

FEDERAL SCIENCE AND TECHNOLOGY: THE PURSUIT OF EXCELLENCE

A Report
on Federal
Science and
Technology
— 2003



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Cat. No. lu1-8/2003

ISBN 0-662-68651-9

54226B



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As Canadians, we have long recognized that a strong and vibrant science and technology community can produce significant social, economic and environmental benefits, improving our standard of life and economic well-being.

Canadian researchers, scientists and technologists have received international acclaim for their innovative work. The Government of Canada has supported these professionals by making significant investments in the research capacity of universities, institutes, businesses and federal laboratories across the country.

We have built upon these investments by forging partnerships and linkages with science and technology organizations in Canada and abroad. These promote the effective and efficient application of original research, in many instances leading to the development of innovative products and technologies. In communities in every province and territory, federally funded researchers and institutes are contributing to the growth of technically specialized industries like health, climate change, agri-food biotechnology, fuel cells and aerospace.

A particular challenge — essential if our economy is to remain vibrant and our standard of living high — is to help small firms identify the research, knowledge and technology necessary to their continued growth and success. We can help these companies bridge the commercialization gap by providing the scientific expertise that they cannot develop on their own. The Prime Minister's Advisory Council on Science and Technology, among others, is currently undertaking research in this important area.

The Government of Canada also relies on the advice of the scientists, researchers and technologists working in more than 20 science-based departments and agencies for the protection of the public interest. Their work ensures a flow of basic scientific research, applied knowledge, and considered policy advice for the Government of Canada in areas like health, safety and the environment.

Together, these professionals and organizations help realize the goals first set out in the 1996 science and technology strategy, *Science and Technology for the New Century*:

- advancement of knowledge;
- sustainable job creation and economic growth; and
- improved quality of life for all Canadians.

Further progress can and must be made, however. The Prime Minister has demonstrated his commitment to this endeavour through two recent announcements: the appointment of a National Science Advisor and the creation of the Canadian Academies of Science.

Through these new instruments, as well as ongoing investments, Canada continues to build on its enviable record of world-class science and technology. *Federal Science and Technology: The Pursuit of Excellence* highlights some of 2003's achievements.



David L. Emerson
Minister of Industry

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Federal Science and Technology: The Pursuit of Excellence, one of a series of reports issued since the release of the Government of Canada's 1996 science and technology (S&T) strategy, *Science and Technology for the New Century*, covers the calendar year 2003. While 2003 was a year of continual evolution and fundamental change for federal S&T, it was also a year of pragmatism. Following directives to do more collaborative S&T, we asked ourselves some tough questions and began to respond through a number of mechanisms. This report captures the progress of 2003 in a format that is readable and accessible for all.

As with previous years, this report is a collaborative effort involving 22 science-based departments and agencies (SBDAs). The appendix of this report highlights how the S&T activities of each of these SBDAs help them to deliver on their mandates. This report and the appendix are available in electronic format at www.innovation.gc.ca/s-tinfo

The 2003 Report on Federal S&T

This year's report reviews the activities of the federal science and technology community during 2003, and describes major developments that influenced it during the year. The report is organized into three chapters and an appendix.

- **Chapter 1** sets out the more recent investments and announcements that continue to shape federal S&T. Topics covered include: an overview of what federal S&T entails; the S&T highlights of Budget 2003; the August 2003 announcement by the federal government on its spending intentions for technology and innovation projects related to climate change; the new framework for precautionary approaches, which is a risk-management framework that provides guidance on how and when precautionary approaches should be applied; and the federal pilot project on S&T Foresight. It ends with the reorganization of science responsibilities and governance announced on December 12, 2003.
- **Chapter 2** provides an overview of how the government is drawing on external expertise to enhance the role that S&T plays in the government and in the nation. This chapter includes updates on the activities of the Advisory Council on Science and Technology (ACST), the Council of Science and Technology Advisors (CSTA) and, for the first time, the Canadian Biotechnology Advisory Committee, and the Canadian Biotechnology Strategy, which involves the ministers responsible for Agriculture and Agri-Food, Environment, Fisheries and Oceans, Health, Industry, International Trade, and Natural Resources.
- **Chapter 3** provides a review of some of the challenging questions the S&T community began asking itself, and the mechanisms through which it has started to respond. It includes the directions being pursued by federal science-based departments and agencies to enhance collaboration amongst themselves and better integrate federal S&T activities with those in other governments, academia, the private sector and the international S&T community.
- The **Appendix** (only available online at www.innovation.gc.ca/s-tinfo) presents highlights of the performance and achievements of 22 SBDAs during 2003. These include implementation of the *Framework for Science and Technology Advice* for policy and regulation development and decision making.

INTRODUCTION

1.1 WHAT FEDERAL SCIENCE AND TECHNOLOGY ENTAILS

Science and technology (S&T) activities within the federal government are crucial to the ability of departments and agencies to serve the public interest. S&T informs the formulation of policy, the establishment of appropriate standards and limits for regulation, and the anticipation of the impacts of various courses of action. Federal S&T also provides the basis for services to Canadians, such as weather forecasting and advice on food safety, and brings to life new ideas and technologies with global implications, such as broadband, the heart pacemaker, and telecommunications satellites.

S&T activities, as defined by Statistics Canada and the Organisation for Economic Co-operation and Development, consist of two related components: research and development (R&D); and non-research activities (related scientific activities, or RSA), such as the scientific assessment of products and data analysis.

The federal government invested more than \$8.5 billion in S&T in 2003–04, including both R&D and RSA (details of this investment follow in Table 1 on p. 2).

S&T activities to meet federal mandates and responsibilities are performed internally by science-based departments and agencies, or are performed externally with federal funding. Federal investment in S&T also extends to the funding provided by federal granting agencies¹ and foundations for university-based research. Science-based departments and agencies (SBDAs) employ scientific researchers and workers from a variety of disciplines in the natural and social sciences, engineering, and technology, and maintain institutes, laboratories, field stations, and offices across the country.

Science and Technology for the New Century, released in March 1996, marked a turning point in federal science and technology. This strategy challenged the community to examine new and different ways of doing business. The key priorities under the strategy were creating value for Canadians, serving the public interest, and collaborating better across departments and with the other players in the science and innovation systems.

The 1996 federal S&T strategy set up a system of governance founded on the principle that individual ministers should

1. Three granting agencies are involved in funding S&T: the Natural Sciences and Engineering Research Council of Canada; the Social Sciences and Humanities Research Council of Canada; and the Canadian Institutes of Health Research.

Table 1: Science and Technology Indicators

	Units	1998	1999	2000	2001	2002	2003
General economy and population^a							
Gross domestic product (GDP)	\$ millions	914 973	982 441	1 076 577	1 108 200	1 157 968	1 218 772
GDP implicit price index	1997 = 100	99.6	101.3	105.5	106.7	107.8	111.2
Population	thousands	30 157	30 404	30 689	31 021	31 362	31 630
Gross domestic expenditures on R&D (GERD)^b							
"Real" GERD	\$ millions 1997	16 142	17 405	19 298	20 727	20 134	20 189
GERD/GDP ratio	ratio	1.76	1.79	1.89	2.00	1.87	1.84
"Real" GERD/capita	\$ 1997	535.27	572.45	629.82	668.16	641.99	638.29
GERD funding by sector							
Federal government	% of GERD	17.6	18.2	17.5	18.1	19.5	19.5
Provincial governments	% of GERD	4.0	4.4	4.3	4.9	5.4	5.6
Business enterprise	% of GERD	45.7	44.9	44.1	48.3	45.3	44.3
Higher education	% of GERD	14.5	15.0	14.2	13.5	15.1	16.0
Private non-profit	% of GERD	2.3	2.2	2.2	2.4	2.7	2.9
Foreign	% of GERD	15.9	15.3	17.7	12.9	12.0	11.7
GERD performed by sector							
Federal government	% of GERD	10.8	10.5	10.2	9.5	10.2	9.7
Provincial governments	% of GERD	1.3	1.3	1.3	1.4	1.5	1.5
Business enterprise	% of GERD	60.2	59.0	59.8	59.6	55.2	53.7
Higher education	% of GERD	27.2	28.8	28.4	29.3	32.8	34.9
Private non-profit	% of GERD	0.5	0.4	0.3	0.2	0.2	0.2
Federal GERD performed as a % of federal funding	% of federal	61.6	57.8	58.4	52.6	52.5	49.8
"Real" federal performance of R&D	\$ millions 1997	1 750	1 835	1 972	1 971	2 063	1 966
Intellectual property commercialization^c							
Federal government							
New patents received	number	130	89	—	109 ^r	133 ^p	146 ^p
Royalties on licences	\$ thousands	6 950	11 994	—	16 467	16 270 ^p	15 253 ^p
Universities							
New patents received	number	143	325	—	339	—	—
Royalties on licences	\$ thousands	15 600	18 900	—	44 397	—	—

r = revised

p = preliminary

a. Source: Canada. Statistics Canada. *Canadian Economic Observer*. Cat. No. 11-010-XIB, Vol.16, No. 5. Ottawa, May 2003.

b. Source: Canada. Statistics Canada. *Science Statistics*. Cat. No. 88-001-XIB, various issues. Ottawa, 2003.

c. Sources: Canada. Statistics Canada. Federal Science Expenditures and Personnel Survey, and Survey of Intellectual Property Commercialization in the Higher Education Sector. Ottawa, various years.

be responsible for the science directly related to their mandates. Individual ministers needed to retain the authority over, and accountability for, those scientific activities.

The 1996 strategy has served as an important catalyst for improving federal S&T performance. Its principles continue to be relevant as the demands placed on federal S&T change and evolve. As a result of the strategy, federal government scientists and researchers have forged stronger links with each other, as well as with the broader Canadian and international S&T communities. The governance and advisory mechanisms put in place as a result of the strategy have helped shape new ways of doing business for federal S&T.

The establishment of the Council of Science and Technology Advisors (CSTA) in 1998, in particular, has provided a valuable independent and external perspective on the government's approach to S&T. Its first report on science advice formed the basis of the federal *Framework for Science and Technology Advice*. Subsequent advice from the CSTA has focussed on other aspects related to promoting excellence in federally performed S&T.

These reports also provided thoughtful analysis of the evolving context for federal S&T. It is a context characterized by:

- rapid changes in S&T knowledge and capacity worldwide;
- an aging workforce;
- competing demands for government resources to attract a new generation of scientists and researchers and to upgrade facilities and equipment; and

- increasing public expectations for S&T to provide the answers to complex challenges that reach across jurisdictions and disciplines, such as climate change, stem-cell research, food safety, national security and epidemic-disease threats.

1.2 THE SCIENCE AND TECHNOLOGY POLICY LANDSCAPE

Federal S&T in 2003 was marked by several significant funding and policy announcements, as well as the addition of several new players to the national S&T policy arena.

The federal budget of February 18, 2003, continued the government's pattern of investing in S&T, with more than \$13 billion invested in research and innovation since 1997. In 2003 more than \$1.7 billion in new funding over three years was announced (see the box on page 4).

1.3 CANADA'S TECHNOLOGY AND INNOVATION INVESTMENT IN CLIMATE CHANGE

Global climate change is a prime example of the types of science-based issues facing governments today: the effects are global and pervasive; they have impacts on all facets of the environment, economy and society; responding to them requires expertise from across many disciplines; and the science underpinning the issue is controversial.

Canada has been investing in climate-change S&T for a number of years. On August 12, 2003, the Government of Canada announced details of the investment of \$1 billion toward the implementation of the Climate Change Plan for Canada. Included in this spending was a total investment of \$500 million in

S&T Highlights of Budget 2003

Strengthening Research and Innovation

This budget invested \$1.7 billion in 2002–03 and over the following two years to support research and innovation. These investments included the following:

- a \$125-million-per-year increase in funding for Canada's three federal granting councils, beginning in 2003–04;
- a new Canada Graduate Scholarships program supporting 4000 new scholarships at program maturity;
- \$225 million per year to help fund the indirect costs associated with federally sponsored research through the granting councils, beginning in 2003–04;
- \$16 million over two years for northern science;
- investments of \$500 million in the Canada Foundation for Innovation, for state-of-the-art health research facilities, and \$75 million in Genome Canada, for health genomics;
- \$15 million to the Rick Hansen Man In Motion Foundation, and \$20 million to the Medical and Related Sciences project;
- \$30 million for SchoolNet and the Community Access Program;
- an additional \$70 million over two years for the National Research Council Canada to strengthen the Industrial Research Assistance Program, support astronomy and establish new regional innovation centres;
- an additional \$190 million in equity to expand venture capital through the Business Development Bank of Canada, and \$20 million for Aboriginal Business Canada, in support of entrepreneurship and business development; and
- investments in the Climate Change Plan for Canada.

S&T, of which \$250 million was allocated to Sustainable Development Technology Canada (SDTC), with the remainder to the Climate Change Technology and Innovation Initiative (CCTII). These investments were part of the Budget 2003 allocation.

SDTC was granted an initial endowment of \$100 million in Budget 2000 and opened for business in April 2002. A second endowment was announced in Budget 2003, bringing the total funding for the SDTC to \$350 million. The SDTC believes that, for clean technologies to be successful in the marketplace, effective, goal-oriented partnerships must be established early on. For that reason, it maintains a national database of organizations active in the clean-technology market, and uses that resource to help link entrepreneurs with complementary technologies and potential consortium members.

