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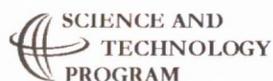
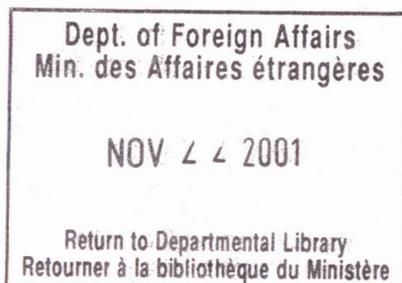
Science & Technology Partnerships



| The Canadian Way |

Excellence

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www.infoexport.gc.ca/science

where you can also find more information on DFAIT's Science and Technology Program.

Aussi disponible en français à la même adresse.

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March 2001

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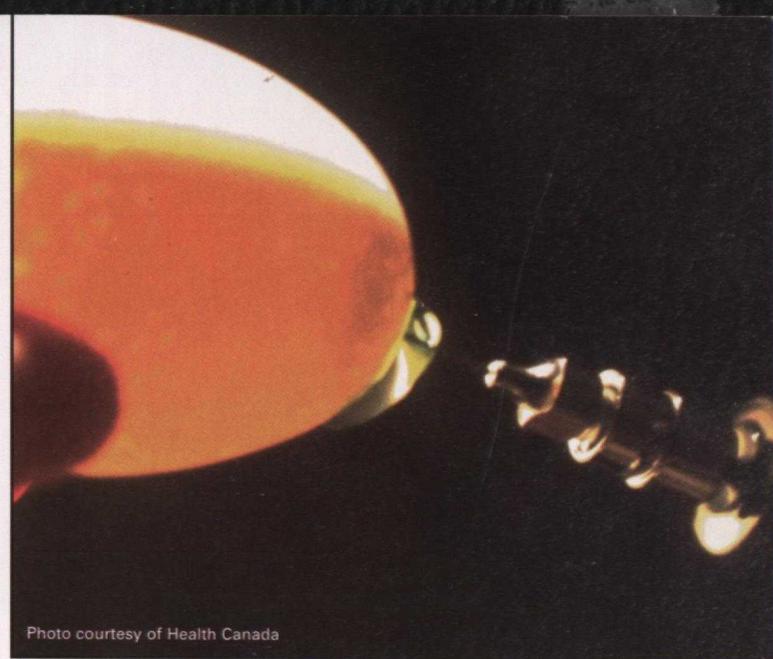


Photo courtesy of Health Canada

Executive Summary

Introduction

Research, partnerships and networks

The cornerstones of Canada's S&T excellence

"The Canadian Way" of pursuing scientific research is founded on partnerships and networks, an approach that goes back to Canada's early years, when survival depended on working together. Excellence is also an essential ingredient at all levels of the Canadian innovation system, from governments, to universities, to industry, to the international partnerships that are helping the world's business community to see Canada as "one of the best places to do R&D."

International S&T collaboration

Agreements. Partnerships. Programs.

Canada's S&T community welcomes other countries' interest in partnering and networking with Canada. And because we're open to it, Canada's international collaboration is increasing, and for good reason: we offer generous research and development tax credit programs, we're one of the most connected nations in the world, and we have a highly skilled workforce, among other benefits.

Canada's R&D excellence

Science. Technology. Innovation.

Three key groups drive S&T in Canada: industry, governments (both federal and provincial), and universities. Government plays four roles: funder, facilitator, performer and regulator. Universities advance knowledge through basic research, while also preparing a highly skilled workforce for the future. And industry works with partners and governments to power the knowledge economy.

Partnerships and networks

Industry. Government. University.

Industry-government-university partnerships are one of the best incubators for the innovation process. In fact, their impacts can now be felt throughout Canada. These collaborations are fostered at the federal level by Canada's key S&T organizations, including three granting councils that support university research and partnerships, special funding programs (including some to encourage international collaboration) and science-based departments and agencies performing R&D.

Excellence in action

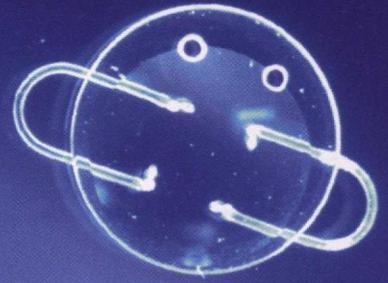
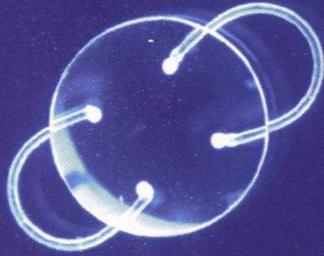
Canada's R&D sectors

The benefits of "The Canadian Way" are evident in many industry sectors in which Canada is a world leader and regions where several established and emerging R&D clusters can be found. Canadian companies are now pioneering the latest information and communication technology developments. We are taking great strides in the life sciences, particularly in pharmaceuticals, agricultural biotechnology and health research. And our aerospace, environmental and resource technologies and advanced manufacturing sectors show Canadian excellence at work.

For more information

To serve as your first line of contact for Canada's S&T community and programs, Canada has a network of Science and Technology Counsellors at Missions in six key OECD countries, as well as Trade Commissioner Service Officers who have S&T responsibilities in a number of Canadian Missions (see page 24).

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Science & Technology

Partnerships

Introduction

“We are better positioned than at any time in the last three decades to seize the opportunities of the global economy....To secure our continued success in the 21st century, Canadians must be among the first to generate new knowledge and put it to use.”

Canada's Governor General on opening Canada's 37th Parliament, January 2001

Research, partnerships and networks

The cornerstones of Canada's S&T excellence

The Canadian Way

In Canada, scientific research increasingly takes place within partnerships and networks—whether conducted in private industry, in government research institutions or in academia. In fact, as Canada entered the new millennium, networks had become a major contributor to The Canadian Way of pursuing research excellence.

Canadians have come by this penchant for collaboration naturally. From our earliest years as immigrants in a vast and forbidding land, we understood that survival depended on working together. By collaborating, we overcame the enormous challenges of a harsh climate and a small population spread over huge geographical distances.

Our earliest scientific and engineering exploits included completion of a 6,400-kilometre national railway that linked the country from the Atlantic to the Pacific. One of our first telecommunications breakthroughs was Canadian Alexander Graham Bell's invention of the telephone. It's not surprising, therefore, that we went on to create one of the most modern communications networks in the world.

Today we are home to such innovative firms and internationally recognized giants as Nortel Networks and JDS Uniphase in communications, Bombardier in transportation, and BioChem Pharma Shire in pharmaceuticals.

These and other companies in the information technology, life sciences, aerospace, advanced manufacturing and resource technology sectors have laid the foundation for our current success in the knowledge economy, a success that reflects a Canadian vision still unlimited by borders or distance.

telecommunications industries, government labs and universities in Canada's national capital, Ottawa (also called Silicon Valley North), and other major cities such as Vancouver, British Columbia; Calgary, Alberta; Toronto, Ontario; and Montréal, Québec (see centrefold map on Canada's R&D clusters, pages 12 and 13).

International collaborations welcome

As members of the national and international science community, Canadian researchers have always communicated and worked with their colleagues in Canada and other parts of the world. Now, however, these collaborations are growing in scope and scale.

The Canadian Way

Excellence—the other success factor in Canada's innovation system

But collaboration alone isn't enough: excellence is essential. The private sector's need to meet the demanding requirements of a competitive market economy has meant that only the best companies survive in the long term. Canada's government-supported programs promote excellence through the competitive processes they use to evaluate collaborative research proposals. This kind of rigour has built excellence into all levels of the Canadian innovation system: into individual research and into partnerships among industry, government and universities.

The drive for excellence has also encouraged the development of strong formal and informal networks and collaborative programs that capitalize on each other's strengths. Examples include our model Networks of Centres of Excellence (NCE) program, and our risk-sharing mechanisms, such as partnerships with federal laboratories and R&D support programs.

Increased growth in regional development of S&T

S&T collaborations are also expanding rapidly in Canada's provinces and cities. The early impetus came from the information technology, life sciences, telecommunications and aerospace sectors. Now, expanding clusters of research and industry facilities are becoming concentrated around particular cities across Canada. Typical examples are the burgeoning information and communication technology clusters that have developed around the

And as Canada's S&T profile has begun to attract notice globally, the international business community is coming to see Canada as "one of the best places to do R&D." Harbingers of this move to increased international participation in Canada's S&T partnership system are the substantial knowledge-intensive R&D investments made throughout Canada from multinationals, such as IBM, Ford, Motorola, GM, Hewlett-Packard, Ericsson, Alcatel, Pratt & Whitney, Merck Frosst, Nabisco, GE and DaimlerChrysler, among others. Currently, more than 40% of the top 100 corporate R&D performers in Canada are foreign multinationals.

An invitation from Canada

In response to increasing interest from the S&T communities of other nations, Canada's federal government has produced this booklet to summarize information about the opportunities for S&T collaboration with Canada that are open to industry, government and university research leaders in other countries.

So for an overview of The Canadian Way of achieving S&T excellence, read on.

| agreements |
| partnerships |
| programs |

Canada's S&T community welcomes other countries' interest in partnering and networking—both formally and informally. Innovative ideas and technologies can originate anytime, anywhere in the world, with individuals, research networks, centres of excellence and companies. By networking with their counterpart groups in other countries, Canada's scientists ensure that our research institutions and companies have the opportunity to share their knowledge in a synergistic way and gain mutual access to vast knowledge networks. Such collaborations within our partnership and network programs are, in fact, an extension of The Canadian Way of pursuing excellent research globally.

International

Many international partnerships already in place

On an informal basis, Canadian scientists from universities, industry and government participate in many thousands of bilateral and multilateral collaborations with their counterparts around the world. Canada maintains active S&T agreements with **Germany, France, Japan** and the **European Union**. In addition, there are more than 500 bilateral or multilateral S&T arrangements in place between Canadian federal and provincial government departments and research organizations in other countries. Approximately 40 percent of these international scientific collaborations are with the **United States**.

