transfer and export opportunities for local marine biotechnology products and services.

A series of technology trade missions to Ireland, facilitated by Oceans Advance and led by NRC-IRAP and NATI, has already produced more than 20 agreements primarily involving technology transfer and collaborative R&D in ocean information and communications technologies. Planning has also begun on a technology, trade and investment mission to Brittany, France.

**Many in the local industry believe the ocean technology cluster is poised to help leverage the sector's technology capacity for strong export growth based on local research, development and production.**

Newfoundland & Labrador Association of Technology Industries

For more information on these  
**TECHNOLOGY CLUSTERS...**

<b>National Research Council – General Information</b>	1 877 672-2672 TTY: (613) 949-3042 <a href="http://www.nrc-cnrc.gc.ca">www.nrc-cnrc.gc.ca</a> <a href="mailto:info@nrc-cnrc.gc.ca">info@nrc-cnrc.gc.ca</a>
<b>NRC Institute for Fuel Cell Innovation (NRC-IFCI)</b>	<b>Vancouver:</b> (604) 221-3099
<b>NRC National Institute for Nanotechnology (NINT)</b>	<b>Edmonton:</b> (780) 492-8888
<b>NRC Plant Biotechnology Institute (NRC-PBI)</b>	<b>Saskatoon:</b> (306) 975-5571
<b>NRC Institute for Biodiagnostics (NRC-IBD)</b>	<b>Winnipeg:</b> (204) 983-7692 <b>Calgary:</b> (403) 221-3221 <b>Halifax:</b> (902) 473-1850
<b>NRC Institute for Microstructural Sciences (NRC-IMS)</b>	<b>Ottawa:</b> (613) 993-4583
<b>NRC Institute for Aerospace Research (NRC-IAR)</b>	<b>Ottawa:</b> (613) 991-5738 <b>Montréal:</b> (514) 739-7285
<b>NRC Biotechnology Research Institute (NRC-BRI)</b>	<b>Montréal:</b> (514) 496-6100
<b>NRC Aluminium Technology Centre (NRC-ATC)</b>	<b>Saguenay:</b> (418) 545-5545
<b>NRC Institute for Information Technology (NRC-IIT)</b>	<b>Ottawa:</b> (613) 993-3320 <b>Fredericton:</b> (506) 451-2500 <b>Moncton:</b> (506) 851-3607 <b>Saint John:</b> (506) 636-4775 <b>Sydney:</b> (902) 564-6481
<b>NRC Institute for Marine Biosciences (NRC-IMB)</b>	<b>Halifax:</b> (902) 426-6095
<b>NRC Institute for Nutrisciences and Health (NRC-INH)</b>	<b>Charlottetown:</b> (902) 566-7465
<b>NRC Institute for Ocean Technology (NRC-IOT)</b>	<b>St. John's:</b> (709) 772-2479 or (709) 772-6001