The purpose of the CCTII is to reduce emissions over the long term, and to position industry to maximize economic opportunities in new technology development. To achieve these goals, it is investing in transformative technologies — that is, technologies that would completely change or eliminate current methods. It implies a paradigm shift rather than just improving the technologies and methods that already exist, thus impacting society and the economy.

In the case of climate change, these technologies will help us decouple greenhouse gas emissions from economic growth. Consequently, considerable investment in research, development, demonstration and commercialization will be required over many years. With this initiative, the government reduces the risks faced by industry and consumers in the development and adoption of such technologies.

The CCTII is focusing on five key technology areas:

Cleaner Fossil Fuels

- Technologies for cleaner fossil fuel production, conversion and combustion.

Advanced End-Use Efficiency Technology

- Energy-efficient technology that can be used in the industrial, commercial, community and transportation sectors.

Decentralized Energy Production

- Technologies that allow for greater use of locally available energy resources and renewable sources of energy, such as wind, solar, and landfill gas.

Biotechnology

- A range of technologies, including biomass and waste conversions; cellulosic ethanol from biomass and other biofuels; bio processes; biomass production, harvesting and transportation; and energy from biomass.

Hydrogen Economy

- Fuel cells and other technologies of the emerging hydrogen economy.

The diversity of technologies required to address climate change is so great that only a collaborative approach at an international scale can hope to succeed. By drawing upon its ongoing investment in energy S&T and CCTII funding, the federal government will be able to strengthen its engagement with domestic and international S&T climate-change players.

1.4 A FRAMEWORK FOR THE APPLICATION OF PRECAUTION IN SCIENCE-BASED DECISION MAKING ABOUT RISK

As the scientific process is often characterized by uncertainty and debate, the decision-making process for managing risks associated with scientific information requires sound judgement.

A Framework for Science and Technology Advice (May 2000) identifies a number of principles and guidelines that, when implemented, contribute to sound

government decisions and mitigate crises. In an ideal situation, government decision makers identify issues early and reduce scientific uncertainty by initiating the collection and review of scientific information. The Government of Canada achieves effective risk management by using this timely information in an open decision-making process.

Achieving this ideal situation is not always possible. The Government of Canada is often required to make decisions in the face of new or emerging risks of serious or irreversible harm. It recognizes that the high level of scientific uncertainty in these circumstances is not a reason to postpone decisions. In these cases, the Government of Canada uses a precautionary approach.

The *Framework for Science and Technology Advice* called for the Government of Canada to “develop a risk management framework that includes guidance on how and when precautionary approaches should be applied.”

As of June 2003, *A Framework for the Application of Precaution in Science-based Decision Making about Risk* (the Framework) is part of the policy of the Government of Canada. The Framework outlines the guiding principles for the application of precaution to science-based decision making in areas of federal regulatory activity for the protection of health and safety, and the environment and natural resources.

The application of precaution recognizes that the absence of full scientific certainty shall not be used as a reason for postponing decisions where there is a risk of serious or irreversible harm. Thus, it is characterized by three basic tenets: the need for a decision, a risk of serious

or irreversible harm, and a lack of full scientific certainty. The Framework identifies 10 guiding principles that serve to strengthen and describe existing Canadian practice.

The purpose of the Framework is to:

- improve the predictability, credibility and consistency of the federal government's application of precaution to ensure adequate, reasonable, and cost-effective decisions;
- support sound federal government decision making while minimizing crises and controversies and capitalizing on opportunities;
- increase public and stakeholder confidence, in Canada and abroad, that federal precautionary decision making is rigorous, sound and credible; and
- increase Canada's ability to positively influence international standards and the application of precaution.

Ultimately, the Framework provides a lens through which to assess whether precautionary decision making is in keeping with Canadians' social, environmental and economic values and priorities.

Over the coming year, many regulatory departments and agencies will be incorporating the Framework into their decision making. In some cases, they will be developing, in consultation with their stakeholders, guidance documents for the application of precaution in their particular area of responsibility. The Framework is also the basis for Canadian officials to engage in informed discussions at the federal, provincial, territorial and international levels of "what precaution is" and "how it should be applied."

A Framework for the Application of Precaution in Science-based Decision Making about Risk is available on the English Privy Council Office Web site (www.pco-bcp.gc.ca — click on Publications in the top navigation bar, and you will find the document filed under "F").

1.5 SCIENCE AND TECHNOLOGY FORESIGHT — LEARNING FROM A FEDERAL PILOT PROJECT

The world is full of surprises, unforeseen events and developments that few have anticipated. A retrospective look at some of the events and challenges from the past 20 years demonstrates the high degree of uncertainty that has become the norm for the industrialized world. From the challenges of AIDS to the end of the Cold War, and from the Human Genome to the World Wide Web, the global context is full of surprises. More recently, the SARS situation cost Canada \$1 billion and temporarily damaged the perception of Toronto as a tourist destination. It is clear that globalization forces in trade, technology and economic factors are resulting in increasing integration.

To cope with the higher risks associated with this new reality — where security and flexibility matter, where institutions and governance mechanisms are being transformed by technology, and where one's future is growing more contingent upon strategic choice — it becomes important for nations to increase their peripheral vision, contingency planning and preparedness capacities. Many governments around the world make extensive use of S&T foresight to inform these future-looking choices.

Science and technology foresight is a systematic attempt to look into the long-term future of science, technology, society, the economy and their mutual interactions in order to generate knowledge and inputs for policy making. The aim is to help identify those specific technologies and technology trends that will best improve the quality of life for a nation's citizens over the next 10 to 20 years. To more closely resemble the real world, foresight exercises factor in uncertainties associated with business and cultural trends and societal changes to arrive at possible outcomes or timelines for technology applications. The value of foresight is both the prompt identification of emerging generic technologies and the synergies that the process creates among those who participate in the foresight activities.

This was the context that underpinned the development of the interdepartmental Science and Technology Foresight Pilot Project (STFPP) carried out during 2002–03. It involved 13 federal departments and agencies in an exploration of S&T foresight with a view to better understanding some of the long-term, integrative and horizontal challenges and opportunities that the federal S&T community might have to cope with — looking ahead to 2015 and beyond.

It is accepted that one can never predict the future through S&T foresight. However, the attempt to anticipate a variety of plausible developments, innovations and disruptive technologies that could cause major shifts in the social and economic environment represents a necessary flexibility-enhancing investment. Canada has not had a regular forum for societal or S&T-focused foresight, but,

given the enormous complexity and vulnerabilities of a globalized world and the inevitability of major surprises, building some new contingency-planning capacities through foresight is a logical and cost-effective investment — even if only to begin to learn how to better anticipate the unexpected and to increase the resilience of Canada's S&T readiness. This was the conclusion of deputy ministers in March 2002, when it was decided that the National Research Council Canada (NRC) would lead a pilot project that would explore the application of foresight tools.

An interdepartmental working group solicited input from across the federal government on foresight focus topics. In pulling together these diverse suggestions, they applied the following criteria. Focus topics should:

- represent long-term views associated with convergent technologies being explored mainly in the United States, through the National Science Foundation and other federal agencies, such as the National Reconnaissance Office, that are acknowledged as leaders in advanced infrastructure technologies;
- be able to subsume or be inclusive of most of the more narrow topics advanced by individual SBDAs;
- present contrasting challenges and opportunities, one being more science-determined, the other more applications- and engineering-oriented;
- enlist and stretch the expertise of several partners; and
- not directly replicate existing planning domains.

Foresight Focus Topics

Geostrategics

Potential geo-spatial future applications, technical developments, scenarios and S&T pathways derived from technological advances expected in:

- land-, sea- and space-based sensing, robotics and wireless data infrastructure, advanced imaging capabilities, pattern interpretation, and location-based functionalities;
- intelligent systems, with emphasis on real-time identification and decision making;
- prospective new tools for monitoring and managing Canada's environment, resources and crops;
- understanding of disease-network structures and threats; and
- emergency- and security-implications drivers.

Biosystemics

Identification and assessment of the areas of strategic scientific research and emerging technologies based on convergence opportunities involving:

- genomics and proteomics, nanoscience and technology bio-informatics, and bio-computing;
- the intersection of cognition, information science, environmental sciences and human ecology; and
- disease systems and spread factors.

Overview of the Process and Findings

From November 2002 to March 2003, the STFPP elaborated an extensive set of events that involved individuals from all of the sponsors and partners, as well as many other federal organizations and innovation stakeholders outside government. These events, findings and outcomes included the following:

- implementation of the STFPP involving 13 federal S&T departments and agencies;
- extension of foresight awareness to many other Canadian organizations,

including universities, firms and non-profit organizations;

- exploration and testing of foresight tools — i.e., topic selection and scoping, Web conferencing, technical expert panels, scenarios; S&T, policy backcasting, and R&D implications;
- connection with more than 15 international foresight organizations;
- creation of a network of 200 professionals with foresight awareness and experience;
- elaboration of 10 scenarios to 2025, based on multiple disciplines, sectors and stakeholders;
- derivation of 12 prospective resonant R&D themes — a first approximation of candidates for future horizontal collaboration; and
- testing and confirmation of the viability of an entrepreneurial leverage model to share costs, risk and responsibilities.

The STFPP had several broad content components:

- First, future S&T drivers and prospective significant events linked to the two topics selected were mapped, via a series of scoping workshops and eight technical panels.
- Second, a set of grounded yet thought-provoking stimulus scenarios were created by the Project Team from their review of the scoping, technical and synthesis consultations and reports.
- Third, a wide range of S&T, policy, industry, academic, and international experts and stakeholders were invited to a two-day intensive workshop in March 2003, where they developed

detailed scenarios and some policy advice that could be useful in understanding S&T and policy contingencies, looking ahead to Canada as it might be in 2025.

- Fourth, the Project Team designed a process to move from these constructed scenarios to a set of resonant themes that identify some provocative R&D and policy implications for Canada today. These are a first approximation of a prospective list of domains for which interdepartmental collaboration would be required to generate adequate horizontality for their realization through R&D.

General Findings of the Science and Technology Foresight Pilot Project

1. **Technology Dynamics** — There are forces within the innovation process that are accelerating the pace of discovery, such as convergence; gene-related health; military and security transformation; global S&T competitiveness; and deeply connected, sensor-rich mesh computing networks. There are also many potentially disruptive technologies, such as neural scanning, genetic therapies for regeneration and enhancement, quantum computing, nanotechnology, household robots, space-based power, and long-life portable and fixed fuel cells, that could affect the direction of technology and societal infrastructure in unforeseen ways.
2. **Near-Term Possibilities** — Many new and significant technologies could well appear in a fairly short time frame. The bio-health and nanotechnology environments, in particular, are advancing much more quickly than anticipated

because of new instrumentation and bio-informatics. The technical expert panels identified extensive lists of bio- and geo-possibilities in this regard, which are summarized in the Synthesis Research Reports.

3. **Governance** — The Canadian federal S&T community was not well positioned to take advantage of the benefits of technology that require horizontal approaches to optimize benefits. As well, the competing cultures of SBDAs often make it harder to deal with failures in research. The STFPP again exposed some vulnerability of alignments and commitment, but additional and more intensive application of foresight tools could strengthen horizontal governance and assist the federal system as a whole in demonstrating anticipatory capacities.

Overall, the STFPP confirmed that foresight techniques could be applied in S&T to increase the horizontality of research perspectives and the collaborative learning abilities of professional staff. The NRC confirmed that federal departments and agencies could work together to reach further into broad issues and challenge domains related to S&T, and that scenario planning should be further developed in the context of more focused projects to examine some of the specific areas highlighted by the various teams of volunteers. Accordingly, the NRC Office of Technology Foresight has identified a series of prospective “deeper dive” topics that it will be discussing with potential partners during 2004 and beyond.

The full deliverables list of foresight research reports from the STFPP are available at <http://agora.scitech.gc.ca> This is the link to the main NRC Agora

Community of Practice Web page. From here, select “Communities,” then “Foresight,” then “Library” to view or print documents in PDF format.

Government Reorganization, December 12, 2003

Along with a new Prime Minister of Canada, the Right Honourable Paul Martin, the government made changes to departments and agencies involved with federal S&T. Some of these changes are reflected in the individual appendixes of SBDAs.

Most prominent in the S&T changes was the nomination of the distinguished chemist and recent president of the NRC, Dr. Arthur Carty, as the new National Science Advisor, effective April 1, 2004. As well, with the elimination of the position of Secretary of State (Science, Research and Development), a new position of Parliamentary Secretary to the Prime Minister on Science and Small Business was created. The Minister of Industry retained the mandate and responsibility for science in Canada. This responsibility has been clearly vested in the Minister of Industry since the passage of the *Department of Industry Act* in 1995.

The Prime Minister’s interest in S&T was emphasized by the appointment of Dr. Carty. In creating this position, the government has provided itself with the opportunity to harness the great S&T potential in Canada and to help build a stronger science culture in this country. The National Science Advisor will provide sound, expert advice on the full range of issues related to research and the impact of science considerations on public policy. He will work closely with the Advisory Council on Science and Technology and others to help the government identify S&T priorities and directions.