Collaborations a "win-win" situation for all participants

Continuing and increasing this international R&D collaboration is one of Canada's key goals in S&T. Industrial R&D collaboration is one of the most important global sources of new and highly competitive product, process and services-production technologies. In fact, we consider collaboration crucial to strengthening our research base and our economy because it provides:

- interaction with the world's best minds and research organizations;
- creative stimulation through the friendly competition that exists among researchers in the international science community;

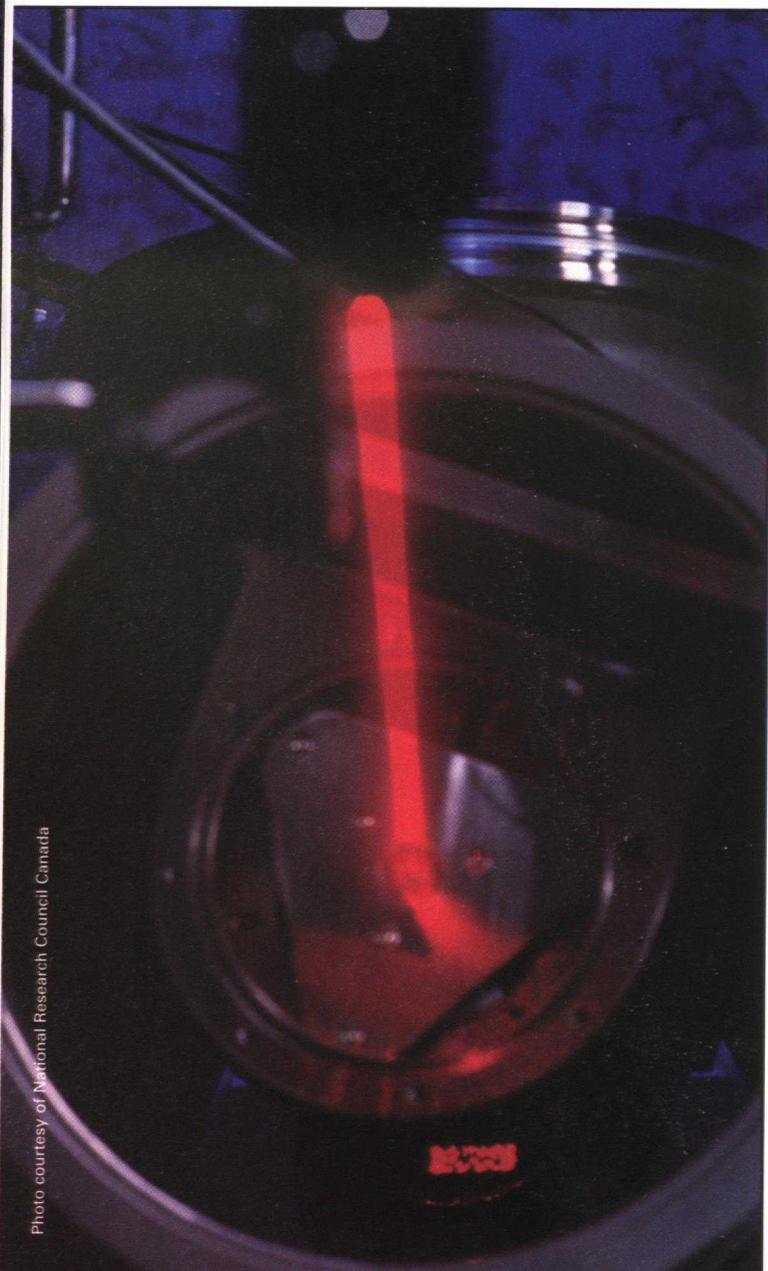


Photo courtesy of National Research Council Canada

Excellence

- “intelligence” that helps each country select which areas of investigation to pursue effectively, eliminating wasteful or inefficient duplication of efforts already well advanced elsewhere;
- cost-sharing opportunities for infrastructure resources too expensive for most countries, laboratories and companies to support individually; and
- access to vast pools of knowledge and new international business opportunities.

Taken together, these elements help all participating countries make S&T policy decisions that will maximize strengths and resources.

Canadians' bright idea changes international standards for paper brightness

Just how white is white? This is a question suppliers of bleached pulp products must be able to answer to assure customers that their products meet certain agreed-upon standards of brightness. Brightness is measured by reflectance, for which there are a number of metrological measurement techniques. International measurement methods required Canadian suppliers to add more bleach to their papers to increase their reflectance. Canadian researchers conducted extensive research and were eventually successful in convincing our international partners to accept the Canadian measurement method. The resulting international agreement has been estimated to create savings in the hundreds of millions of dollars, while protecting the environment.

S&T collaboration

For more information

See also Canada S&T programs specifically dedicated to international collaboration, page 15. For further information about Canada's federal S&T networks and partnership programs—and their sponsoring agencies—see pages 24 and 25.

“The Government will pursue a global strategy for Canadian S&T, supporting more collaborative international research at the frontiers of knowledge.”

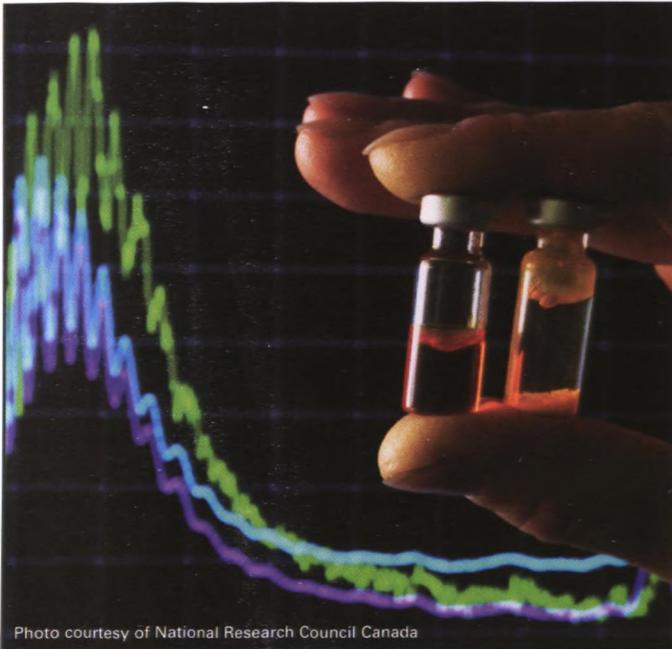
Canada's Governor General on opening Canada's 37th Parliament, January 2001

Canada puts ice know-how to work on world stage

Canada is known the world over as a land of snow and ice. Now our first-hand experience with ice is paying off on the international scene. In the summer of 1998, Canada's Department of Fisheries and Oceans (DFO) led a successful marine oceanographic program called the Joint Ocean Ice Studies (JOIS). Using two Canadian Coast Guard icebreakers, more than 50 scientists from Canada, the United States and Japan conducted research in climate change, contaminants and marine ecosystems. Some of the research work has become Canada's contribution to the Arctic Climate System Study (ACSys) of the World Climate Research Program and addresses the primary goals of this 10-year multinational science program. It also allows DFO scientists to engage in projects of much broader scope and larger scale than would otherwise be possible with the department's resources alone.

Collaboration the real star of International Space Station

That new star lighting up the evening sky is none other than the International Space Station, an unprecedented international collaboration on the most ambitious engineering project ever undertaken. Canada is working with 15 international partners, including the United States and Russia, to build this wonder of science and technology, located 400 kilometres above the Earth. To date, Canadian astronauts Julie Payette and Marc Garneau have flown on missions to assist in the assembly of the International Space Station. Canada's key contribution is the Mobile Servicing System, also called Canadarm2, which is key to constructing the station in orbit, as well as operating the station during its planned 10-year life.

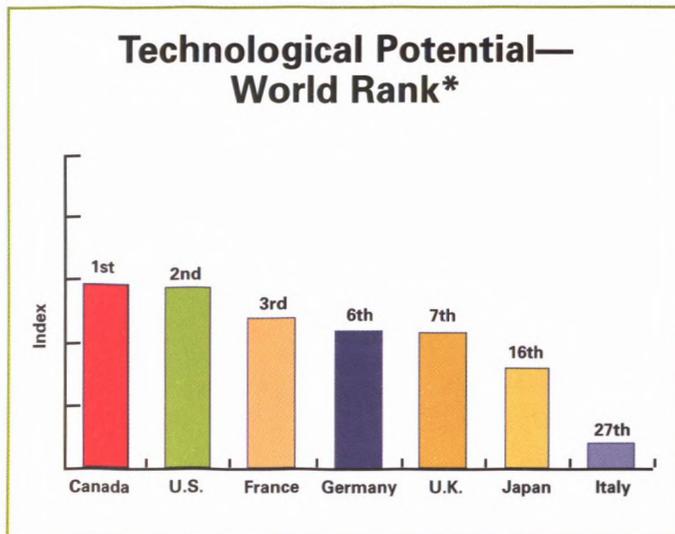


Why Canada's S&T environment is attracting international attention

Canada has a first-class technological infrastructure. The Global Competitiveness Report 2000 ranked Canada first among 38 countries. The report based this ranking on such characteristics as the quality of scientific research institutions and widespread per capita availability of technological infrastructure, including computing power and access to direct-dial international telecom services (Figure 1).

Canada offers the most generous research and development tax credit programs in the world. Individuals, corporations and partnerships can qualify for 100% tax deduction on scientific research and experimental development expenditures and capital expenses. When an investor combines federal and provincial tax credits, every dollar invested in industrial research costs the investor between 34 and 50 cents (depending on the province where the investment is made).

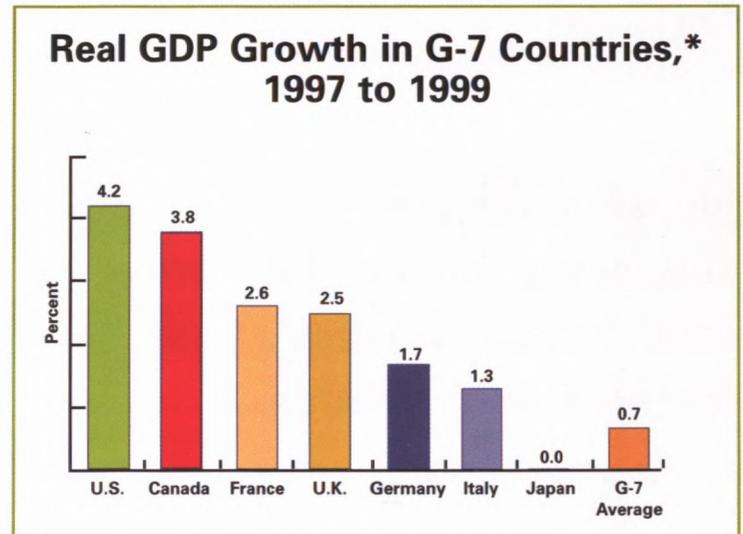
Figure 1



*Standing among 38 countries; index based on several information technology and human capital characteristics, including the availability of direct-dial international service, number of fax machines per capita, computing power in the country per capita, enrollment in tertiary schools, quality of scientific research institutions and power generation capacity.

Source: Global Competitiveness Report 2000

Figure 2



*Average of year-to-year percentage changes in real GDP

Source: OECD, Main Economic Indicators, April 2000

In a ten-country comparison, Canada ranked first in manufacturing costs. We have low interest and inflation rates. Our labour costs in manufacturing (wage and non-wage) are the lowest in the G-7, including direct pay and the cost of other labour taxes, employer expenditures for legally required insurance programs and contractual and private benefit plans.