The National Science Advisor

The role of the National Science Advisor to the Prime Minister is to:

- provide sound, independent, non-partisan advice on the government’s directions and priorities for S&T;
- provide input on priorities for future investments in science and innovation — balancing the need to support excellence in S&T with benefits to society and the economy;
- advise on the commercialization and innovation gap in Canada and mechanisms to close it;
- examine Canada’s role in international S&T and work with the research community to bring the benefits of our R&D to bear on the challenges of the developing world;
- find mechanisms to remove barriers to horizontal collaborations, and build partnerships between various departments, agencies, institutions, and foundations, and between the public and private sectors;
- develop a framework for the evaluation and funding of big science projects;
- help build a stronger science culture in Canada, and serve as a science ambassador for Canada, whenever possible, to help convey to the world that we are a scientifically and technologically sophisticated nation; and
- provide sound foresight on future impacts of S&T in Canada.

The National Science Advisor will also work with Canada’s research community to apply the benefits of Canada’s R&D to the challenges faced by the developing world. He is seeking to serve as a champion to help build and enhance S&T collaboration across government, industry and academia, and access knowledge from the global S&T capacity. The National Science Advisor is also well placed to harness the collective knowledge in this country to identify and assess future science-based opportunities and risks that Canada might face in coming years. The National Science

Advisor will undoubtedly play a key role in mapping out a plan to deliver on one of the government's key S&T priorities — ensuring that Canada's knowledge investment is converted to commercial success, and growing small and

medium-sized firms that can benefit from science and research. In this regard, he will work closely with the Minister of Industry and the Parliamentary Secretary for Science and Small Business.

PROFITING FROM EXTERNAL ADVICE

The 1996 federal science and technology (S&T) strategy, *Science and Technology for the New Century*, called for the government to make better use of external advice, as it sought to build a strong, forward-looking, dynamic Canadian innovation system. In response, the federal government created the Advisory Council on Science and Technology (ACST) and the Council of Science and Technology Advisors (CSTA) — independent, external advisory bodies that provide expert advice to the government on S&T and innovation issues. These councils are complemented by the Canadian Biotechnology Advisory Committee (CBAC), a group of external experts that advises the government on policy issues associated specifically with biotechnology.

The ACST, created in 1996, provides the Prime Minister and the Minister of Industry with advice on national science, research and innovation priorities and policies. It reviews Canada's performance in research and innovation, identifying emerging issues and advising on a forward-looking agenda that will position Canada in an international context. The work of the ACST, therefore, contributes in a strategic way to helping strengthen

Canada's economic performance, while integrating the critical social and cultural aspects of Canadian society. The ACST is composed of prominent Canadians drawn from the business, academic and research sectors from across Canada's regions.

Created in 1998, the CSTA complements the mandate of the ACST by providing advice to the federal Cabinet on one specific sector of the national science and innovation system — the government's own internal S&T enterprise. The CSTA consists of representatives from the academic, private and not-for-profit sectors, and reflects the diversity of S&T-based disciplines. Council members are appointed by the ministers of science-based departments and agencies (SBDA's), and are drawn from the external science advisory bodies that advise these organizations. The CSTA draws these advisors into a single body mandated to enhance federal S&T management by examining issues common across SBDA's and highlighting opportunities for synergy and joint action.

Established in 1999, the CBAC advises government on the policy issues associated

with the ethical, social, regulatory, economic, scientific, environmental and health aspects of biotechnology. In an open and inclusive manner, the CBAC engages in dialogue with stakeholders, undertakes expert research and analysis, and debates the implications of developments in biotechnology, all with a view to providing practical, evidence-based advice to government. The CBAC reports to the Biotechnology Ministerial Coordinating Committee, which consists of the ministers responsible for Agriculture and Agri-Food, Environment, Fisheries and Oceans, Health, Industry, International Trade, and Natural Resources. The CBAC is composed of experts from the science, business, nutrition, legal, environmental, public advisory, philosophy and ethics fields, as well as representatives from the public.

Previous issues of this report have highlighted the operations of these bodies and the advice they have provided to the government. The year 2003 saw an enhanced level of activity from the ACST, the publication of the CSTA's sixth report, and a new initiative on biotechnology and health innovation from the CBAC. This chapter provides an update on their continuing contribution to strengthening S&T in Canada.

In addition, this report is the first in this series to outline the activities under the Canadian Biotechnology Strategy (CBS), which focuses on innovation, stewardship and citizen engagement in the critical area of biotechnology.

2.1 ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY — ACTIVITIES IN 2003

In its early years, the ACST provided advice to the federal government on the

commercialization of university research, skill requirements, Canada's role in international S&T, and the indirect costs of federally supported research. Since the November 2002 Innovation and Learning Summit, the ACST has been very active in providing advice on Canada's Innovation Strategy, *Achieving Excellence*. The ACST received a broad mandate from the Prime Minister to provide advice on the way forward for the Innovation Strategy. In 2003 the ACST chose to concentrate on providing recommendations that centre on the research and commercialization themes of the innovation agenda.

In providing advice to chart Canada's future course in research and commercialization, the overarching theme of the ACST's recommendations to the Prime Minister may be expressed as building Canadian business capacity to successfully transform knowledge into national wealth and well-being. The four key policy themes contained in the ACST's recommendations are:

1. Seed-Stage Commercialization — Building business innovation capacity through a new initiative that bridges financing and skills gaps to address the seed-stage project development challenge in Canada.
2. Human-Capital Development — Ensuring a supply in Canada of highly skilled people with a short-term focus on university graduate studies and a long-term focus on children.
3. Communication and Shared Decision Making — Improving communication and shared decision making among all stakeholders (e.g. provinces, municipalities, the research community, and the business and financial

sectors) to build an effective national innovation system.

4. Strategic Investments in Research — Continuing to build Canadian research capacity through strategic investments in Canada's research enterprise.

As follow-up to these recommendations, the ACST Deputy Chair initiated an active consultation process with key decision makers and stakeholders within government to discuss the ACST's findings. This helped to build awareness of the strategic role that the ACST's recommendations can play in Canada's research and commercialization agenda. The Deputy Chair also sought to foster stronger relations with other organizations in an effort to create greater coherence in Canada's efforts in scientific research and commercialization. In that context, the ACST will work closely with the Minister of Industry and Canada's new National Science Advisor as it continues to explore and debate emerging policy issues related to Canada's future research and innovation capacities.

For further information on the ACST, please visit their Web site at www.acst-ccst.gc.ca

2.2 COUNCIL OF SCIENCE AND TECHNOLOGY ADVISORS — ACTIVITIES IN 2003

Since its inception, the CSTA has addressed a number of issues related to enhancing the strategic management of federal S&T, exploring these issues in a series of reports delivered to the federal Cabinet and subsequently released to the public. The Council has provided advice related to: the effective use of science advice in the government's decision-making process; the roles of the government in performing S&T, and the fundamental principles to guide the conduct of

federally performed and funded S&T; the foundations and pillars of excellence to define government S&T; characteristics and practices to maximize the contribution of the SBDAs' external science advisory bodies; and the means to ensure the attraction and retention of high-quality government S&T employees.

In 2003, the CSTA presented its sixth report to the federal Cabinet, *Science Communications and Opportunities for Public Engagement (SCOPE)*. In this *SCOPE* report, the CSTA maintained that effective communication of S&T information and issues is fundamental to Canada's economic and social well-being. As a key player in the national science and innovation system, and as a democratic government responsible to its citizens, the federal government has a duty to communicate openly and effectively about its S&T and S&T-informed policy, why and how it does science, how it uses science, and the impacts of this science on Canadian citizens and society.

The CSTA suggested that S&T communications in government have tended to be interpreted as unidirectional action, communicating *to* an audience in order to increase awareness, educate and persuade. In its *SCOPE* report, the Council suggested that this concept of communications be expanded to encompass the idea of communicating *with* citizens, engaging them in dialogue, deliberation and decision making. Referring to this as participatory communications, the CSTA noted the importance of inclusiveness and consideration of the local knowledge and expertise of various geographic, cultural and interest-based communities.

In the *SCOPE* report, the CSTA identified the foundations, guiding principles and

best practices of effective federal S&T communications, and proposed guidelines for the preparation of departmental S&T communications strategies. In its conclusions, the CSTA recommended that federal science-based departments and agencies:

- embrace the concept of participatory communications, whereby audiences are engaged in dialogue, deliberation and decision making;
- adopt communications as an integral part of the management of conduct of S&T and S&T-informed policy, integrating communications planning early in the S&T cycle;
- develop comprehensive S&T communications strategies to complement and support the conduct of S&T, respecting the principles and best practices outlined (see the box on this page); and
- invest in S&T communications planning, training and delivery, in order to foster excellence in S&T communications.

In 2003, at the request of the federal Cabinet, the CSTA also initiated work on a study of federal S&T linkages, examining how the federal government can foster closer S&T ties among departments and with industry and academia, in the pursuit and use of S&T for mutual interest and benefit. The CSTA believes that, through linkages, the government can engage the full capacity of the national science and innovation system, and draw on the most appropriate expertise, experience and resources, wherever they reside, in order to more effectively address and resolve national issues. The Council's report on federal S&T linkages is expected in 2004.

Guiding Principles and Best Practices

In its report *Science Communications and Opportunities for Public Engagement*, the CSTA identified guiding principles and best practices of effective federal S&T communications. These included recommendations that the government do the following:

- Build its S&T communications around issues that are informed by S&T, rather than around the specifics of the S&T itself. Position these S&T-related issues in the context of the public agenda, and link them to broader economic, social, environmental, and other concerns.
- Practice transparency about the mechanisms and processes it employs in the management and conduct of its S&T and S&T-informed policy, and about the processes by which decisions are reached.
- Practice openness in its S&T communications, defined as the willingness to put information, ideas and debate in the public realm. Empower authorized government employees to communicate freely with the public.
- Balance transparency and openness appropriately with accountability. The government has a responsibility to ensure that all S&T communications emanating from all internal sources are appropriate and accurate. It must retain the ability to restrict the release of information in the public interest when full disclosure will jeopardize national security, violate personal privacy, break an intellectual property agreement or pose undue risk to the public.
- Build relationships with stakeholders, striving to foster mutual confidence and respect. Be inclusive, incorporating the diverse perspectives and local expertise of different sectors, cultures and geographic areas.
- Seek continual improvement through evaluation of its S&T communications strategies.

All of the CSTA's published reports, as well as supporting documentation, can be found on the CSTA Web site, at www.csta-cest.ca

2.3 CANADIAN BIOTECHNOLOGY ADVISORY COMMITTEE — ACTIVITIES IN 2003

In 2003 the CBAC initiated a major project on biotechnology and health innovation to assess the institutional changes that are required to ensure that Canada maximizes the adoption of beneficial health biotechnologies and minimizes the risks associated with them. The report and its recommendations, which were released in December of 2004, are based on research and expert consultation, and will assist governments in assessing the adequacy of current policies and programs. The year 2003 also saw the completion of a new tool, designed to support productive dialogue and increased understanding of the issues related to genetically modified (GM) foods and feeds. The need for this dialogue tool became apparent during the CBAC's earlier work on the regulation of GM foods, when diverse perspectives were expressed but lacked a structured format to facilitate discussion. The CBAC supported an exploratory committee composed of representatives from stakeholder groups — industry, the supply chain (farmers, producers and retailers), consumers, faith and public-health interests, and environmentalists — to develop a made-in-Canada approach to talking about biotechnology. Called the Dialogue Tool, this instrument promises to be an important part of the citizen-engagement toolkit.

In 2003 the CBAC also significantly augmented its communications and outreach activities as part of its mandate to make the CBAC and its work more visible to the public. These endeavours included an enhanced Web site, a new kiosk and expanded exhibit program, and participation in key forums and conferences.

The CBAC also launched a new quarterly newsletter, *Biotech Watch*, designed to inform a broad audience of key developments in biotechnology and their implications, and to keep readers up to date on the CBAC's own projects.

Further information on the CBAC can be found at www.cbac-cccb.ca

2.4 CANADIAN BIOTECHNOLOGY STRATEGY

Biotechnology refers to a set of biological techniques that use living organisms or their constituent parts to make a product or run a process. This technology presents an exceptional economic opportunity for Canada in the 21st century. Applications of biotechnology are far-reaching and will fundamentally change traditional approaches to health care, agriculture and environmental sustainability. To date, biotechnology's greatest impact globally is in health care, with more than 90 percent of the advanced biotechnology products on the market related to health.

The CBS was established by the Government of Canada in 1998 to provide an overarching framework to guide government initiatives in this area. The Strategy is designed to integrate social, ethical, health, economic, environmental and regulatory issues in order to achieve the following vision: "To enhance the quality of life of Canadians in terms of health safety and environmental, social and economic development by positioning Canada as a responsible world leader in biotechnology."

Investments in S&T and R&D have established Canada as a world-class player in the global quest for new knowledge that uses biotechnology to solve major

problems and that capitalizes on the technology to improve quality of life. In 2003 the federal granting councils, Genome Canada, the Canada Foundation for Innovation, and the Networks of Centres of Excellence, continued to provide the support necessary to train researchers, develop infrastructure, create research teams and carry out research projects that form part of the discovery and innovation cycle leading to new products and processes on the market. The intramural science conducted by the National Research Council Canada and by federal departmental laboratories (e.g. the intramural Genomics Research Program) contributed to the wealth of biotechnology activity in Canada. These organizations are the science foundations on which Canada's success in biotechnology is built.