We have one of the highest ratios of computers per capita in the world and rank second only to the United States in terms of overall connectedness. We also have the second lowest Internet access charges in the world, are tied with the United States in Internet use per capita, and lead the world in the use of electronic banking. In addition, Canada ranks first among the G-7 countries in terms of the cost of wireless communications.

Canada's economy is growing rapidly. Real annual GDP growth between 1997 and 1999 averaged 3.8%. We led the G-7 in output growth in 1999, and we've continued the trend, expanding above the OECD average in 2000 (Figure 2).

Canada's workforce has an impressive skill level. Canada has a large stock of skilled workers and a strong technological environment. In fact, the overall skill level of our work force ranks first among competing countries (Figure 3). In addition, we have the highest percentage of students enrolling in post-secondary education among 59 countries, leading the United States, the United Kingdom, France and Germany.

Canada's international collaboration is on the rise. Out of the nearly 26,000 scientific papers published by Canadians in 1997, fully 35% were done in partnership with scientists in other countries. Twenty years ago, only about 15% of all our scientific papers were written with international partners. In addition, with about 0.5% of the world's population, we generate more than 4% of the world's scientific knowledge, measured in the number of scientific publications (Figure 4).

Canada's percentage of patents with foreign co-inventors is up. Canada leads the OECD countries with the percentage of patents developed in collaboration with foreign inventors, with 24% from 1993 to 1995, up from 19% between 1985 and 1987.

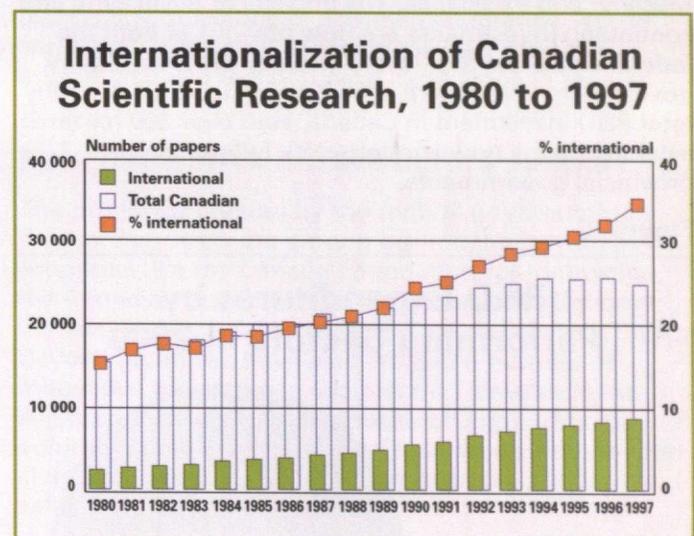
Figure 3



*Tertiary education enrollment among 59 countries considered in the Global Competitiveness Report 2000

Source: Global Competitiveness Report 2000

Figure 4



Source: Observatoire des Sciences et des Technologies, Montréal, Québec

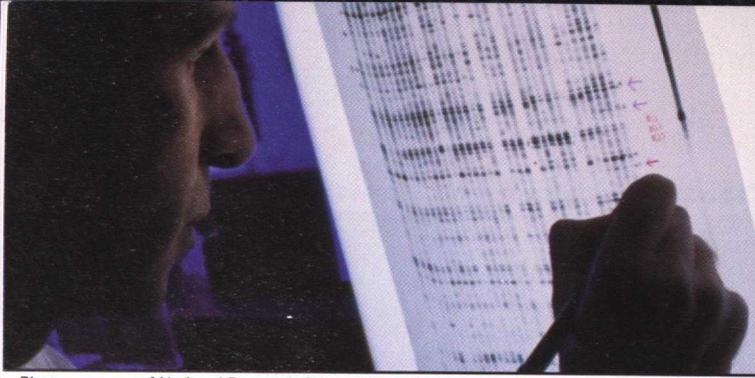


Photo courtesy of National Research Council Canada

| science |
| technology |
| innovation |

Canada's S&T structure

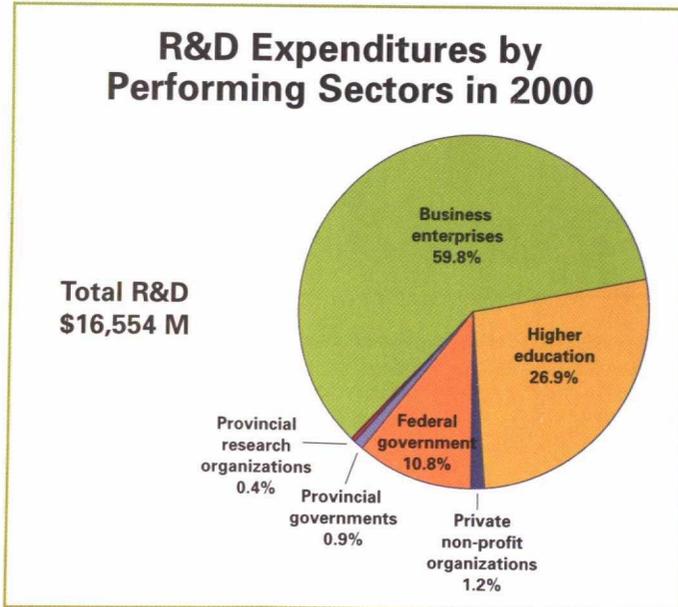
Canadian science and technology is organized around key players such as: industry, governments (both federal and provincial), and universities and colleges. Figure 5 shows R&D expenditures by performing sectors in 2000.

Canada's R&D

The S&T climate: zest for innovation, excellence

Soon after World War I, Canada's federal government began to make significant investments to promote research and excellence. The impacts of these early and continuing investments are now obvious at both the federal and provincial levels in every province. Today, government investment accounts for about 25 % of the total R&D investment in Canada, with over 360 research establishments now supported by federal and provincial governments.

Figure 5



Source: Statistics Canada, 2001

Industry

Knowledge-intensive companies involved in R&D are essential partners in Canada's S&T system, accounting for about 62 percent of R&D performed and over 50 percent of its funding. The success of the Canadian innovation system lies in our capacity to put scientific discoveries developed through partnerships to industrial use quickly. Canadian-based companies work with customers, partners and governments to power the knowledge economy.

Federal role

The federal government plays four roles: funder, facilitator, performer and regulator. At last count, there were 48 federal organizations performing and/or funding R&D and 120 federal research laboratories. National Research Council Canada alone, for example, has 16 research institutes and four innovation centres. Other federal science-based departments and agencies (SBDAs), such as Environment Canada, Natural Resources Canada, Agriculture and Agri-Food Canada, Fisheries and Oceans, and Health Canada also support research centres across Canada. These institutions and laboratories fulfill the government's role of research performer to support policy, regulation and economic development.

Three other federal organizations—the Natural Sciences and Engineering Research Council, the Social Sciences and Humanities Research Council, and the Canadian Institutes of Health Research—fund research performed at universities. In addition, they also foster research partnerships among academia, government institutions and the private sector, and train the next generation of highly qualified people.

CA*net3 is Canada's research and education backbone

CA*net 3 is its name, and gigaspeed is its game. A national state-of-the-art R&D optical network, CA*net3 is designed to reach speeds of 40 gigabits per second, allowing a two-hour movie to be downloaded in less than half a second. More importantly, it is Canada's research and education backbone, connecting individual universities, federal and provincial government labs, and research institutes through provincially based Regional Advanced Networks, or RANs. An excellent example of Canada's expertise in communications, CA*net3 allows developers to explore new communication technologies in a more hands-on way and could also ultimately reduce the cost of basic Internet delivery for everyone. A generation ahead of competitors, the network is the result of a partnership with the federal government; the not-for-profit industry consortium CANARIE (the Canadian Network for the Advancement of Research, Industry and Education); and a Bell Canada consortium. **Web site:** www.canet3.net

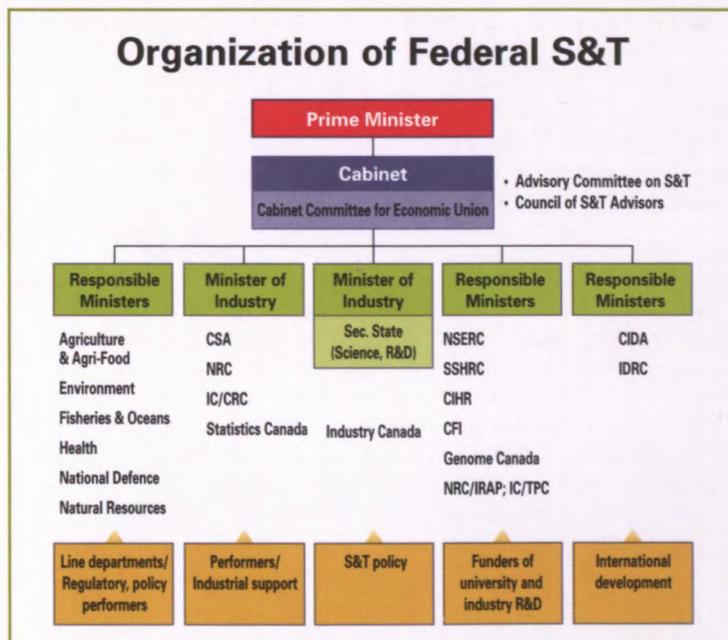
The federal government relies on S&T advice from two independent bodies that report directly to the federal Cabinet of Ministers and the Prime Minister: The Advisory Committee on Science and Technology advises the Government on national S&T issues; and the Council of Science and Technology Advisors advises the Government on S&T issues internal to the federal government (Figure 6).

excellence

The Provinces and their municipalities

At the provincial level, governments actively seek national and international partnerships and investment in science, research and technology. The provinces provide most of the basic physical infrastructure and operating costs for education and for research in universities and teaching hospitals across the country. Some provinces also perform and fund research in ways similar to the federal government. This federal-provincial relationship ensures that Canadian researchers have the facilities and funds necessary to conduct world-class research and train the highly skilled people necessary for the knowledge-based economy.

Figure 6



Universities and colleges

While university researchers advance knowledge through basic research, over 100 Canadian universities and colleges collaborate extensively with national and international industry partners on research and technology questions of commercial interest. At the same time, they offer students the best possible educational and technological experience in regular, co-operative and professional training programs.

New innovative infrastructure support

The programs created by the federal government in the last five years are among our most innovative—programs like the Canada Foundation for Innovation, the Canadian Institutes of Health Research, Genome Canada, and for the 21st century, Canada Research Chairs. Several provinces have also created a number of innovative programs to support S&T development. Another growing source of research support is the voluntary sector, where organizations raise money for specific fields of research in, for example, the life-sciences sector.

A good place for international collaboration

In Canada, the pursuit of collaborative research at a distance is much less of a problem than anywhere else in the world, thanks to CA*net3, the world's longest and fastest R&D Internet. With this well-developed, mature communication system in place, Canada has created a favourable S&T climate, built a strong research infrastructure and put together an inviting atmosphere for international collaboration.

| industry |
| government |
| university |

It has become common wisdom that industry–government–university partnerships are one of the best incubators for the innovation process. These alliances capitalize on the strengths and resources of each partner:

- government fosters partnerships and provides funding for strategic areas of research;
- universities supply a steady stream of new ideas and educate tomorrow's knowledge industry leaders; and
- industries give life to these ideas in exciting new commercial opportunities.