Biotechnology is being targeted by most industrialized countries as one of the most important drivers of jobs and economic and social progress in the 21st century. Canada is currently home to more than 400 bio-based firms. The growing importance of biotechnology applications requires world-class business and regulatory regimes that nurture innovation and build public trust and confidence. Critical to this business climate are Canada's marketplace frameworks and the talent — highly qualified people — who can capitalize on a competitive business climate. Canada's biotechnology sector is facing key challenges in financing, regulatory approaches and skills. In 2003 progress was made in key areas to support the Canadian advantage in biotechnology. Efforts were directed, in particular, at enhancing stewardship and regulations and improving Canadian competitiveness.

The social and ethical implications of biotechnology are a prominent feature of the CBS. In 2003 work was completed on genetic information and privacy that provided in-depth analysis of existing Canadian legislation and the protections it offers the public. The first phase of the multiyear Biotechnology and Human Rights Framework project was initiated in July 2003. Researchers are examining current and future biotechnology applications to see if they raise any human rights issues and if the existing human rights framework addresses these issues.

A feature of biotechnology that distinguishes it from other technological innovations is its basis in genetic manipulation and, consequently, the strong — and, at times, polarized — views in society about some applications of this technology. Public opinion research (POR) is an important tool used by the CBS to take the pulse of the public on current and emerging issues. Canada's POR database is one of the most comprehensive in the world, resulting in international interest in partnering with us to better understand public opinion and to compare countries around the world. In 2003, large-scale surveys of Canadian public opinion on emerging technologies, including genomics and nanotechnology, and of Canadian and U.S. residents' attitudes towards biotechnology, were completed. These studies indicated support in Canada for biotechnology rising over time, with U.S. residents slightly more supportive in general. Details on the POR can be found at www.biportal.gc.ca

MOVING FORWARD ON COLLABORATIVE SCIENCE AND TECHNOLOGY

Federal S&T is There for Canadians

Federal science and technology (S&T) contributes directly to a broad range of outcomes that Canadians expect from their government — that is, enhancing human health, assuring national security, improving economic strength, sustaining the environment, and advancing the quality of life. It provides information affecting the daily lives of Canadians, such as weather warnings and food safety, and brings to life new ideas and technologies with global implications, such as the heart pacemaker and telecommunications satellites.

A Solid Foundation to Build On

The 1996 federal strategy, *Science and Technology for the New Century*, outlined the federal government's approach to the development of federal S&T policies and programs and to the enhanced management of S&T. It served as an important catalyst for improving federal S&T performance. Its principles continue to be relevant as the demands placed on federal S&T change and evolve. As a result of the strategy, federal-government scientists and researchers have forged stronger links with each other, as well as with the

broader Canadian and international S&T communities. The governance and advisory mechanisms put in place as a result of the strategy have helped shape new ways of doing business for federal S&T.

The establishment of the Council of Science and Technology Advisors (CSTA) in 1998, in particular, has provided a valuable independent, external perspective on the government's approach to S&T. Its first report on science advice formed the basis of the federal *Framework for Science and Technology Advice*. Subsequent advice from the CSTA has focused on other aspects related to promoting excellence in federally performed S&T.

The Role of the Federal Government in Performing S&T

The CSTA identified four core roles of federally performed S&T, distinct from that conducted by the other participants in the national innovation system — industry, academia and not-for-profit organizations. The CSTA concluded that the unique and essential role of the federal government is in performing public-good S&T, that is, undertaking activities that focus on protecting and advancing the

public interest on behalf of Canadians. Science-based departments and agencies (SBDAs) agree with the following roles:

- Support for decision making, policy development and regulation.
- Development and management of federal and international standards.
- Support for health, safety and security, and environmental needs.
- Enabling economic and social development.

In carrying out these roles, the federal government is continually engaged with other participants in the national innovation system, and with members of the international S&T community. Such linkages are key to the effective functioning of the national, regional and local systems of innovation.

In addition to the direct role it plays in these systems as a performer of S&T, the federal government also has several indirect yet critical roles as a leader, funder and facilitator. For example, the federal government provides grants for academic research, research chairs and research infrastructure, as well as tax credits for industrial research and development (R&D). It also supports innovation systems through several other critical activities, such as infrastructure, information systems, industrial and trade policy, regulatory systems, training and intellectual property rules.

An Evolving Context for Federal S&T

In keeping with the roles of the federal government in S&T, the CSTA's reports also provided thoughtful analysis of the evolving context for federal

S&T. It is a context characterized by the following:

- rapid changes in S&T knowledge and capacity worldwide;
- an aging workforce;
- competing demands for government resources to attract a new generation of scientists and researchers, and to maintain and upgrade facilities and equipment; and
- increasing public expectations for S&T to provide the answers to complex challenges that reach across jurisdictions and disciplines, such as climate change, stem-cell research, food safety, national security and the threat of epidemic diseases.

S&T is becoming increasingly central to our lives, and global advancements are proceeding at a rapid pace. As Canada strives to increase its international ranking in R&D performance, the volume of activity in the national innovation system will have to increase, thereby increasing pressures on the overall S&T system.

Challenges and Responses

The 2002 Speech from the Throne (SFT) committed the Government of Canada to strengthening the contribution of federal science resources by integrating efforts across departments and disciplines, and focusing on the priorities of Canadians. This commitment recognized citizen expectations that resources will be directed to producing results for Canadians on national priorities. It also recognized that an integrated approach to federal science management is required to have good science advice for complex national issues that cross traditional departmental boundaries and

to recognize the context of increasing convergence across scientific disciplines.

SBDAs have recognized these imperatives and have continued the work begun before the SFT commitment to develop policy and program responses. Through this dialogue, consensus emerged across SBDAs on principles and practices for collaboration, and integration of science efforts across departments. This consensus is reflected in a common vision for federal S&T, produced at a national forum involving scientists, science managers and policy advisors from across Canada. The vision was adopted by the deputy ministers of SBDAs and has six main elements:

- identify emerging issues important to Canadians and refocus efforts on them;
- mobilize resources to seek solutions;
- integrate across disciplines and departments, with policy and with external partners;
- contribute to better policies and delivery of superior services;
- attract, develop and support outstanding scientific experts; and
- be a prime source of credible, useful and trusted information.

To further address the challenges issued, SBDAs spent 2003 looking pragmatically at the S&T system. They examined ways in which they could increase collaboration in order to facilitate a more consistent and integrated approach to S&T across the government. This effort was underpinned by their desire to maximize the federal S&T effort and ensure that it will continue to provide world-class knowledge, credible scientific advice, critical science-based services, innovative

technology for Canadians in an increasingly competitive global marketplace. SBDAs began by asking and addressing some challenging questions. Two facets in particular were examined: human resources and, more broadly, maximizing the federal S&T effort. Together, SBDAs have started to take collaborative action to address key issues in these areas.

3.1 HUMAN RESOURCES

People are fundamental to the federal government's ability to deliver on its S&T responsibilities. Its ability to effectively recruit, develop and provide support to talented S&T personnel, and to invest in the resources needed to attract, develop and support them in the performance of consistently excellent work, is critical.

In each of the CSTA's reports to date, human resources was identified as one of the most critical challenges facing federal S&T. In 2002, the CSTA released *Employees Driving Government Excellence: Renewing S&T Human Resources in the Federal Public Service (EDGE)*. The federal S&T workforce, as described in *EDGE*, consists of more than 21 000 employees representing approximately 17 percent of the public service.

SBDAs have, for several years, managed cross-cutting human resources issues facing federal S&T employees through a common scientific-community approach. The resulting benefits include recognition of the common vision, sharing of best practices, creation of multidisciplinary teams to work on horizontal S&T issues, and the colocation of S&T workers.

Most recently, in an attempt to begin to address some of the key S&T human resources issues facing the federal government, SBDAs asked the following questions, and partnered on a wide range of

projects and initiatives in order to address these fundamental challenges.

- How do we address recruitment and retention?
- How do we address the specialized learning needs of federal S&T employees?
- How do we improve communications within the federal S&T enterprise?

These initiatives, many ongoing over several years, are designed to strategically address the unique human resources needs of the S&T workforce.

Addressing Recruitment and Retention

The federal government's ability to effectively recruit, develop and provide support to talented S&T personnel will greatly affect its ability to fulfill the federal role in the innovation system.

A coordinated approach to recruitment was funded in 2003 as part of HR Modernization. It seeks to simplify and expedite external and internal recruitment for the S&T workforce, within the framework of existing legislation and anticipating the implementation of Bill C-25, the *Public Service Modernization Act*. The design goals for the project offer the additional benefit of considerable cost savings for departments and agencies who avail themselves of this staffing route, while, at the same time, ensuring that the unique needs of SBDAs and their S&T employees are addressed.

A new career-progression framework for Canada's federal research scientists has been in development for several years now. When it is completed, S&T employees will have a modern career-progression tool that reflects the

values of science and is aligned with the vision for federal S&T.

Employment Equity initiatives include two special projects of note. To address the goal of increasing the participation and awareness of Canada's Aboriginal youth interested in careers in S&T, development is continuing on an Aboriginal Youth Initiative. In 2003 this initiative, in collaboration with the Canadian Aboriginal Science and Technology Society (CASTS), worked to promote awareness of federal S&T, expanding the project Web site (www.casts.ca), and produced a guide entitled *CASTS' 2003 Student's Guide to Education and Employment*. In 2003 a renewed effort in support of the recruitment and retention of women in S&T was undertaken with the naming of both a federal champion and working-level champions in S&T community departments and agencies. An emphasis on regional networking and effective problem solving led to an S&T workplace-analysis workshop based on organizational health principles. The workshop, a component of the larger Hypatia Project (named after the scientist Hypatia of Alexandria), was held at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. In addition, a specialized chapter for women in federal S&T was commissioned for the recently published *Becoming Leaders: A Handbook for Women in Science, Engineering and Technology*.

Addressing Specialized Learning Needs

Three key initiatives illustrate efforts to address the specialized learning needs of the federal S&T workforce.

Leading Scientific Teams, a course designed and delivered in cooperation with the Canadian Centre for Management

Development (CCMD), went from development to full production and was offered in five sessions across Canada. This course works to foster a new generation of science managers and is designed to complement the management continuum of leadership in the federal public service. In 2003 close to 100 S&T professionals who took the course expressed a very high degree of satisfaction, and the course is now established in the CCMD calendar.

In order to address the learning needs of all workers in the community strategically, a full mapping of those learning pathways is needed. The S&T community embarked on the development of a tool for S&T professionals, called the Learning Continuum, along with the provision of a tool box of aids to assist all employees to both plan and advance their S&T careers. This roadmap to learning will also allow the S&T community to identify strategies and tools to address gaps that can be effectively addressed on a community-wide basis.

In recognition that continuous learning for the S&T workforce is primarily experiential in nature, and that the major barrier to finding experiential learning opportunities for many federal S&T workers is knowing of them, a pilot project called the Science Opportunities System (SOS) was initiated. Using partner funding from the National Joint Career Transitions Committee, an adaptation of the existing Career Opportunities System was developed. The first step was a workshop where 60 participants, comprising the full spectrum of S&T leaders, researchers, support workers, bargaining-agent representatives and human-resources personnel, designed the SOS to meet

their needs. Interested S&T workers and project leaders across all participating organizations will be linked using this learning and mobility tool according to their interest in science activities — most notably, those activities in emerging priority areas. SOS provides opportunities to learn across a much broader set of possibilities than one department or agency could provide, and will be particularly effective in regional settings.

Maintaining and Improving Communications

The Federal S&T Community Web site (www.sciencetech.gc.ca or intranet.sciencetech.gc.ca) has remained the primary communications tool since its creation for the 2002 Federal S&T Forum. The site contains the evolving strategic plan, objectives and priorities for two Assistant Deputy Minister (ADM) committees: the Science ADM Advisory Committee and the ADM S&T Integration Board.

The increasing demand for information from the site has led to enhancements. Web corners for the Employment Equity initiatives (Aboriginal Youth Initiative, Women in S&T, and Science and Technology Abilities Recruitment and Retention) were launched and then expanded. An intranet-only subsite to support the Recruitment pilot project was also developed.

During 2003 the communications strategy for the whole community was revised and expanded, with detailed plans prepared for additional projects such as the Learning Continuum and the Recruitment pilot project. Communications remains a key challenge to be addressed for all S&T efforts undertaken at the community level.

3.2 MAXIMIZING THE FEDERAL SCIENCE AND TECHNOLOGY EFFORT

In 2003, SBDA came together to identify ways to improve the management and delivery of federal S&T and, in doing so, raised a number of challenging questions and attempted to address them through a number of collaborative initiatives. The questions included:

- In light of increasing pressure on the system, how can we continue to meet our scientific and technological needs?
- How do SBDA encourage better horizontal collaboration in federal S&T?
- How do SBDA ensure a consistent and integrated approach to federal S&T?
- Are there fundamental principles that should guide the federal S&T effort?
- What are the necessary features of an environment that promotes and supports the principles of federal S&T?