Working together, these partners ensure that our economic, health and social systems perform well and keep pace with both domestic and international developments in S&T.

Partnerships

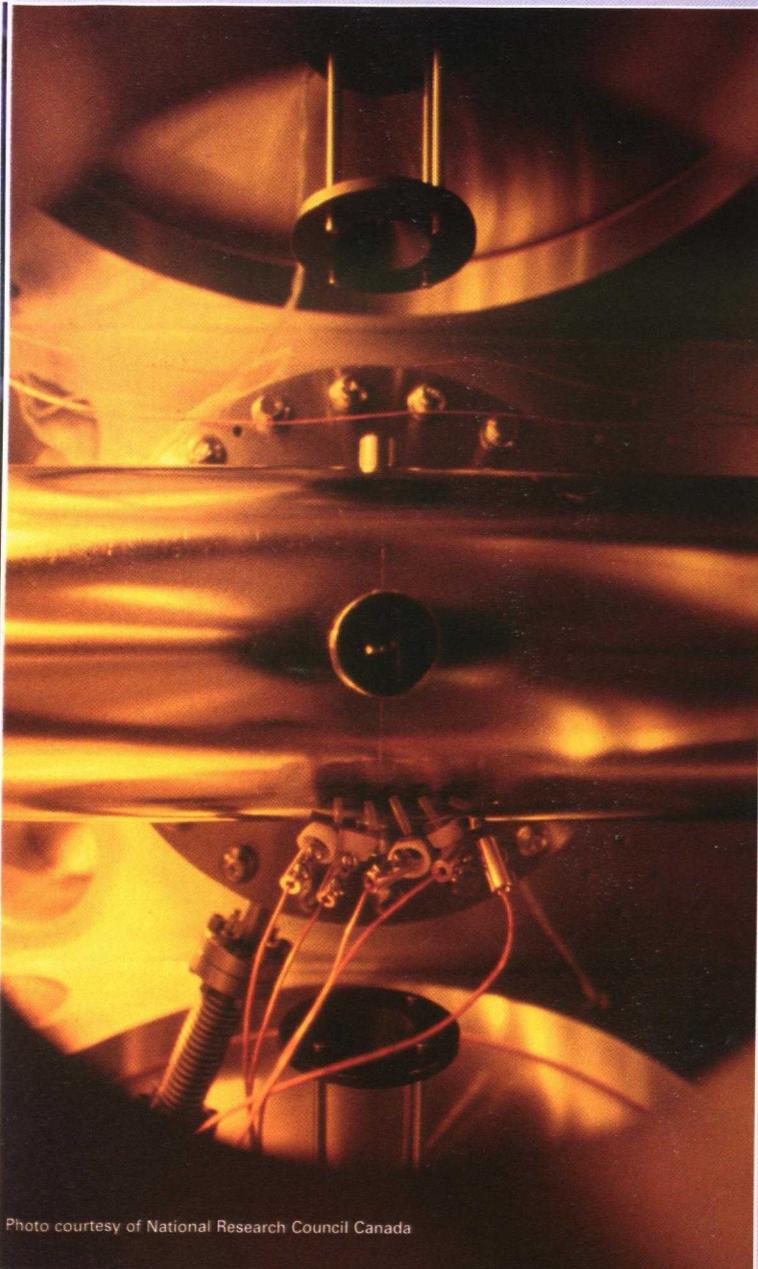
In Canada, industry–government–university partnerships are now more the rule than the exception, and they have been so successful in meeting the objectives listed above that the impacts of their accomplishments can now be felt throughout the economy. Such partnerships have led to productivity improvements and created a pool of leading-edge researchers. They have also created knowledge-based industries and regional R&D clusters that ensure Canada's continued contribution to the new globalized economy. And they show the world that working together achieves far more than the sum of the individual parts.

Sharing the risks in S&T

The federal government's role in ensuring Canada's success in the globalized, knowledge-based economy takes many forms. It enters into collaborative research activities. It shares the financial risk in leading-edge areas of industrial R&D. It provides, with the provinces, fiscal and financial incentives that foster R&D investment. And it supports the development of a highly skilled work force able to contribute to private-sector growth.

In addition, the federal government operates research laboratories in its science-based departments and agencies. Most of these organizations undertake research related to their sectoral mandates, but some conduct basic and applied research involving Canadian industry.

To facilitate technology transfer, many government and university labs participate in collaborative research with Canadian companies, giving the companies access to state-of-the-art facilities they might not otherwise have.



Canada's granting councils

Canada's Natural Sciences and Engineering Research Council (NSERC)

While not performing research itself, NSERC invests over \$600 million per year in research grants to be carried out in Canadian universities in the natural sciences and engineering. Investing in people, discovery and innovation, the Council uses peer review to evaluate competitive proposals from university researchers. NSERC annually supports more than 9,000 master, doctoral and post-doctoral students, as well

Canada's key federal S&T organizations

At the federal level, Canada's key S&T organizations are:

- Three granting councils that support university research and partnerships
- Strategic funding programs
- Science-Based Departments and Agencies (SBDAs) performing R&D

and networks

as over 8,700 university-based researchers. It also fosters innovation with programs designed to encourage more than 1,000 Canadian companies to invest in university research. **Web site:** www.nserc.ca

Social Sciences and Humanities Research Council (SSHRC)

The Social Sciences and Humanities Research Council supports high-quality, peer-reviewed, research and research training in the social sciences, humanities, education and management fields to help us understand the evolving nature of society and address emerging challenges effectively. It puts the benefits of research to work by promoting the transfer of knowledge among researchers, research partners, policy makers and others. Each year, the Council supports the work of close to 5,000 researchers and graduate students, in 87 universities, and partners with governments, community groups and businesses to build expertise on social, cultural and economic issues. **Web site:** www.sshrc.ca

Canadian Institutes of Health Research (CIHR)

The Canadian Institutes of Health Research is Canada's newest innovative, multi-disciplinary network of 13 "virtual" institutes, each dedicated to a specific area of health research. The approach encourages multidisciplinary, integrative research that enables basic biomedical research to co-exist with applied clinical research, research into health systems and services, and population health research. Each virtual institute is led by a scientific director and an independent board that oversees funding, and each

supports and links researchers in universities, hospitals and research centres across Canada. They pursue common goals from disciplinary perspectives, including biomedic and clinical science, health systems and services, and the social, cultural and other factors that affect the health of populations. Like their counterparts in Canada's other research centres, CIHR researchers are often involved in international collaborations. Their CIHR projects may well become opportunities for future international collaborations. **Web site:** www.cihr.ca

"University-industry research is indispensable to the growth of our country. It allows our best minds to focus without a lot of distractions on conceptual advances in science, and our best entrepreneurs to bring them to market."

Rod Bryden, President and Chief Executive Officer of World Heart Corporation, Ottawa, Canada

Legend

- ★ Information/communication technologies
- Life sciences/biotechnology
- Advanced manufacturing
- ▲ Resource technologies
- Regional concentrations or clusters
- Cities

"In a world of global competition, sources of competitive advantage are becoming increasingly localized and true competitive advantage is found within our communities."

Professor Michael Porter, Harvard University

Canada's R&D clusters

Provincial R&D expenditures by performing sectors in 1998

- Governments
- Private sector
- Higher education

Source: Statistics Canada, 2001



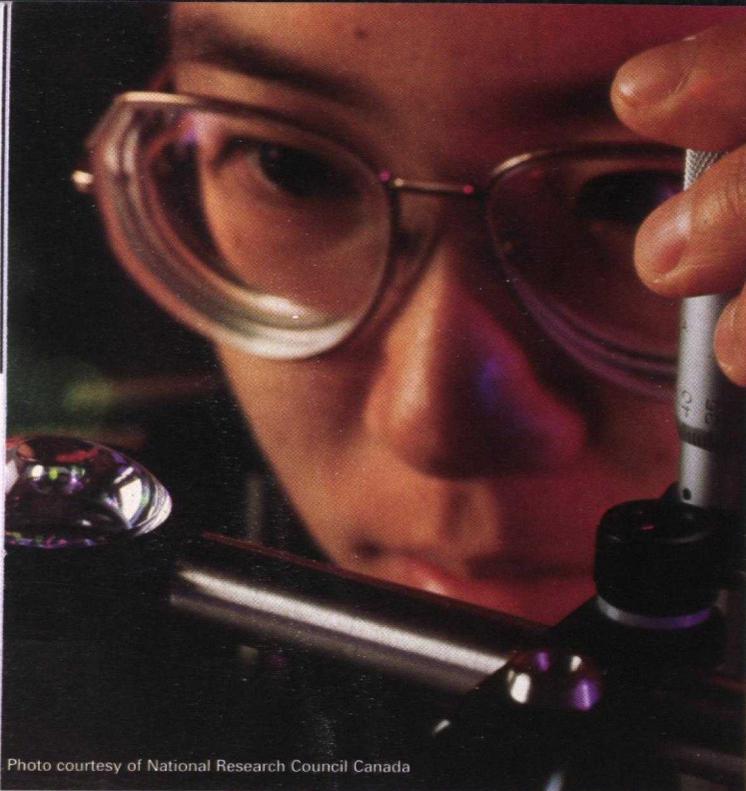


Photo courtesy of National Research Council Canada

Some NCE Success Stories

The merger of two spin-off companies from the **Canadian Genetic Diseases Network** has created an organization with the critical mass to accelerate multiple drug discovery programs in cardiovascular disease, diabetes, obesity, ocular disorders, epilepsy, schizophrenia and other neurological diseases. The network is also working with two partners to create Canada's first national training environment in bio-informatics.

The **Mathematics of Information Technology and Complex Systems Network** is conducting research into the filtering theory behind computer-based tracking and image-processing systems. Their work related to navigational tracking can be applied to search and rescue missions, quality control in building material manufacturing, and military aircraft applications to reduce civilian casualties.

The **Canadian Bacterial Diseases Network** is collaborating with universities, the Alberta Research Council and the private sector to develop and bring to market a cattle vaccine to counteract the bacterium *E.coli* 0157:H7, the cause of "hamburger disease," which could have significant health impacts in Canada and around the world.