Meeting Our Scientific and Technological Needs

Since 1997, S&T spending for federal intramural S&T has increased steadily. However, the federal government's share of total national spending has declined, as spending for university research has grown at a faster rate. Departments are facing budget shortages in attempting to address their mandated departmental and government priorities. There appears to be a general trend of resources being stretched to meet an expanding set of demands on federal S&T.

To cope with this pressure on the system, federal departments are actively seeking out new ways to meet their scientific and technological needs. These include

working more efficiently internally, collaborating with other federal departments and agencies, and reaching out to the private sector, universities, and government and private sources around the world.

Encouraging Better Horizontal Collaboration in Federal S&T

Federal SBDA have, over the past few years, explored numerous options for encouraging better horizontal collaboration. These options have ranged from proposals for competitive processes to fund S&T infrastructure through to complex proposals for new mechanisms to organize and govern cross-government S&T initiatives. In a climate of limited new resources for government operations, and competition for S&T-related resources with universities and the private sector, none of the proposals have found favour.

In this context, federal departments and agencies are now exploring collaborative models that do not require new funds — they are exploring ways to tackle key public policy issues that cross departmental mandates through innovative sharing and pooling of resources, and joint planning and decision making. These activities are being promoted across SBDA by the ADM S&T Integration Board.

Ensuring a Consistent and Integrated Approach to Federal S&T

A key challenge faced by SBDA has been to facilitate a consistent and integrated approach to S&T across the government. In this way, the public's investment in S&T will continue to provide world-class knowledge, credible scientific advice, critical science-based activities, and innovative technology for Canadians. A more integrated approach could build

on the many examples of good practices already in place in SBDA's; demonstrate the federal government's commitment to an S&T system based on excellence and continuous learning and improvement; promote more effective horizontal management of cross-cutting issues that touch on both departmental mandates and government-wide priorities; create greater economic benefits from spin-off opportunities for commercialization of government-discovered S&T applications; and allow for the application of more consistent mechanisms for promoting greater accountability in the use of federal S&T resources.

In 2002 there were significant efforts to develop program-based approaches to strengthening federal S&T capacity (see *Science and Technology Advice: A Framework to Build On, A Report on Federal Science and Technology — 2002*). The following year, 2003, was characterized by a more pragmatic approach, fostering collaboration and integration based on the existing activities, authorities and spending of SBDA's. In June 2003, the ADM S&T Integration Board was established by the ADMs of the major SBDA's to lead the integration of S&T on cross-cutting issues across federal departments and agencies. The challenge facing the Board is to create an environment where, even in the absence of new funding, existing S&T resources are continually realigned and linked across departments to achieve national goals.

Over the latter half of 2003, the Integration Board developed a portfolio of horizontal initiatives based on an integrative, collaborative approach. The 10 SBDA's represented on the board have made good progress in defining programs that they will develop and nurture according to

their operating principles. A workshop in November 2003 led to the identification of six areas of pressing policy importance for which new or strengthened cross-government S&T efforts were needed:

- water;
- the impact of climate change on natural resources;
- wildlife diseases;
- invasive alien species;
- northern S&T; and
- oceans management.

The Integration Board has taken on the role of facilitator for these initiatives by providing a focal point within departments, identifying and trying to reduce barriers to collaboration, and enhancing communications around those issues.

At the same time, member departments of the Integration Board, together with client departments and agencies and the U.S. Department of Homeland Security, developed the Public Security Technology Program, which was implemented in 2004. The Integration Board also assumed the role of steering committee for the S&T Cluster of Government On-Line, and began work on an inventory of existing collaborative S&T programs, in order to demonstrate that SBDA's are working together and using resources efficiently on a range of issues.

Case Studies of Integration

Success Stories

Chemical, Biological, Radiological, Nuclear Research and Technology Initiative

In 2003 the Integration Board conducted a case study of the five-year, multistakeholder Chemical, Biological, Radiological,

Nuclear (CBRN) Research and Technology Initiative (CRTI), launched as part of the 2001 comprehensive security package. With a budget of \$170 million, the CRTI was designed to significantly enhance Canada's capacity to deal with potential chemical, biological, radiological and nuclear threats to public security. This case study serves as a success model for further efforts in integration, demonstrating successful practices, ongoing challenges and key lessons learned.

The CRTI is an interdepartmental collaboration, with all participants having been involved in identifying the needs to improve Canada's ability to respond to CBRN threats, and select those proposals that best lend themselves to meeting those needs. Its mandate is to implement the following recommendations, as funded by Budget Plan 2001, which include strengthening coordination and collaboration of capacity, capabilities, research, and technology plans and strategies by:

- creating clusters of federal labs as elements of a federal-laboratory response network that will build S&T capacity to address the highest-risk terrorist-attack scenarios;
- creating a fund to build capability in critical areas, particularly those identified in the scenarios that address biological and radiological attack;
- accelerating technology into the hands of the first-responders community and other operational authorities; and
- providing funds to those areas where national S&T capacity is deficient, owing to obsolete equipment, dated facilities and inadequate scientific teams.

Preliminary evaluations of the implementation of the CRTI identified the following:

- an articulate visionary in senior scientific leadership;
- a comprehensive vision;
- a highly credible multidisciplinary team with strong leadership;
- consultation mechanisms for obtaining and maintaining key stakeholder buy-in; and
- a detailed action plan for an operational implementation manifest in the framework document.

There were four significant innovations in the CRTI's implementation:

- bringing together disparate communities (S&T and intelligence) to work on the risk assessment;
- establishing laboratory clusters with multiple federal S&T departments and agencies and with non-traditional partnerships;
- continuing to demonstrate incremental levels of collaboration among stakeholders; and
- shifting from the policy development role of S&T to one of federal S&T leadership.

In the first year of operation, the CRTI managed two rounds of project selections totalling \$75.2 million for research and technology and technology-acceleration projects, and \$20.2 million in technology acquisitions for federal laboratories. The reach has been expanding into the broader CBRN community, both nationally and internationally, through workshops and other opportunities.

Toxic Substances Research Initiative

In 2003 the Integration Board conducted a case study of the four-year Toxic Substances Research Initiative (TSRI) established by the federal government in 1998 in response to a Red Book commitment. With a budget of \$40 million, its overall objective was “to enhance the knowledge base needed to define and reduce ecosystem and human health effects of toxic substances in Canada.”

Additional objectives were to:

- strengthen and accelerate delivery of science to national policies and priorities on toxic chemicals;
- identify emerging issues and respond in a timely fashion;
- enhance the ability of federal departments and agencies to carry out their responsibilities to manage toxic substances;
- enhance cooperation between researchers engaged in research on toxic substances; and
- strengthen Canada’s contribution to international programs on toxic substances.

The ministers of Health and Environment were jointly responsible for the TSRI and, for purposes of administration, a small secretariat was established in Health Canada. Of the 340 research projects that were received, 99 were supported under the initiative in five priority research areas: persistent organic pollutants; metals; endocrine-disrupting chemicals; urban air; and cumulative effects of toxic substances.

The TSRI encouraged collaboration between researchers in federal departments and other institutions, allowing the government to gain access to external

expertise and facilities. Non-government researchers received 60 percent of the funds, while 40 percent went to federal researchers. The majority of the funded projects involved government and non-government partnerships; others included university partners only.

The case study concluded that the TSRI model worked well and could be applied easily to other government programs where research is needed to support policy development and programs. In particular, the Integration Board was pleased that the conclusions demonstrated the program’s strength, as it provided funding to both government and non-government researchers, increasing the government’s access to Canadian expertise in addressing its policy and program needs, and leveraging funding from other sources.

Fundamental Principles to Guide the Federal Science and Technology Effort

In 2003, SBDA’s explored a number of fundamental principles originally proposed by the CSTA in its reports. They agree that these should guide the federal S&T effort and be applied in planning, managing, performing and funding S&T. They build on the 1996 Federal S&T Strategy and provide sufficient flexibility to allow for the evolution of federal S&T in response to new challenges and opportunities. The principles include:

- Alignment: Federal S&T must reflect and be supportive of the priorities of Canadians.
- Linkages: Federal S&T must be built on effective collaborative relationships.
- Excellence: Federal S&T must incorporate the highest standards of excellence.

An Environment that Promotes and Supports the Principles of Federal Science and Technology

SBDAs also explored the features of an environment that promotes and supports the above-mentioned principles of federal S&T. An enabling environment of people, policies and infrastructure is needed to ensure that the guiding principles for federal S&T can be applied within individual SBDAs and across the government. Attention to the enabling environment will help ensure that the federal government has a dynamic, high-calibre internal S&T workforce; strong relations with Canadians on S&T issues, based on engagement; and the necessary facilities and equipment to address its S&T roles. Features of this environment include:

- people;
- leadership;
- management;
- engagement; and
- S&T infrastructure.

These features and the above-mentioned principles will be expanded upon over the next year as part of the Government of Canada's response to the CSTA's advice.

3.3 THE WAY FORWARD

This report provides a retrospective on federal S&T activities in 2003. In particular, the focus of this year has been one of looking pragmatically at the federal S&T enterprise, and finding ways to work better collaboratively and more effectively.

Like any large enterprise, federal S&T has its challenges. Federal S&T does not exist as a single entity, but as a number of departments and agencies that all share the commonality of federal S&T.

Recent collaborative initiatives, such as the ADM S&T Integration Board and the interdepartmental effort to respond to the CSTA's advice, are helping to unify SBDAs.

While a number of successful collaborative initiatives are under way that address both human resources and maximizing the federal S&T effort, more is still to be done. Further strengthening of the federal S&T enterprise will result from the formal adoption of the federal S&T roles, guiding principles for federal S&T, and features of a supporting enabling environment across SBDAs.

Adoption of these key directives will facilitate a more consistent and integrated approach to S&T across the government by building on the many examples of good practices already under way in SBDAs. Their application will help build public confidence in government decision making, and in the calibre and accountability of the federal S&T process. Canadians will know that their investment in federal S&T is aligned with broad societal priorities, that it is more effective and efficient through collaborative approaches, and that it embraces the highest standards of excellence.

The federal S&T roles, principles and features of a supporting environment build directly on the 1996 federal S&T strategy, *Science and Technology for the New Century*, which provided a strong guiding foundation for federal S&T in its initial years. We anticipate that when these key directives are coupled with the guiding ideas from the 1996 strategy, the federal S&T enterprise will be strengthened as the demands placed on it continue to change and evolve into the future.

AGRICULTURE AND AGRI-FOOD CANADA

In 2003, Agriculture and Agri-Food Canada (AAFC) implemented its new Agricultural Policy Framework, which sets out a comprehensive national policy agenda with common national goals, and calls for an active partnership between governments, the agriculture and agri-food sector, stakeholders, and citizens. Integrated action across the framework's five key elements — food safety and quality, environment, science and innovation, renewal, and business risk management — uniquely positions Canada for world leadership in food safety and quality, environmentally responsible production, and innovation.

However, world leadership in these areas would not be possible without significant science and technology (S&T) support. The AAFC requires scientific knowledge and evidence to develop regulations, policies and programs, and to provide information, products, and services to Canadians.

Accordingly, the AAFC has created horizontal teams to realign and integrate departmental efforts to achieve the strategic outcomes identified in the policy framework. As a result, the AAFC scientific research and development (R&D) efforts are now tied to strategic outcomes within the policy framework and are fully integrated into the departmental horizontal governance structure.

In an effort to ensure accountability for results and to foster informed, science-based decision making, an external Science Advisory Panel (SAP) was created to review the management of science within. The SAP confirmed that science is fully integrated into the department, and that it supports the key roles for government in performing S&T. In addition, the SAP made recommendations for improvements that would position the department to strengthen Canadian science capacity for agriculture and food. These recommendations are the foundation upon which the AAFC has been building the following comprehensive strategy for science over the past year.

The AAFC's science strategy aims at strengthening Canada's science capacity for agriculture and food to ensure the ability of government and the department to fulfil their roles and responsibilities on behalf of Canadians and the agriculture and agri-food sector.

This strategy has five key objectives:

- Ensuring strategic alignment;
- Achieving science excellence;
- Accelerating adoption and commercialization of scientific and technical knowledge;
- Developing science capacity; and
- Building understanding and engagement.

1. Ensuring Strategic Alignment

The AAFC will apply strategic criteria to ensure alignment of scientific and research efforts with government and department priorities.

Strategic criteria will ensure that:

- the research represents an appropriate role for government;
- projects are targeted to strategic priorities;
- there is a realistic potential that research will contribute to sustainable sector profitability and growth; and
- those best positioned are selected to conduct this research.

An external validation mechanism, namely the Science Advisory Board (SAB), will review the strategic relevance of departmental science and research efforts. The SAB, composed of a variety of scientific sources and experts from relevant disciplines, will provide strategic advice to the Deputy Minister regarding the relevance of the AAFC science priorities, national science programs, and supporting strategies. In addition, an external program review mechanism will be established to advise the departmental horizontal teams on the relevance and impact of the scientific and research efforts supporting team outcomes.

2. Achieving Science Excellence

The AAFC will apply operational criteria to the projects that have passed through the strategic filter, to ensure sound science.

Operational criteria will ensure that:

- the science is credible and feasible;
- the probability of success warrants the cost; and
- the project team has access to the right skills and capital assets, directly or through partners, to successfully carry out the proposed research.

An external due diligence mechanism, namely the Science Peer Review (SPR), will validate the scientific excellence of departmental scientific research projects. The SPR will advise the AAFC national science program leaders on the excellence of the AAFC scientific research prior to project initiation and funding, and again upon completion.

3. Accelerating Adoption and Commercialization of Scientific and Technical Knowledge

Intellectual property and commercialization strategy objectives:

- Increase the adoption and commercialization of scientific and technical knowledge by helping move discoveries from the lab to the marketplace to, ultimately, create jobs and growth in Canada.
- Manage intellectual property to foster public good, attract investments in science, and promote innovation that contributes to economic growth and profitability.

International science strategy objective:

- Build international science and technical capacity through enhanced international science and innovation cooperation in agriculture and agrifood.

4. Developing Science Capacity

The objective of the AAFC strategy for developing science capacity is to ensure that departmental science and research resources are developed in a way that optimizes the synergies between national science and research providers and builds on the significant federal investments that have already been

made. The AAFC strategy to develop science capacity consists of the following three interrelated elements:

Human Resources Strategy Objectives:

- Short term — recruit highly skilled researchers from university science departments.
- Medium term — retain researchers, by planning for succession, maintaining capacity in core areas, facilitating a research career path, supporting postgraduate and postdoctoral programs, building interdisciplinary links among researchers, and connecting these to research institutions, universities, etc.
- Longer term — attract prominent young researchers into scientific careers in the agriculture and agrifood industry.

Capital Assets Strategy Objectives:

- Ensure scientists have access to state-of-the-art infrastructure, technology and equipment.
- Leverage existing federal investments and promote synergies, thus reducing infrastructure costs, allowing a reallocation of funds to support further research.

Collaborative funding mechanisms objective:

- Develop and implement federal leadership through funding mechanisms that provide incentives for increased collaboration and pooled knowledge and resources among research institutes, colleges, universities, and government, to further optimize national capacity to undertake research that is increasingly multidisciplinary, collaborative, and sophisticated.

5. Building Understanding and Engagement

Communications strategy objective:

- Communicate the results and benefits of the AAFC's investment in science and research, to enhance understanding of the significance of science, and to engage Canadians, governments, and S&T providers in discussions and decision making on scientific-related issues.

The AAFC will increase:

- Private sector and non-government collaboration — partnering with universities, research institutes and industry will create synergies that will increase our capacity to undertake research that is increasingly multidisciplinary, collaborative and sophisticated.
- Intergovernmental collaboration — engaging provinces, territories, cities and municipalities in collaborative relationships will foster economic and social development.
- Interdepartmental collaboration — increasing interdepartmental collaboration will help the government to develop a team approach, as well as eliminate overlap and duplication and achieve better results at lower costs.
- International collaboration — increasing international cooperation will position Canada competitively within emerging international regulatory standards and intellectual property regimes.
- While this strategy provides a roadmap to strengthen Canada's science capacity for agriculture and food, the success of this strategy depends on the AAFC's ability to re-engage the various players in a national science agenda through increased collaboration.

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ATLANTIC CANADA OPPORTUNITY AGENCY

Innovation is one of the Atlantic Canada Opportunity Agency's strategic priorities with a focus on strengthening the innovation capacity and performance of the Atlantic Canadian economy through the adoption/adaptation of leading-edge technologies, the development and commercialization of new technologies, and the growth of strategic sectors/clusters. ACOA's "vision" for innovation in Atlantic Canada is a region that is recognized for its innovative capacity and its competitiveness in global markets, with an environment conducive to innovation by SMEs.

ACOA launched the Atlantic Investment Partnership (AIP) in June, 2000. The AIP is a \$700 million initiative, a major component of which is the \$300 million Atlantic Innovation Fund (AIF) which was designed to strengthen the Atlantic economy by making strategic investments in leading-edge research and development that directly contributes to the development of new technology-based economic activity in Atlantic Canada. In Round II of the program, a total of 174 project proposals were received, (80 commercial and 94 non-commercial), requesting \$545 million in AIF funding towards total project costs of just over \$1.0 billion. The second round was completed in September/October, 2003 and the Agency announced AIF funding for 54 projects for \$135 million. The following three projects are examples of the type of research funded under the AIF.

- The Institute for Nutrisciences and Health (INH) was established in July, 2003 to become the cornerstone of an Atlantic Canada knowledge-based bioresource cluster in Charlottetown, Prince Edward Island. The focus of the INH will be the discovery, development and commercialization of high-value bioactive compounds for human and animal health and nutrition, derived from a diversity of renewable bioresources and based on sustainable development concepts. ACOA is actively working with its partners, including the National Research Council (NRC), to develop a formal 5-year project implementation plan based on NRC requirements. In Round II of the AIF, the University of Prince Edward Island was awarded \$6.15 million to conduct research activities to be conducted within the INH, focussed in the area of bioresource innovation.
- With the support of the AIF, the Canada Foundation for Innovation and the Natural Sciences and Engineering Research Council, Dalhousie University, together with its university and private sector partners, is creating a network of world-class materials research capability in Atlantic Canada. The Materials Technology Network for Atlantic Canada (MatNet) involves five Atlantic universities and twelve private companies which are undertaking research projects to address a broad range of new technologies within three themes: Energy and Communication Technologies, Technologies to Monitor and Improve Materials Performance, and Smart/Responsive Materials.

- In July of 2003, ACOA announced \$15.6 million through the AIF for the Pan-Atlantic Petroleum Systems Consortium, an alliance of three Atlantic Canadian universities which is intended to provide an integrated and comprehensive response to the research and skill requirements of the petroleum industry in Atlantic Canada. The members of the consortium, Memorial University, Dalhousie University and the University of New Brunswick, will increase the teaching and research positions specific to oil and gas, develop new undergraduate and graduate programs, and increase the number of graduates conducting research into oil and gas issues. They will also invest in a seismic data visualization centre, underwater vehicles and robotics capability, petroleum basin modeling facilities, a biostratigraphic analytical research facility for sedimentological research, a facility for integrated multi-platform software for reservoir flow simulations, and facilities for research related to gas transport and synthetic fuels.

The AIP also includes the Innovation Skills Development Initiative (ISDI), which was officially launched by the Minister of State in October, 2002, and which is intended to help SMEs incorporate enhanced innovation management and technical skills into their firms in order to make them more productive and globally competitive. Fostering positive changes in SME attitudes towards the benefits of enhanced skills and the ongoing implementation of technology are two important tenets of the initiative. Since its launch in October 2002, there has been a steady increase in demand for the ISDI. Three companies which have benefited from funding support through this program are Testori Americas Corporation, Verafin Inc. and DynaGen Technologies Inc.

- Testori Americas Corporation is a Summerside, PEI, based company involved in the design, development and manufacture of aircraft and mass transit interiors components. The Company required an investment in a new manufacturing process known as Resin Transfer Moulding (RTM) which allows the company to increase efficiencies and to, in turn, compete with the larger global competitors. The Company also required a large investment in CATIA software, a CAD system used in aerospace and mass transit industries which allows Testori to interface electronically with Bombardier and Alstom.

ACOA provided support to strengthen the skills of existing management and senior technical staff in the new manufacturing process and software environment and allows the company to add to its technical capacity.

- Verafin Inc. of St. John's, Newfoundland, with funding from ACOA was able to hire two highly skilled software programmers to enhance its R&D capabilities in the area of anti-money-laundering detection systems. The company is currently developing a product that provides a cost-effective software solution for financial institutions interested in implementing an automated means of assessing suspicious activities within its banking system.
- DynaGen Technologies Inc., founded in Sydney, N.S. in 1992 has become North America's fastest growing manufacturer of power generation controls. The company's singular focus is on products serving the Distributed Power market, which is any small-scale power generation technology that provides electric power at a site closer to customers than central station generation. DynaGen is receiving assistance to hire technical expertise to help the company achieve the technical skills required to increase productivity and competitiveness in the global economy. Advanced automation technology will be essential to the company's product development strategy as this is the only viable technology for the next generation of control products. It is expected that an Automation Systems manager will bring proven knowledge and competencies in automation to spearhead the initiative. Dynagen's ability to target, fund and execute an aggressive R & D program is critical to the company's ongoing success.

The Strategic Community Investment Fund (SCIF) is a component of the AIP which aids communities in creating opportunities for economic development in order to stimulate investment and job creation. Complementing the AIP, is the Business Development Program (BDP), which offers access to capital for SME innovation and adoption/adaptation of leading-edge technology. Under the innovation component of the Business Development Program (BDP), the Agency has funded a number of commercialization/technology projects at Atlantic universities to assist in bringing research from the laboratory to commercialization in the marketplace. The *Regroupement des*

centres de recherche is an example of how these programs are used to support innovation in Atlantic Canada.

- The *Institut de recherche sur les zones côtières*, is a non-profit research institute with the principal objective of providing research centres with adequate facilities and equipment, and enabling sustainable development of resources along coastal zones in the Acadian Peninsula by providing incremental research and development activities as well as scientific analysis services to the business community and industry. The institute's project, *Regroupement des centres de recherche*, groups together three existing research centres. Le Centre de recherche et de développement de la tourbe is actively involved in the development of quality products with the peat moss industry. L' Aquarium et Centre marin, has developed an expertise in shellfish and now plays an important role in the development of aquaculture in the province. Le Centre de recherche et de développement des produits marins is concerned mainly with the development of new products, quality control and added value to marine by-products. All three research centres offer specialized scientific services to the industry: laboratory analysis for quality control, information services, technology transfer, and development of new products and services through research projects in partnership with different government departments and industry. This project is supported by \$2.5 M in funding from the Agency's the SCIF and \$1.0 M from the BDP.

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CANADA ECONOMIC DEVELOPMENT FOR QUEBEC REGIONS

Canada Economic Development for Quebec Regions (CED) focusses on innovation to fulfil its mandate to promote the economic development of the regions of Quebec. The Agency intervenes directly with enterprises, and works with a network of collaborators in every region of Quebec. Through its activities, it aims to reinforce enterprises' innovation capability so that they

can become more competitive in both domestic and international markets. Over the past few years, the CED has significantly increased the proportion of its financial assistance devoted to projects associated with innovation, thus enabling the agency to achieve its objectives and commitments with respect to this national priority.

In 2002–03, the funds invested by the agency in innovation led to the staging of many awareness, capability-development and guidance activities aimed at strengthening the innovation capability of Quebec entrepreneurs. These efforts have meant that close to 350 enterprises have developed and implemented innovation action plans. In this way, many enterprises will now be able to conduct feasibility and diagnostic studies; modernize their business practices; enhance their productivity; or develop and fine-tune new products, manufacturing processes, equipment or innovative technologies. Over the past three fiscal years, the relative share of financial assistance provided by the agency for projects associated with innovation rose from 40 percent in 2000–01 to 57 percent in 2001–02 to 69 percent in 2002–03. The agency also aims to reinforce the marketing and export capabilities of enterprises, especially those that innovate and commercialize their new products in international markets.

The CED tailors its actions in the different regions of Quebec by supporting the establishment of enterprises in economic activities deemed strategic for their region's development. The establishment of strategic enterprises targets the development and consolidation of a critical mass of economic activities in the niches of excellence specific to each region. The niches of excellence on which the agency intends to build have been carefully identified by local economic agents, through the reinforcement of knowledge-based competitive advantages. The agency also offers guidance services to strategic start-up enterprises (primarily technological enterprises).

Finally, the CED coordinates its support for innovation with, among others, the NRC (which helps enterprises through its Industrial Research Assistance Program) and, in particular, the Canadian Technology Network. It also coordinates with the Canada Revenue Agency to inform enterprises about the application of tax credits to R&D expenditures.

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CANADIAN FOOD INSPECTION AGENCY

The Canadian Food Inspection Agency (CFIA) delivers programs and services aimed at safeguarding Canada's food supply and the plants and animals on which safe and high-quality food depends. As Canada's largest science-based regulatory agency, the CFIA relies on sound science for program design and regulatory decision-making and to identify emerging issues. The CFIA supports its business objectives using laboratory science, risk assessment, surveillance, technology development and research.

This work is carried out under three main business lines:

1. Food Safety

The CFIA works closely with Health Canada and Agriculture and Agri-Food Canada (AAFC) and other parties to maintain the safety of Canada's food supply, the Agency's top priority. Each year the Agency conducts hundreds of food recalls using science-based risk assessments. Agency scientists continue to develop and improve tests in an effort to detect harmful substances or organisms in food. In 2003, the Agency developed tests to detect an illegal and toxic colourant in chili powder; bacteria in foods such as salads; and residues in fresh produce, honey and fish. Other key accomplishments included:

- In collaboration with AAFC, CFIA scientists developed and adapted new technologies to detect enteric viruses in various foods. In North America, two-thirds of all food-borne diseases of known origin are caused by viruses.
- CFIA scientists are playing a key role in the largest international study ever conducted on the epidemiology of *Campylobacter* in farm poultry production, including analysis of the role of broiler chickens in human illness. Located in Iceland, this unique study has great potential for future development of on-farm solutions to this leading cause of human enteric disease in Canada and world-wide.