Canada's strategic funding programs

Canada Foundation for Innovation (CFI)

Established as an independent corporation by the Government of Canada in 1997, the CFI invests in infrastructure projects to support research excellence and strengthen research training at universities, colleges, hospitals and not-for-profit research institutions across Canada. CFI funding covers 40 percent of the eligible costs of projects, with the remaining 60 percent coming from the research institutions and their funding partners, which include the provinces and other levels of government, as well as the private and voluntary sectors. To date, the CFI has been entrusted with a capital investment of \$3.15 billion from the Government of Canada. The CFI's mandate runs until 2010. **Web site:** www.innovation.ca

Canada Research Chairs

This new federal government initiative will fund the creation of 2,000 new research chairs in Canadian universities and their affiliated research institutes and hospitals with an investment of \$900 million over five years. The program's goal is to achieve the highest levels of research excellence. It has been designed to attract the world's most promising researchers in all fields of scientific research to Canadian universities.

In their positions as Chairholders, they are expected to provide the vision for and lead specific programs that will extend the boundaries of Canadian research, thereby ensuring Canada's continued ability to participate at the forefront of international research. The program is designed to ensure the effective use of research resources through institutional strategic planning. **Web site:** www.chairs.gc.ca

Genome Canada

Another new federal government program, Genome Canada, was created to coordinate genomics research in Canada. The program will help Canada to become a world leader in genomic research in a few selected sectors of strategic importance to this country, such as health, agriculture, environment, forestry and fisheries. Five new genome science centres located across the country are being created to provide laboratory services to researchers from universities, government and industry, giving them access to the leading technologies in the field. The centres will also support research into the social, legal and ethical questions related to genomic research. **Web site:** www.genomecanada.ca

Networks of Centres of Excellence (NCEs)

Canada's NCE program is a unique research and development partnership of universities, the private sector, governments, hospitals and agencies in the natural and applied sciences, social sciences, health and humanities. Its objectives are to:

- stimulate internationally competitive, leading-edge fundamental and applied research in areas critical to Canadian economic and social development;

- develop world-class researchers in areas essential to Canada's productivity and economic growth;
- create national multidisciplinary and development priorities of all participants; and
- accelerate the exchange of research results within the networks and the use of this knowledge for Canadian social and economic development.

Formally inaugurated in 1988, a handful of networks has grown to more than 20 (a complete listing is available on the NCE Web site), in the areas of health and biotechnology, information technology, natural resources, infrastructure and human resources. In 1999–2000, 563 companies, 138 federal and provincial agencies, 46 hospitals, 98 universities and more than 266 other organizations from Canada and elsewhere were involved with NCE programs. At present, the networks are active in every province and territory and have more than 200 partnerships in 20 countries.

Industry's active participation makes the NCEs a magnet for students, who enjoy both training and employment opportunities. With a federal investment of \$77.4 million per year, the networks stimulate outside R&D investments of over \$80 million annually. **Web site:** www.nce.gc.ca

Technology Partnerships Canada (TPC)

A program of Industry Canada, TPC provides contributions toward research conducted in Canadian companies in areas of strategic economic importance. These contributions are repayable, usually on the basis of royalties tied to product sales. By partnering with research-active companies, TPC shares in the risks as well as the rewards of Canadian innovation, fostering competitiveness and commercialization of novel ideas. The primary focus of the program is on environmental technologies, aerospace, defence and enabling technologies such as advanced manufacturing, resource technologies, life sciences, and information and communication technologies. **Web site:** <http://tpc.ic.gc.ca>

Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)

With \$60 million to be disbursed over six years, the federal government established the CFCAS in 2000, along with other key initiatives in the climate change research area. The Foundation's objectives are to foster scientific research on the climate system, climate change, extreme weather, air quality and marine environmental prediction. This research will strengthen Canada's scientific capacity, improve scientific understanding of processes and predictions, provide relevant science to policy makers, improve understanding of how these challenges affect human health and the natural environment, foster collaboration and interdisciplinary approaches, and encourage participation and support of others, including the private sector. **Web site:** www.cfcas.org

Canadian S&T programs dedicated to international collaboration

While most of Canada's support for international research comes from our flexible domestic funding programs, a few funds are specifically dedicated to promoting international collaboration.

Canada Foundation for Innovation (CFI) International Funds

In 2001, the CFI is launching a major new funding initiative to support the participation of Canadian universities, colleges, hospitals and not-for-profit research institutions in international research projects. Investments will go toward innovative research opportunities that require international partnership to fully achieve their objectives and that increase international collaboration on S&T in Canada. The initiative includes two international funds, each with a budget of \$100 million. Funding under both of these programs is available for up to 100% of Canadian costs:

- The **International Joint Ventures Fund** supports the establishment of a maximum of four high-profile research infrastructure projects in Canada. These projects are aimed at taking advantage of unique research opportunities with leading facilities in other countries.
- The **International Access Fund** helps Canadian institutions and researchers access major collaborative programs where multinational facilities are required to pursue innovative research projects in other countries.

The **Natural Sciences and Engineering Research Council** operates two programs specifically targeted at international research projects: the **International Opportunity Fund** and the **Collaborative Research Opportunity**.

National Research Council Canada (NRC) administers the Technology Inflow Program as part of the Industrial Research Assistance Program to help Canadian small- and medium-sized enterprises acquire foreign technology and establish international R&D partnerships.

Various post-doctoral fellowships are also accessible to non-Canadian researchers through the granting councils and NRC.

The **Department of Foreign Affairs and International Trade** manages the Going Global S&T program, which provides funding to assist Canadian researchers to identify and establish new international collaborative R&D initiatives.

The Canada Foundation for Innovation supports "big science" in Canada

One of the largest scientific projects ever undertaken in Canada—the Canadian Light Source—is under construction at the University of Saskatchewan. Slated for completion in 2003, this massive particle accelerator will produce intense radiation that can be controlled so precisely it can pick apart minute details of matter. Similar facilities in other countries have demonstrated the capability to dramatically increase the rate at which materials can be analyzed, allowing work that previously took months or years to be completed in days or even hours. This potential for speedy discoveries opens up research in a wide range of fields, including pharmaceuticals, protein structure and analysis of materials for industry. Total project costs are \$173 million, of which the CFI is contributing \$56 million. This national project is an outstanding example of collaboration that brings together a wide range of partners, including the federal government; the provinces of Saskatchewan, Ontario and Alberta; the city of Saskatoon; SaskPower; GlaxoSmithKline; Boehringer Ingelheim; 18 universities across Canada; and the Canada Foundation for Innovation.

Program of Energy Research and Development (PERD)

Operated by Natural Resources Canada (NRCan), PERD is Canada's only federal interdepartmental R&D program focused on the non-nuclear energy sector and its economic and environmental impacts. Working with 12 SBDA's, PERD supports the development of environmentally and economically sustainable energy production and end-use technologies, particularly those that address climate change and greenhouse gas emissions. At the international level, by virtue of PERD, NRCan has fostered strong linkages through a Memorandum of Understanding with the U.S. Department of Energy and the collaborative R&D program of the International Energy Agency. In addition, PERD has ties with the European Union and the Asia-Pacific Economic Co-operation (APEC).
Web site: www.nrcan.gc.ca/es/oerd

Canada Foundation for Sustainable Development Technologies

Canada is establishing the Foundation with an initial allocation of \$100 million to fund the technological innovation needed to address the difficult sustainable development challenges facing the world today. The Foundation will provide funding on a project-by-project basis in two dominant areas: new and emerging climate-friendly technologies that have the potential to reduce greenhouse gas emissions, and technologies that address clean air issues. The Foundation's activities will complement other federal programs related to sustainable development, environmental priorities and technology innovation.

Science-Based Departments and Agencies (SBDAs)

Many departments and agencies in Canada's federal government play key roles in meeting the challenges of the globalized knowledge-based economy. Through partnerships and collaboration with universities and industry, and with other levels of government in communities all across Canada, these organizations use their core competencies, strengths in S&T, networking abilities and infrastructure support to help Canadian firms realize their future potential. Some of Canada's most active SBDA's are profiled in the following pages.

Industry Canada (IC)

Industry Canada coordinates Canada's science and technology policy. As part of this role, the department monitors the implementation of Canada's S&T Strategy, and supports the Advisory Council on Science and Technology (which provides external advice to the government on Canada's science, technology and innovation challenges and opportunities) and the Council of S&T Advisors (which provides advice to science-related Ministers). The department also conducts some research, primarily in information and communication technologies, through the **Communications Research Centre** (www.crc.ca). In addition, Industry Canada develops and applies state-of-the-art information technologies to collect and disseminate information on science, technology and innovation opportunities (www.strategis.ic.gc.ca), and promotes a strong science culture in Canada.
Web site: www.ic.gc.ca

National Research Council Canada (NRC)

NRC is Canada's premier federal scientific research organization. With 16 research institutes across Canada, NRC pursues a diverse range of scientific investigation—including the fields of biotechnology, marine dynamics, microstructural and molecular sciences, aerospace research, and measurement standards. NRC also has one innovation centre and four technology centres. NRC works in partnerships with innovative companies, universities and research organizations worldwide, in many joint activities based on formal and informal agreements.

These international collaborations and exchange programs bring an annual average of 700 visiting scientists to work in NRC labs for periods from one to three years. NRC is also Canada's adhering member in over 39 international scientific unions, most of which come under the International Council for Science. NRC's **Industrial Research Assistance Program (IRAP)** is a technology support program that provides a nation-wide network of more than 260 Industrial Technology Advisors, scientists and engineers chosen for their expertise and business experience. Using the IRAP network and program, small- and medium-sized enterprises (SMEs) have access to high-calibre technical assistance,

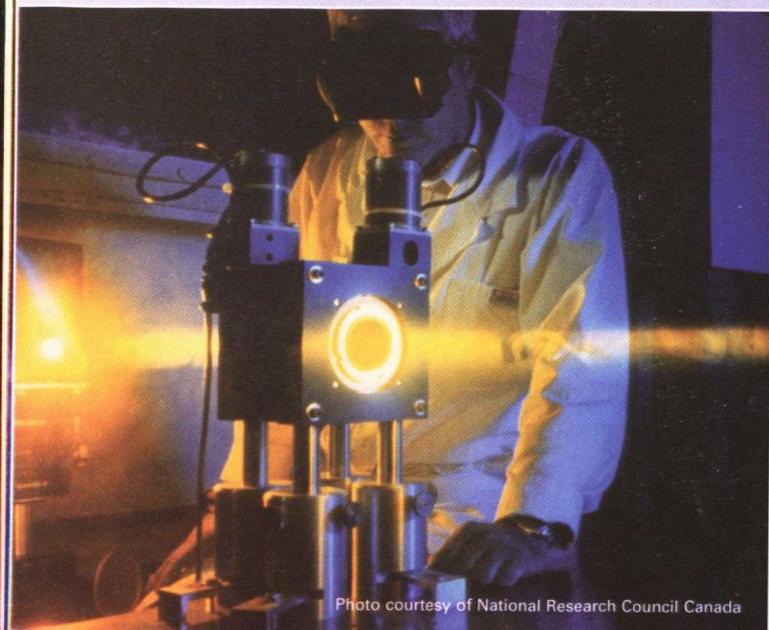


Photo courtesy of National Research Council Canada

Excellence

resources and facilities, as well as financial, marketing or management services that may otherwise be out of their reach. NRC offers access to one of the world's largest collections of S&T information via its **Canada Institute for Scientific and Technical Information (CISTI)**.
Web site: www.nrc.ca