- The CFIA developed a simple, highly sensitive, and specific system for the detection of antibiotic resistance associated with a subspecies of *Salmonella typhimurium*. This system has also been used to develop detection methods for genetically modified organisms in food.
- The CFIA's allergen network developed and validated methodology to detect hazelnuts and brazil nuts in foods, providing test capabilities which previously did not exist and expanding the Agency's surveillance program to include these priority allergens. An assay has been developed for the simultaneous detection of these two nuts as well as peanuts in foods. Undeclared allergens are one of the principle causes of food recalls in Canada.

The CFIA significantly expanded the scope of its testing for pesticide residues in feed. In many cases the limit of detection has dropped significantly enabling the detection of residues that was not possible with older technologies.

2. Animal Health

The protection of Canada's animal resource base is integral to maintaining food safety, public health, and national and international confidence in Canadian agriculture and agri-food products.

The discovery of a BSE positive cow in Alberta in May 2003 made the year a challenging one for the Agency. Using recognized epidemiological principles and laboratory tools, including DNA testing, the Agency was able to identify the birth herd of the infected cow and trace its birth cohorts. The CFIA's investigation was commended by a panel of international experts and the Agency received the Head of the Public Service Award for Excellence in Service Delivery.

The CFIA is implementing the results of a study it commissioned to develop scientifically sound policies and methodologies to safely dispose of BSE infected material. The CFIA is implementing science-based regulations developed by Health Canada for the removal of specified risk materials from the human food chain. As well, the CFIA has been leading an international effort to strengthen the scientific basis for assessment of risk factors and the adoption of country status assessment by the World Organization for Animal Health (OIE).

The country status assessment will form the scientific basis for the international movement of animals and animal products.

In collaboration with scientists in the United Kingdom and the United States (US), CFIA scientists have evaluated three rapid tests for BSE and one for Chronic Wasting Disease (CWD) and scrapie. As a result, rapid tests have been approved to diagnose these diseases. The tests reduce the cost and time required to test animals and the time for processing material from animals tested.

CFIA scientists are working with United Kingdom and other European scientists on alternate methods of identifying the different types of TSEs. This has enabled the CFIA to determine that the BSE identified in a Canadian cow was identical to that identified in the United Kingdom and to establish that the prion associated with CWD is different from that associated with BSE.

CFIA scientists have worked with US scientists to adapt and validate specific tests for detecting CWD in specimens from animals which were previously untestable. The increased percentage of animals tested will enhance the confidence of governments and trading partners in the CWD status of Canada's farmed deer and elk. The CFIA is contributing to the Canadian Institute of Health Research partnership with the University of Toronto to develop a live animal test for BSE.

Also in the area of animal health, the CFIA, in collaboration with Health Canada and the National Research Council, is developing rapid methods for the detection of high risk animal pathogens such as foot and mouth disease, hog cholera, avian influenza and Nipah virus. In 2003, the Agency received a Federal Partners Technology Transfer award for the development of a field test for the detection of brucellosis in cattle. The test allows immediate identification and quarantine of diseased animals and is now the official test for brucellosis in Canada. Although Canadian cattle and farmed bison have been officially free of brucellosis since 1984, a reservoir of disease in Canadian wildlife means that Canada must regularly survey its cattle for this disease.

3. Plant Protection

By controlling and/or eradicating plant pests, the Agency helps to sustain Canada's plant resource base. The forestry and agriculture and agri-food industries rely on these bases, as do millions of Canadians for their livelihoods. To protect this resource base, the CFIA is collaborating closely with the Canadian Forest Service (CFS) to learn more about the Asian Longhorned Beetle which has been found in the Toronto area. This beetle could jeopardize \$11 billion in wood products annually and have a major impact on the Canadian maple syrup industry (worth \$100 million annually) as the beetle primarily attacks maple trees. The Agency drafted a risk assessment for the Emerald Ash Borer (EAB). The EAB could have a large environmental impact as ash trees make up as much as 30-50% of Eastern hardwood forests. Also, in the area of plant protection:

- The CFS and the CFIA are developing trapping methods and detection information for the brown spruce longhorned beetle. A database for this and related species was established. Currently, in Nova Scotia, the beetle is attacking and killing spruce trees, however there is significant risk that spread of this insect would destroy valuable forest resources.
- The causal agent of Sudden Oak Death (SOD) was found in one nursery in British Columbia and was eradicated following extensive traceback/traceforward investigations and a sampling survey. New survey protocols and laboratory diagnostic methods were developed. Although the scientific understanding of SOD is rapidly evolving, its potential impact in Canada is still uncertain.

The CFIA has also undertaken a number of other initiatives to support its mandate:

Science Branch

In January 2003, the President of the CFIA created a Science Branch as the focal point for scientific leadership both within the Agency and within the federal science community. The Branch plays a key role in ensuring that the required scientific capacity is in place to maintain an effective and efficient regulatory regime. This scientific capacity is founded on a strong internal knowledge base, access to specialized expertise, a network of

diagnostic and research laboratories, and a willingness to think and partner globally. Partnerships are also being developed with provincial and territorial governments, with academia, industry and the public to identify global science trends and provide intelligence that will help direct the science-based development and delivery of the CFIA's programs.

Horizontal Strategies

Public Security

The CFIA continues to work with other departments, agencies, industry and academia to enhance overall preparedness to minimize the impact of potential terrorist threats to the safety of Canada's food supply and its animal and plant resource bases. In 2003, under the Chemical, Biological, Radiological and Nuclear Research and Technology Initiative (CRTI), the Agency strengthened its risk assessment modeling and rapid test diagnostic capacities against foreign animal diseases which could be used as threat agents, improved its emergency response systems for animal health emergencies and crisis management, expanded its plant health diagnostic laboratory capacity, and made preliminary investments for GIS positioning in emergency management. As well, under the Public Security and Anti-Terrorism initiative, the Agency is enhancing its capacity to address its public security science and technology responsibilities, including pathway analysis risk assessments for both animal and plant health threats.

Biotechnology

The CFIA regulates agricultural products of biotechnology to protect the health and safety of Canadians, Canada's animal and plant resources, and the environment. In 2003, in keeping with recommendations by the Royal Society of Canada, and to keep pace with emerging science and support the regulatory system, the CFIA contracted several research projects to study the environmental safety of transgenic plants. Some studies focused on pollen movement, while others focused on the environmental effects of insect-tolerant crops. CFIA laboratories have further developed their capacity to detect or identify genetically modified organisms. For example, techniques were developed for detection of genetically modified maize, soybean, and canola, and for recognition of different lines of transgenic papaya and squash. New in-field testing kits have been developed and are currently in operational trials to

enable on-farm rapid testing of genetically modified corn varieties. Techniques were also developed to detect genetically modified ingredients in food and agricultural inputs.

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CANADIAN INSTITUTES OF HEALTH RESEARCH

In June 2003, the Canadian Institutes of Health Research (CIHR) celebrated its third anniversary. CIHR's legislated mandate is "to excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health care system."

As Canada's premier health research organization, CIHR supports research and training in four pillars of health research: biomedical science; clinical science; health services and systems research; and social, cultural and environmental determinants of population health. In addition, CIHR has a mandate not only to create new knowledge but also to translate that knowledge into improved health for Canadians. Knowledge translation means turning research into results to improve health products and services, create more effective health policy and practice, and strengthen the health care system.

After three years of developing a vibrant health research enterprise, CIHR launched its *Blueprint 2007* to usher in the next step in its evolution. *Blueprint 2007* is a strategic plan that identifies five key areas where CIHR will focus over the period 2003-2008:

1. Strengthen Canada's health research communities.
2. Address emerging health challenges and develop national research platforms and initiatives.

3. Develop and support a balanced research agenda that includes research on disease mechanisms, disease prevention and cure, and health promotion.
4. Harness research to improve the health status of vulnerable populations.
5. Support health innovations that contribute to a more productive health system and prosperous economy.

CIHR cannot fulfill its mandate alone and has entered into partnerships with other Canadian and international health research organizations, including the voluntary sector, provincial organizations, federal departments and agencies, and biotechnology and pharmaceutical companies. Since research must engage the users and practitioners of health care, CIHR has also engaged communities and stakeholders in health research on issues relating to safe food and water, homelessness, global health, environmental health, and rural and northern health, to name just a few.

Major S&T Achievements

During the fiscal year 2002–03, CIHR supported 4 524 operating grants, clinical trials, equipment and maintenance grants, and other grants and awards at a total cost of \$423 362 000. CIHR also provided 713 salary-support grants and awards totalling \$38 835 000, and 1939 research training grants and awards totalling \$42 246 000. CIHR was able to increase its number of grants over last year by 9 percent and the average grant value by almost 11 percent. Success rates in CIHR competitions are now comparable to those of the U.S. National Institutes of Health (around 30 percent).

Other initiatives in support of research (conference support, travel and exchange, Institute support grants) totalled \$23 127 000 for 142 projects and initiatives. CIHR also supported the Networks of Centres of Excellence (\$25 031 000) and 250 Canada Research Chairs (\$34 225 000).

The Government of Canada's sustained investment in health research and training, and CIHR's dedication to excellence in these areas are yielding nationally and internationally recognized results.

Responding to SARS

In response to SARS crisis, CIHR launched in 2003 a three-part health research strategy that included: research on the causes and consequences of SARS; research to examine and analyze public health and health care system preparedness and Canada's response to the SARS outbreak; and the creation of the Canadian SARS Research Consortium to coordinate, promote and support Canadian research on SARS and newly emerging infectious diseases. Also in 2003, CIHR-funded Canadian researchers were the first to sequence the SARS virus genome and also announced that the development of three potential SARS vaccines

Diabetes

If research in Edmonton by Drs. James Shapiro and Ray Rajotte and their team hold up, Canada will once again have made a major contribution to juvenile diabetes research and treatment. The "Edmonton Protocol" is supported by a unique partnership of CIHR, the Alberta Heritage Foundation for Medical Research, the Juvenile Diabetes Research Foundation, and Wyeth–Ayerst. This unique study, involving the transplantation of islet cells into the liver to help patients stay insulin-free, illustrates the potential of health research to yield enormous economic and social returns on relatively small investments. Diabetes is the seventh leading cause of death by disease, affecting more than two million Canadians and costing the health care system \$9 billion annually. Indirect costs, including time off work by parents and the social costs of living with a life-long chronic disease, are also substantial.

Neurology

Thanks to support from CIHR, Drs. Molly Shoichet and Charles Tator from the University of Toronto have grown spinal cords in porous tubular "bridges" implanted in rats. While it is too early to declare a solution to spinal cord injuries, the results of this research show that this bridge, which allows tissue to grow, may be a cause for hope.

Extending Life Through Commercialization

Thanks to a CIHR Proof of Principle (POP) grant, Dr. Yves Raymond of the Université de Montréal is determining the potential of a unique technology to improve the life expectancy

of thrombosis (stroke) victims and reduce health care costs. POP program grants provide support for research projects aimed at establishing proof of a discovery's principle, thereby improving the likelihood of its commercialization. The POP program is offered in conjunction with three other notable programs: the Proof of Principle Partnered (POPP) Grants, the CIHR SME Program and the CIHR/Rx&D program. Proof of Principle Partnered (POPP) Grants fund previous POP grantees at the co-investment stage undertaking follow-on proof of principle activities in partnership with a non-academic investor. The CIHR SME Program is jointly funded by Canadian biotechnology companies to strengthen Canada's technology-transfer capacity by supporting research commercialization in startup companies, university spin-offs and SMEs. The CIHR/Rx&D program is a partnership between CIHR and Canada's research-based pharmaceutical companies that facilitates collaborative partnerships between university, academia and government with the aim of developing new drugs for the treatment of disease.

Protection Against E. coli

Tragedy struck Walkerton, Ontario, after E. coli from cow fecal matter contaminated the town's drinking water. As a result, government inspectors adopted a policy of zero tolerance toward beef that carries a particular E. coli strain. The cost to meat producers has been staggering — as much as \$5 billion annually. CIHR Distinguished Investigator Dr. Brett Finlay, a professor at the University of British Columbia, has developed a vaccine to protect cows against E. coli. Dr. Finlay's vaccine has been effective in a small number of cows and is now being tested in more than 70 000 of these animals. If successful, the vaccine will help reduce both the dramatic economic and health costs associated with E. coli contamination.

Extending Life Through Commercialization

Developing a culture of innovation in Canada requires skilled people with training in research and knowledge of the innovation pipeline. As part of its commitment to training the next generation of health researchers, the CIHR Strategic Training Initiative in Health Research was launched to train new research scientists and develop the adaptability, problem-solving and other key skills necessary to conduct research in an environment of convergent disciplines and approaches. This

initiative, the most ambitious and innovative training program of its kind in North America, is critical to building Canada's health research capacity. To date, over 80 projects worth approximately \$1.8 million each have been funded across Canada in areas such as bioinformatics, cardiovascular health and genomics (total investment in excess of \$125 M over six years).

CIHR's Establishment Grants contribute to brain-gain in Canada by helping host institutions develop competitive recruitment packages that attract established, internationally recognized health researchers. Dr. Prabhat Jha was recently recruited to Toronto's St. Michael's Hospital from the World Health Organization in Switzerland, to research the spread of HIV- and tobacco-related illnesses. Dr. Jeremy Grimshaw was recruited to the Ottawa Health Research Institute from the University of Aberdeen in the United Kingdom. Dr. Grimshaw's research will focus on ways to improve the uptake of research findings by health professionals.