Agriculture and Agri-Food Canada (AAFC)

AAFC promotes the development, adaptation and competitiveness of Canada's agriculture and agri-food sector. World-famous for the breakthrough science that gave the world hardier agricultural products now used in many countries, the Department's research now focuses on the life sciences. Specifically, its goal is to enhance the security of the food-production system, advance the health of the environment and encourage innovation and growth. The department has 19 research centres across Canada, linked electronically and pursuing collaborative research projects under a variety of programs funded by government, industry partnerships and the private sector. Through these programs and through their own department-based work, the department's scientists contribute to many international initiatives. **Web site:** www.agr.ca

Environment Canada (EC)

Environment Canada is one of the largest science-based departments in the federal government. Its mandate is to preserve and enhance the quality of the environment and its renewable resources, including water resources and wildlife. It also carries out meteorology and enforces the rules of the Canada-U.S. International Joint Commission (IJC). The Department's S&T is the basis for its policies, programs and services. Its S&T is integral to giving Canadians the tools needed to achieve sustainable development. Environment Canada's research is focused on freshwater, meteorology and atmospheric science, wildlife, and technology for the prevention and remediation of environmental pollution. S&T activities are carried out across Canada by approximately 3,000 scientific and technical personnel in various laboratories, research institutes and offices. **Web site:** www.ec.gc.ca

Department of Fisheries and Oceans (DFO)

DFO is responsible for policies and programs in support of Canada's economic, ecological and scientific interest in the oceans and freshwater habitat: for the conservation and sustainable utilization of Canada's fisheries resources in marine and inland waters; and for safe, effective and environmentally sound marine services responsive to the needs of Canadians in a global economy. The departmental science and technology endeavours support the priorities of managing and protecting fisheries resources, protecting the marine and freshwater environment, understanding the oceans and aquatic resources, maintaining marine safety and facilitating maritime commerce and oceans development. Internationally, DFO collaborates with foreign governments in scientific research in sustainable fisheries management and in the study of the ocean's role in climate change.
Web site: www.dfo-mpo.gc.ca

Health Canada (HC)

Health Canada provides national leadership in developing Canada's health policy, enforcing health regulations, promoting disease prevention, enhancing healthy living in Canada and responding to the changing nature of health issues in Canada and around the world. The department's S&T activities concentrate mainly on health protection and promotion; and anticipating, preventing and responding to new threats from emerging and re-emerging diseases. Looking to the future, the department is investigating the extensive use of information technology to enhance the sharing of health knowledge and expertise through the "Canada Health Infoway." **Web site:** www.hc-sc.gc.ca

Natural Resources Canada (NRCan)

NRCan specializes in leading-edge science and technology, providing information and expertise in energy, minerals and metals, forests and earth sciences (geoscience and geomatics) as well as policies and regulations that enhance the natural resources sector's contribution to sustainable development and the quality of life of Canadians. Through partnerships and research networks with governments, industry and academia in Canada and internationally, NRCan focuses on knowledge and technology solutions to advance natural resources sector innovation, resource stewardship and environmental performance, including increased energy efficiency. NRCan is working with Canadians to make wise use of our resources, providing information and tools to support balanced decisions on Canada's landmass and resources. In addition, NRCan works with international agencies and other nations to participate in international S&T initiatives, promote Canada's international interests and encourage access to global markets for Canadian products, services and technology.
Web site: www.nrcan.gc.ca

Partnership produces Canadian first with Winnipeg's Level 4 labs

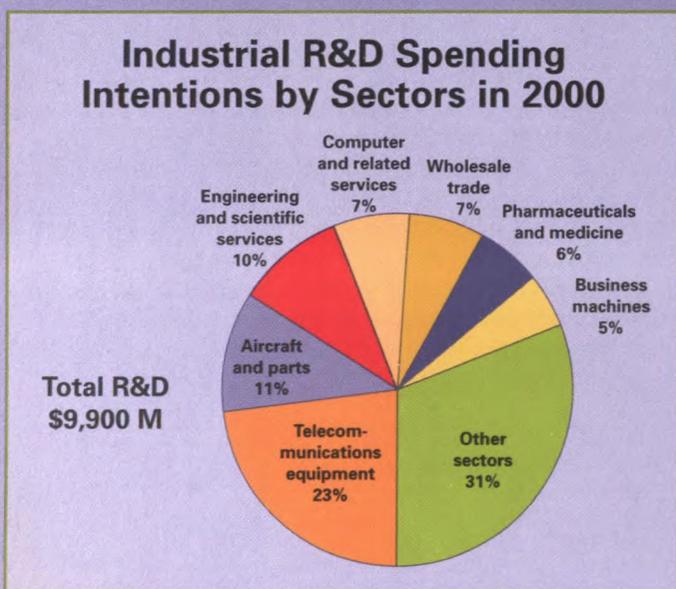
The recently opened Level 4 biocontainment laboratories marked a Canadian first, and almost a world first (there are only a few in the world). Built through a partnership between Health Canada and Agriculture and Agri-Food Canada, the Level 4 laboratories are part of the Canadian Science Centre for Human and Animal Health, a \$172-million state-of-the-art federal laboratories complex. The Centre, located in Winnipeg, Manitoba, also houses laboratories classified at Levels 2 and 3. Jointly operated by Health Canada and the Canadian Food Inspection Agency, the Centre strengthens Canada's capacity to protect the public from infectious disease and reinforces Canada's established reputation for world-class laboratory science.

"From Silicon Valley in California, to Saskatoon's Innovation Research Park, the trend in the global economy is on harnessing local strengths to create globally competitive clusters of expertise and technology... Our goal is to build and sustain the critical mass of resources — research, technological, financial and human — needed for successful technology clusters in each community."

From the National Research Council's series "From Discovery to Innovation...NRC and Regional Innovation"

Excellence in action:

Figure 7



Source: Statistics Canada, 2001

E-commerce when and where you need it

Anytime, anywhere: That type of connectivity is what Research In Motion (RIM) Limited envisions for its next generation of wireless communications devices. And with assistance from Industry Canada's Technology Partnerships Canada (TPC), that vision is set to become reality. TPC made a \$33.9 million repayable investment in RIM, enabling the fast-paced company to accelerate its R&D efforts in wireless Internet platform technologies. The "anytime, anywhere" connectivity aims to generate rapid growth in e-commerce: Canadian e-commerce, presently valued at \$11 billion, is expected to vault to \$94 billion by 2003.

The benefits of Canada's partnering and networking approach to S&T are evident in many industry sectors in which Canadian companies are world leaders. Canadian companies are now pioneering the latest information and communication technology developments. We are also taking great strides in the life sciences, particularly in pharmaceuticals, agricultural biotechnology and health research. Other sectors in which Canadian excellence can be found include aerospace and environmental technologies, particularly for climate change, resource technologies and advanced manufacturing. Figure 7 shows the concentration of industrial R&D expenditures among industries in 2000.

Many of the developments in these sectors are centred in geographical areas with high levels of R&D and high-tech business activity. Anchored by strong universities and labs, these R&D clusters are host to a whole spectrum of thriving, entrepreneurial companies, bringing access to core research capabilities, service and equipment. They also boast low R&D and labour costs; highly skilled pools of scientific and technical labour; modern, extensive and integrated transport and communications networks; and proximity to the U.S. market.

Most importantly, Canadian R&D clusters generate competition, which spurs innovation as best industry practices spill over and generate innovation and continuous improvements. These regional clusters are also attracting increasing domestic and foreign investment, including venture capital, and R&D partnerships with major North American and global S&T players.

Information and Communication Technologies (ICTs)

Canadians have been setting the pace in ICTs for more than a century, beginning with the invention of the telephone. Now our companies specialize in many areas of telecommunications, including switching systems, broadband and multimedia products and services, encryption, fibre-optic cabling, rural communications, submarine cable systems, satellite networking, computer telephony integration, and wireless communications. And they have helped upgrade information and communications systems around the world.

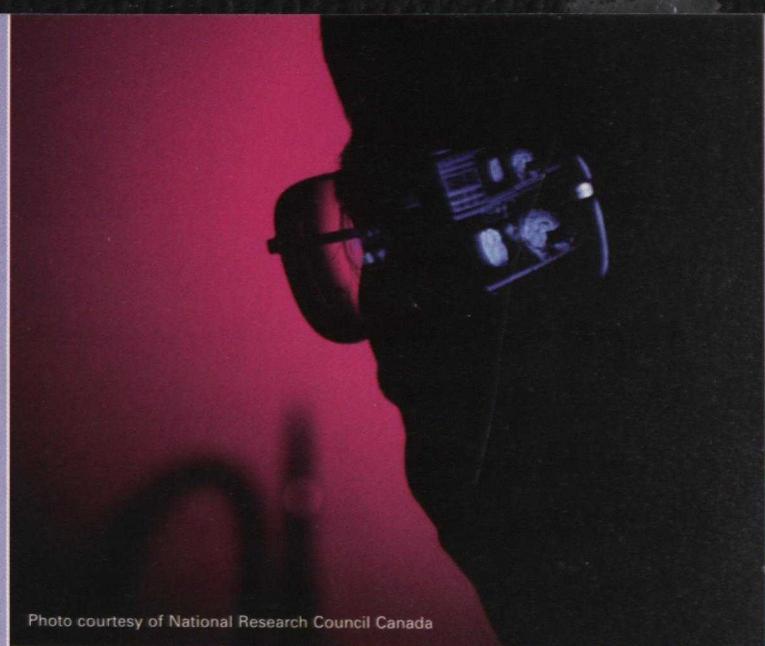


Photo courtesy of National Research Council Canada

Canada's R&D sectors

Ottawa, the National Capital, is the hub of Canada's information and communication technology sector. The city is home to Nortel Networks, Alcatel, Mitel Corporation and over 1,000 other ICT companies, as well as key ICT federal labs and two universities (Carleton University and the University of Ottawa). The high-tech sector employs approximately 72,000 people in Ottawa and attracts over 25 percent of Canada's venture capital. Together with Toronto and Montréal, Ottawa forms a vast pool of ICT resources composed of over 6,000 firms and 300,000 workers.

Toronto, with Nortel Networks, IBM, Celestica Inc. and Hummingbird Ltd., also has impressive strengths in multimedia, software and microelectronics. These companies are supported by the University of Toronto, whose electrical engineering program is ranked fourth and computer engineering program ranked fifth in North America.

In addition, just an hour away from Toronto is Kitchener-Waterloo, Ontario, home to the world-famous University of Waterloo, which alone graduates among the largest number of information technology professionals in North America. Drawing on this talent pool, the Toronto/Kitchener-Waterloo area has developed into a major information and communication technology centre, employing more than 100,000 people.

But other parts of Canada are equally dynamic in this sector. Vancouver, British Columbia, boasts a large number of high-tech firms, most of which are growing at a phenomenal rate. And Calgary, Alberta, is home to a fast-growing wireless communications industry.

Moving toward the east coast, Montréal is carving a niche market in multimedia and e-commerce; Québec City, has a concentration in photonics; Halifax, Nova Scotia, excels with Web applications and software development; while Moncton and Fredericton in New Brunswick aim to be powers in e-commerce.

Hail CSER, Canada's leader in software engineering research

The ability to develop, adopt and exploit technology is a must to gain competitive advantage in the knowledge economy—and the Consortium for Software Engineering Research (CSER) has that ability to spare. Created in 1996, CSER is a multi-party, industry-led research program, geared toward solving selected industrial problems in software engineering. Managed by NRC, the organization brings together six companies—industry giants IBM, Nortel Networks, Mitel, Sun Microsystems, Bell Canada and Object Technology International—nine universities and 16 principal investigators across Canada. Their idea is simple: industry partners help create technology opportunities and determine research directions, while graduate students benefit from access to the latest software engineering tools developed by industry and obtain exposure to industrial project management practices. And their results are clear: working together, they achieve more than would be possible through individual partnerships between companies and universities.

SchoolNet for the tech-savvy generation

In 1999, Canada became the first country in the world to connect its public schools and public libraries to the Internet. SchoolNet connects children and students of all ages to computers, to ready them for the knowledge-based society and promote lifelong learning. In a country as vast as Canada, SchoolNet also closes the digital divide by connecting remote, rural and urban regions, delivering more than 235,000 refurbished computers to schools, funding almost 7,000 public Internet access sites, and connecting over 5,000 voluntary organizations. Building on these achievements, SchoolNet is now working on providing high-speed access, as well as creating more and better learning content on-line. SchoolNet is the result of partnerships between federal, provincial and territorial governments, as well as education associations and the private sector. **Web site:** www.schoolnet.ca

"In 1984 no one knew how to spell biotechnology and the federal government started to invest in it. We particularly chose to focus investments in a couple of cities, and to collaborate and attract major multinationals. It was a long-term strategy that is now paying off."

*Dr. Peter Hackett, Vice-President, Research,
National Research Council Canada*

Investment in vaccines a real boost

An Industry Canada Technology Partnerships Canada (TPC) investment will enable the Laval Technopole, Québec-based BioChem Pharma Shire to evolve into a fully integrated biotechnology company in the field of vaccines—a move that promises to benefit world health. Thanks to TPC's \$80-million repayable investment, BioChem Pharma Shire is expanding its research activity. Nine new vaccines are set to go through clinical trials, including three leading vaccines combatting meningitis, pneumonia and streptococcus infections. All three diseases have been identified as priorities by the World Health Organization. The TPC investment is part of a wide-ranging research and development project that, if successful, will involve further investments of up to \$600 million.

Bionic humans: We have the technology

A partnership between the University of Ottawa and Ottawa-based World Heart Corporation may provide the world's best chance for a completely implantable, easy-to-live-with, reasonably priced heart-assist device. Worldwide, heart failure kills about five million people each year. There are options, such as transplants, but all have clinical limitations. Enter the Ottawa University researchers and their HeartSaverVAD™ (Ventricular Assist Device), a heart-assist device. It is small enough and light enough to fit into the chest cavity, requires no holes in the body or the diaphragm, doesn't cause clotting, can be monitored remotely and, importantly, is affordable. With over \$100 million raised by the World Heart Corporation, research is progressing: human trials are pending, and plans for commercialization are in the works.



Photo courtesy of National Research Council Canada

Life Sciences

Many analysts have suggested that we are now entering the "Age of Biology," when many S&T advances will be centred on the life sciences or biotechnology. Canadian S&T has embraced the life sciences, with over 500 companies and revenues in the billions at last count. In fact, three Canadian cities—Montréal, Toronto and Vancouver—are among North America's top 20 cities for biotech revenue.

Excellence in Canada's life sciences sector falls into two areas in particular—pharmaceuticals and agricultural biotechnology—although Canada is also making great strides in medical devices used for the diagnosis and treatment of illnesses, genetic engineering, health care, telemedicine and environmental biotechnologies.

Greater Montréal, Québec, is Canada's pharmaceutical powerhouse, with more than 200 health biotech firms active in the area. The city boasts international players Abbott Laboratories, BioChem Pharma Shire, Merck Frosst, Pfizer and the Bristol-Myers Squibb's Pharmaceutical Research Institute, as well as many small- and medium-sized enterprises. These companies and organizations benefit from the activities of the four local universities (McGill, Concordia, Université de Montréal, Université du Québec in Montréal) and NRC's Biotechnology Research Institute. In veterinary medicine and agri-food research, Saint-Hyacinthe near Montréal boasts over 120 companies in its scientific park.

In agricultural biotechnology, Saskatoon, Saskatchewan, is the largest centre for this research in the country, home to two federal laboratories, Agriculture and Agri-Food Canada's Research Centre and NRC's Plant Biotechnology Institute, as well as two educational institutions, the University of Saskatchewan College of Agriculture and the Western College of Veterinary Medicine. There are also over 50 agricultural biotechnology companies in Saskatoon, including Ag-West Biotech and POS Pilot Plant. In addition to Toronto's important generic pharmaceutical industry, some of the most significant agriculture research in Canada takes place in Guelph, Ontario, at the University of Guelph and in biotechnology companies clustered in that area.

Resource and Environmental Technologies

Canada is known throughout the world for its wealth of natural resources, which has fostered a resource and environmental technologies industry in Canada that is respected for its innovative approaches. Canadian government, university and industry labs are all active in this process, turning their attention in particular to technologies to mitigate the effects of climate change. Natural Resources Canada is assisting Stuart Energy Systems, which has operations in Québec, Ontario and British Columbia, to develop its hydrogen refueller. Already in use, the refueller is currently servicing three new hydrogen buses, powered by Ballard fuel cells, in Port Coquitlam, British Columbia.

Researchers at **CANMET**, Canada's largest federal laboratory for energy technologies, are developing clean, energy-efficient, conventional, alternative and renewable energy technologies to combat climate change. At other government labs, scientists are assessing the environmental and sustainable performance of technology in areas such as bioethanol production, enzyme bleaching in pulp and paper processes, and fuel cells.

In fact, British Columbia is a world leader in fuel-cell technology. In Vancouver, collaborations between government researchers and Ballard Power have resulted in fuel cell technology for car and bus transportation. In addition, a national fuel cell research centre was established at the University of British Columbia in 1999.

Canadian fire risk management system used worldwide

A forest fire knows no borders: It can rage for weeks, spreading across thousands of kilometres and affecting millions of people. Natural Resources Canada's **Canadian Forest Service**, a leader in the development of internationally acclaimed fire management information systems, developed the "Spatial Fire Management System" now being used in Canada, the United States, Mexico, Indonesia, Malaysia, Brunei, Thailand, Vietnam, and the Philippines. This year, it will be introduced in Russia and the Baltic countries. This system rates the potential for fire ignitions and predicts fire occurrence and expected behaviour, thus allowing managers to evaluate wildfire threats and optimize the use of fire control resources.

Rolls-Royce to give cleaner power to the people

With a \$53.3 million investment from Technology Partnerships Canada (TPC), Montréal-based Rolls-Royce Industries Canada Inc. will soon help meet Canada's future power generation needs in a way that is more environmentally friendly. The company has long been a world leader in the engineering and manufacturing of state-of-the-art gas turbines for aeronautical and industrial applications. With this project, it will turn its attention to improving environmental performance by developing combustors and boosting turbine output and efficiency to reduce emissions that contribute to air pollution and climate change. TPC's investment, repayable through royalties on revenues made by the Canadian section of Rolls-Royce's Energy Business Unit, will leverage an additional \$160 million in R&D spending from the company.



Photo courtesy of Natural Resources Canada

Advanced Manufacturing Technologies (AMTs)

A new dimension in manufacturing

At NRC's Integrated Manufacturing Technologies Institute in London, Ontario, you can get more than a glimpse of the future. You can go on a special tour in the Virtual Environment Technologies Centre. The most advanced research and design facility of its kind, the Centre explores a new dimension in manufacturing. Using the world's most comprehensive array of virtual environment facilities and Canada's fastest graphics computer, users can see—in 3D—environments and objects that don't exist anywhere except in a computer. Already, General Motors Diesel Division has found the Centre fills a critical gap in the product development process by allowing them to identify problems with their vehicles before they begin production. NRC's collaborators on the Centre include the University of Western Ontario, General Motors Diesel Division, Electrohome Ltd./Fakespace and SGI Canada.

"Time-to-market" has become crucial as many manufacturers shift from mass to customized production. AMTs shorten design and production cycles. They improve timeliness, flexibility and quality, save money and show exactly what Canadian innovation can achieve.

Canadian universities and research institutes have a great track record for creating new technologies that have helped Canadian producers become the fourth-largest suppliers of AMTs in the world. These technologies include integrated manufacturing software, intelligent processing equipment, net shape processing, multi-use equipment, continuous materials processing, surface treatment and micro-fabrication.

For example, researchers at the University of British Columbia in Vancouver, McMaster University in Hamilton, Ontario, and Université Laval in Québec City are conducting leading-edge research in machining and metal-forming AMTs, while researchers at the University of Windsor in Ontario are partners with major automakers in developing casting technologies.

Also in the automotive sector, DaimlerChrysler and the University of Windsor have partnered on a \$500 million automotive research centre, focusing research attention on alternative fuels, automotive materials, vehicle durability, mechanical engineering design, vehicle safety, and fuel economy and emissions.

Three National Research Council Canada institutes also focus their work on and create AMTs: the Industrial Materials Institute, Montréal; the Integrated Manufacturing Technologies Institute, London, Ontario; and the Institute for Chemical Process and Environmental Technologies, Ottawa.

Canada concentrates on training more design engineers

Design engineers are the enablers of innovation in the global knowledge-based economy. They're in high demand these days but also in short supply, which is why Canada's Natural Sciences and Engineering Research Council (NSERC) will establish 16 Chairs in Design Engineering over the next three years. This program will help Canadian universities meet the growing demand for design engineering talent, while creating and developing the new and innovative designs, design concepts and design tools needed to train them. Each chair will have a duration of five years and may be renewed for an additional five-year term. NSERC provides up to \$1 million over the first term of a chair. An equivalent amount is to be contributed by any source other than the federal granting councils, including the university itself, industry, government or any other public- or private-sector organization.

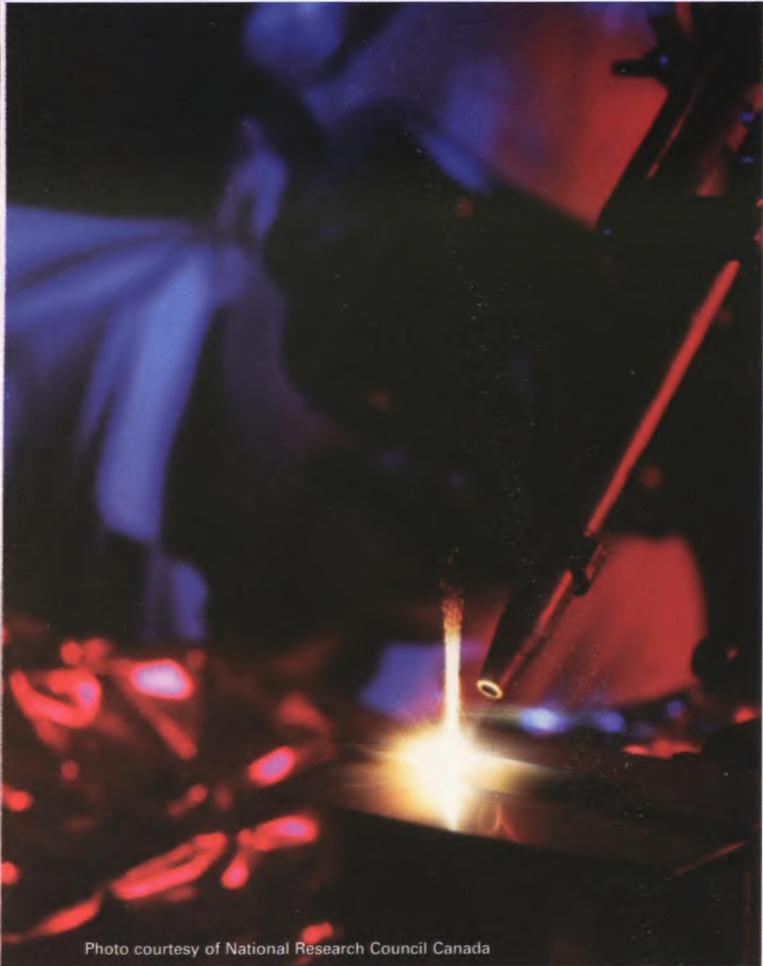


Photo courtesy of National Research Council Canada

Aerospace Technologies

Canada has earned a reputation throughout the world for supplying high-quality, innovative aerospace products and services in selected niche markets, including regional aircraft, helicopters, commercial full-flight simulators and commercial aircraft landing-gear systems. Canadian companies are also recognized internationally for their excellence in aerospace training, specializing in flight simulation and air traffic control, diagnostics and pilot training.

Canada's aerospace industry, the world's third largest, is made up of about 500 firms, over half of which are located in or around Montréal, Québec, including Bombardier Aerospace, Bell Helicopter Textron and CAE Electronics Ltd., as well as Pratt & Whitney and Rolls-Royce, two important aircraft engine manufacturers and R&D performers. Supported by Montréal's four major research universities, these and other companies corner 27 percent of the global corporate aircraft market; more than 40 percent of the world production of commercial helicopters; more than 70 percent of the market for commercial flight simulators; and 60 percent of the world market for landing gear. National Research Council Canada will also locate its new Aerospace Manufacturing Technology Centre in Montréal.

In addition, the **Canadian Space Agency (CSA)** is located in Saint-Hubert, a suburb of Montréal. The CSA works with industry on global satellite navigation, remote sensing and space robotics. It is also working to advance knowledge about space microgravity and life science, and participate in new international space astronomy and planetary exploration missions, which offer new challenges to the scientific community, as well as industry.

The space industry in Canada has come into its own in the past 10 years, becoming a supplier of high-quality niche products and services to large foreign prime contractors. By focusing on strategic areas of expertise, most notably satellite communications, Earth observation, space robotics and space sciences, 350 firms have been able to compete more effectively and capture a larger share of world markets.

Technology for safer search and rescue

A plane goes down in Northern Ontario on a dark, stormy night. People must be rescued, but these are less than ideal conditions under which to conduct a search and rescue mission. Thanks to a project that brings together Defence R&D Canada, National Research Council Canada, and Canadian companies CAE Electronics Ltd. and BAE Systems Canada, poor conditions will be less of a consideration than ever before. These partners are looking at enhanced and synthetic vision systems to improve the safety and efficiency of search and rescue operations. The systems create a virtual flight environment displayed in a pilot's helmet, based on powerful image generation from terrain databases combined with weather-penetrating sensor technology. Although the testing is still in the early stages, the technology may be ready for use in as little as 10 years.

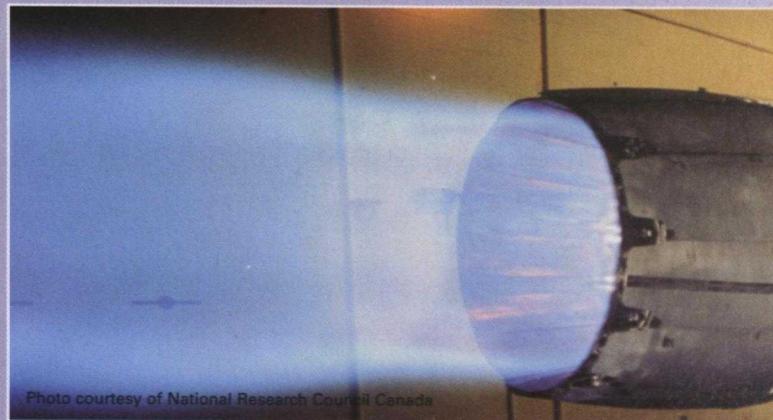


Photo courtesy of National Research Council Canada

For more
information

To serve as **your first line of contact** for Canada's S&T community and programs, Canada has a network of **Science and Technology Counsellors** at Missions in six key OECD countries, as well as **Trade Commissioner Service Officers** who have S&T responsibilities in a number of Canadian Missions.

Canada's federal S&T network abroad

Brussels – European Union

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Fax: (32) 2 741 0629
E-mail: st-eu@dfait-maeci.gc.ca

Paris – France

Tel: (01) 44 43 20 10
Fax: (01) 44 43 20 99
E-mail: fr-eu@dfait-maeci.gc.ca

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Tel: (49-30) 2 03 12 367
Fax: (49-30) 2 03 12 142
E-mail: st-gfr@dfait-maeci.gc.ca

Tokyo – Japan

Tel: (81-3) 5412-6320
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Tel: (44) 0 207 258 6363
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Washington – United States of America

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Fax: (202) 682 7795
E-mail: st-usa@dfait-maeci.gc.ca

To contact **S&T Officers** or **Trade Commissioner Service Officers** in other **Canadian Missions** abroad:

www.infoexport.gc.ca/science/network_e.html

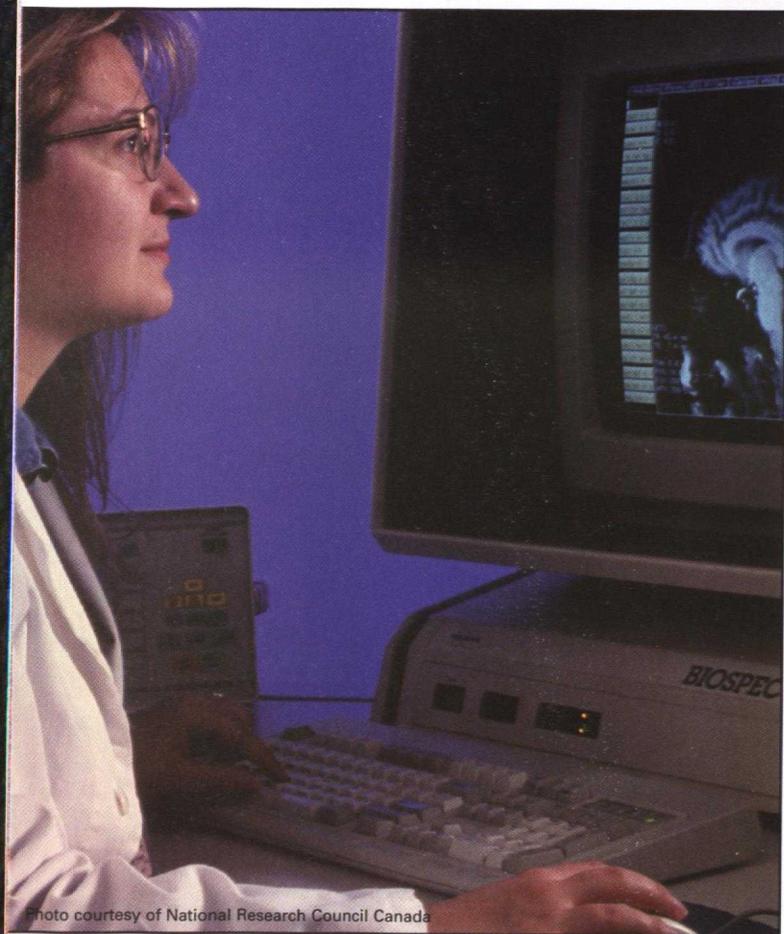


Photo courtesy of National Research Council Canada



Photo courtesy of National Research Council Canada

The federal S&T network in Canada

Agriculture and Agri-Food Canada
www.agr.ca

Atlantic Canada Opportunities Agency
www.acoa.ca

Canada Economic Development
www.dec-ced.gc.ca

Canada Foundation for Innovation
www.innovation.ca

Canada Research Chairs
www.chairs.gc.ca

Canadian Food Inspection Agency
www.cfia-acia.agr.ca

Canadian Foundation for Climate and Atmospheric Sciences
www.cfcas.org

Canadian Institutes of Health Research
www.cihr.ca

Canadian International Development Agency
www.acdi-cida.gc.ca

Canadian Museum of Nature
www.nature.ca

Canadian Space Agency
www.space.gc.ca

Communications Research Centre Canada
www.crc.ca

Department of Fisheries and Oceans
www.dfo-mpo.gc.ca

Department of Foreign Affairs and International Trade
www.dfait-maeci.gc.ca

Department of National Defence
www.dnd.ca

Environment Canada
www.ec.gc.ca

Genome Canada
www.genomecanada.ca

Health Canada
www.hc-sc.gc.ca

Industry Canada
www.ic.gc.ca

International Development Research Centre
www.idrc.ca

National Research Council Canada
www.nrc.ca

Natural Resources Canada
www.nrcan.gc.ca

Natural Sciences and Engineering Research Council
www.nserc.ca

Networks of Centres of Excellence
www.nce.gc.ca

Public Works and Government Services Canada
www.pwgsc.gc.ca

Social Sciences and Humanities Research Council
www.sshrc.ca

Statistics Canada
www.statcan.ca

Technology Partnerships Canada
<http://tpc.ic.gc.ca>

Transport Canada
www.tc.gc.ca

Western Economic Diversification Canada
www.wd.gc.ca

For **additional information** about innovation in Canada and services available to non-Canadians:

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