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CANADIAN MUSEUM OF NATURE

The Canadian Museum of Nature (CMN) is Canada's national natural history museum with operations based in two major facilities. The Natural Heritage Building (NHB) in Gatineau, Quebec, houses a state-of-the-art-collections facility, research laboratories, a new centre for digital imaging, and offices for about 120 of its 165 staff. The historic Victoria Memorial Museum Building (VMMB), located in downtown Ottawa, houses the CMN's public exhibitions and educational programming. These facilities are focal points for collections development, primary research, exhibition creation and educational activities. All contribute to programmes about the natural history of Canada, environmental change and associated issues of relevance to Canadians.

In 2003/04, the Museum began to implement its new five-year strategy to focus attention on environmental change affecting

the natural world. We work with the science community, decision makers and the general public to understand the critical issues affecting environmental change, the role that humans play in accelerating this change, and how these changes affect the distribution of plants and animals and their habitats. This work will be most visible in programming activities to be delivered in the newly-renovated VMNB, slated for renovations from 2004 to 2009.

The new vision of the CMN stresses partnerships and joint efforts to develop new educational projects with national reach. On April 25, 2003, the CMN launched *The Gee! In Genome*, a new, travelling exhibition on genomics. This exhibition and national education project was produced by the CMN and is presented nationally by Genome Canada in partnership with the Canadian Institutes of Health Research. The exhibition is now touring the country, having already appeared in Vancouver and Regina. Its final stop will be Halifax in 2006. *The Gee! in Genome* is supplemented by a dynamic and interactive Web site as well as a series of forums held across Canada to stimulate awareness on the ethical issues involved in genomics research.

In addition to the genome project, the Museum has produced a travelling exhibition about climate change that incorporates traditional knowledge with western science. *Sila: Clue in to climate change* was produced by the CMN in collaboration with the Centre for Traditional Knowledge with support from the Government of Canada Climate Change Action Fund and the Canadian International Development Agency. The information, available in Inuktitut as well as Canada's two official languages, is supplemented by a multimedia presentation and Web site with curriculum-based teaching activities.

The CMN continues to be a Canadian centre of excellence for systematics research and natural history collection conservation and management. Our scientific staff, numbering over 50 researchers, collections specialists as well as research associates, generates knowledge and curates a collection of 10-million specimens, producing an average of 50 peer-reviewed scientific publications and books annually, hosting research and V.I.P. visits, participating fully in the academic community through eight Adjunct Professorships and describing 20-30 new species of plants, animals and minerals each year.

The CMN's natural history collections are part of a public trust, developed to preserve our natural heritage and to document the historical record for both scientific advancement and educational value. Part of the CMN's future focus will be to develop a national collections development strategy, in partnership with a coalition of natural history museums in Canada. The CMN will broaden access to the natural history record using the Internet, collection images and distributed databases.

The CMN continues to work with the Canadian Heritage Information Network (CHIN), a special operating agency of the Department of Canadian Heritage, and the Federal Biodiversity Information Partnership (FBIP) which includes numerous scientific partners from within the federal government. In both cases, the CMN is using and contributing to centralized and distributed databases to mediate access to collection and specimen records. Both the general public and scientists are potential consumers and contributors of this data. Examples include the compilation of data from a community-based science program such as the Rideau River Biodiversity Project, and the transfer of bird specimen records from catalogue card to digitized data so these data can be mapped electronically.

Another example of CMN's commitment to sharing information and knowledge is the use of 3D imaging within the NHB. With the support of Canadian Heritage, the CMN has installed Arius 3D's innovative cameras and software to produce true-to-life, full-colour, 3D images of specimens from its natural history collections. The models are being used for research, collections management, conservation and to develop derivative animation products for education and exhibitions.

The CMN shares its scientific expertise on collections management and conservation issues with other national and international institutions. Museum staff have presented numerous workshops and have consulted on risk analysis for the conservation of collections. Additionally, the CMN is examining the implications of storing and managing tissue samples and DNA sequences in addition to whole specimens. In 2003, the CMN was recognized for its conservation efforts with an international award from The American Institute for Conservation of Historic and Artistic Works and Heritage Preservation.

The Museum's research expertise is integral to a number of federal, professional and academic initiatives. These include the Committee for the Status of Endangered Wildlife in Canada (COSEWIC), the Canadian Arctic Shelf Exchange Study (CASES), the Pan Arctic Flora Project, and the New Mineral Names Committee of the International Mineralogical Association. The CMN is a founding member of COSEWIC, which celebrated its 25th anniversary in 2003, and is a leader on two of COSEWIC's expert sub-committees - invertebrates and freshwater fishes.

The Museum houses and totally supports the Biological Survey of Canada (Terrestrial Arthropods), and has done so for over 20 years. The Survey helps to coordinate scientific research among specialists in the Canadian fauna of insects, mites, and their relatives. It serves as a catalyst for more efficient scientific progress and provides national direction for work on Canada's insect fauna.

Through the Canadian Centre for Biodiversity, the CMN houses and provides support for the Secretariat for the Canadian Committee for the International Union for the Conservation of Nature (CCIUCN). The CMN also hosts the IUCN's Medicinal Plant Species Specialist Group of the IUCN's Species Survival Commission.

In 2003, the CMN was pleased to receive the Patricia Roberts-Pichette award from Environment Canada's Ecological Monitoring and Assessment Network (EMAN), in recognition of leadership and commitment to advancing ecological monitoring and research in Canada.

The Museum is exploring new ways to make natural history more understandable to the public. With our partners at CineMuse Inc., the Museum is promoting high-definition cinema as an interpretive tool and attraction for science centres and museums in North America. The CMN is also developing and facilitating the production of new documentaries with partners.

As part of its new strategic direction, the CMN has helped spearhead the creation of the Alliance of Natural History Museums of Canada. This consortium has established its means of governance, and is now working on priority areas for collaboration, including collections development and

communications strategies as well as exhibition development and educational programming. The initial working group comprises eleven institutions from all regions of Canada.

On the federal scene, the Museum continues to chair the Federal Biodiversity Information Partnership (FBIP). The FBIP helps coordinate biodiversity data and advocates support for systematics expertise and bio-informatics within Canada by promoting research funding, encouraging educational efforts, facilitating projects that are beyond the scope of any one agency, and acting as a Canadian focal point for international activities.

The FBIP also represents Canada on the Governing Board of the Global Biodiversity Information Facility (GBIF), an international agency (www.gbif.org) that facilitates the development and use of bio-informatics tools and the sharing of biodiversity data. Toward this end, Canada has started to establish data nodes for the Canadian Biodiversity Information Facility (CBIF) and begun populating these nodes with data from participating organizations, noted above.

In future, the FBIP will promote a more comprehensive work program to stabilize and enhance federal biodiversity science, including bio-informatics, in Canada. The Partnership completed a federal needs assessment, funded by the Canadian Information System for the Environment.

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THE CANADIAN SPACE AGENCY

S&T Achievements in 2003

Established in 1989 with its headquarters in Longueuil, Quebec, the Canadian Space Agency (CSA) coordinates all aspects of the Canadian Space Program (CSP). Through its Space Knowledge, Applications and Industry Development business line, the CSA delivers services involving earth and the environment, space science, human presence in space, satellite

communications, space technology, space qualification services, space awareness and education. The CSA is at the forefront of the development and application of space knowledge for the benefit of Canadians and humanity.

Earth and Environment

The CSA celebrated eight productive years in space with RADARSAT-1, surpassing all expectations for a mission that was initially planned for five years. Its daily applications are innumerable in such domains as ice monitoring, forestry, cartography and oceanography. RADARSAT-1 has literally mapped the world, and has most recently been used in emergency situations as part of the International Charter on Space and Natural Disasters. It most notably provided images of the flooding in British Columbia that caused such extensive damage to the province. Internationally, RADARSAT-1 provided images of the Prestige oil spill near Spain's coastline and of the Stromboli volcanic eruption in Italy, demonstrating the range and utility of images produced by the satellite. An agreement was signed with the Government of Yukon to provide access to RADARSAT-1 data and data products. The information will be particularly useful for improving natural resource management, land use planning and resource development.

Space Science

2003 has been a very exciting year for the Canadian space science community: among many realizations, the CSA successfully launched SCISAT and MOST. During its two-year mission, SCISAT is helping a team of Canadian and international scientists improve their understanding of the depletion of the ozone layer, with a special emphasis on the changes occurring over Canada and in the Arctic. It will indeed help policy makers assess existing environmental policy and develop protective measures for improving the health of our atmosphere. The CSA also launched its first space telescope called MOST (Micro-variability & Oscillations of Stars). Canada has indeed build the world's smallest space telescope, an instrument that helps us better understand our Universe by looking at neighboring stars. MOST, which is packed in a micro-satellite the size and mass of a suitcase, will make some specialized astronomical observations beyond the capacity of any other instrument on Earth or in space. It is designed to probe the interior of stars, set a limit on the age of the Universe,

and for the first time, detect light reflected by little known planets beyond our Solar System.

Human Presence in Space

The CSA and the Institute for Robotics and Intelligent Systems (IRIS) announced the creation of a new program that will fund Canadian University space researchers and encourage them to build industry alliances. The CSA-IRIS Cooperation Program will provide academic researchers in Canada with one year funding to investigate new research opportunities in advanced intelligent systems technologies in space tele-robotics and tele-medicine. A team of Russian and Canadian space researchers and engineers has successfully pushed back the technology envelope, developing an on-site trainer for the International Space Station. The System for Maintaining and Monitoring Performance (SMP) On-Orbit MSS Astronaut Training System consists of a small laptop computer and two hand-controls. Training and analysis modules incorporated in the system allow astronauts to practice, among other things, capturing free-flying objects such as small satellites, which is the most difficult task that a Canadarm2 operator may be required to perform.

Satellite Communications

An arrangement was signed between the CSA and the European Space Agency (ESA) that ensures Canada's participation in the Development and Validation Phase of Europe's Galileo Program. Galileo will be the first satellite positioning and navigation system intended specifically for civilian purposes and it will improve the reliability and availability of navigation and positioning services worldwide. The CSA's contribution allows Canadian companies to take an active part in the program. The Government of Canada's National Satellite Initiative was launched. This joint project between Infrastructure Canada, Industry Canada, and the CSA will provide high-speed broadband Internet access services via satellite to communities located in the Far and Mid North, and in isolated or remote areas of Canada. This initiative will ensure they can have a prosperous economic and social future, in particular through improved access to tele-health, e-business, and distance learning services. A majority of the approximately 400 communities currently targeted by this initiative are Aboriginal.

Generic Space Technologies

Through its generic space technologies development programs, the CSA is driving the design of leading space technologies. In 2003, more than \$65 million in contracts were awarded to Canadian industry. Forty contracts valued at \$17.4 million in total were awarded via CSA's Space Technology Development Program (STDP). Companies will develop innovative space technologies ranging from satellite equipment to space robotics. Eleven companies also signed deals worth \$47.6 million in total with ESA to develop innovative space technologies for their Earth Observation, Communications, Space Exploration, and Generic Technologies programs. These programs are financially supported by Canada through the CSA-ESA collaboration program. Finally, the CSA awarded over \$3 million in contracts to Canadian companies to develop leading-edge uses of space-based Earth Observation data and applications. The contracts were awarded through CSA's Earth Observation Application Development Program (EOADP). The program is designed as a single-window channel to support industry initiatives focused on the development of earth observation applications.

Space Qualification Services

During the course of the year, both the MOST and the SCISAT-1 satellites underwent an extensive series of tests at CSA's David-Florida Laboratory (DFL). Tests included thermal vacuum, vibration and radio frequency testing. MOST was subsequently successfully launched on June 30, 2003 and SCISAT-1 on August 13, 2003. A significant amount of effort was also dedicated to test preparations in advance of the RADARSAT-2 Program. The DFL also supported the test program for the American space shuttle observation boom. The observation boom will serve as an extension to the space shuttle remote manipulator system (CANADARM) allowing the arm to scan or inspect, in space, almost every square inch of the shuttle. Finally, the DFL successfully completed the transition to the new ISO 9001:2000 standard. The two most significant changes: a much more customer-oriented focus along with an extensive concentration on achieving customer satisfaction, and a major emphasis on continuous improvement.

Space Awareness and Education

A three-day Space Educators' Conference was held at the CSA's headquarters. 120 Educators from across Canada were treated to presentations and hands-on workshops on topics

ranging from unearthing the secrets of Mars and bringing space technologies down to Earth to capturing climate change and troubleshooting in a space environment. CSA Astronauts helped them explore the themes of life support requirements on Mars and the science of spacesuits. Committed to supporting the education community's efforts, the CSA develops innovative resources and opportunities, such as this conference, to improve scientific and technological literacy among young Canadians and increase the number of students pursuing careers in science and engineering. Canadian university students were awarded prestigious scientific scholarships to participate in summer training programs at NASA facilities in Florida and California. Students participated in the NASA Astrobiology Academy, a ten-week summer internship at the Ames Research Center in California, or took part in the six-week program held at the John F. Kennedy Space Center in Florida.

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DEPARTMENT OF FOREIGN AFFAIRS AND INTERNATIONAL TRADE

Summary of the Science and Technology Program

[NOTE: On December 12, 2003, the Department of Foreign Affairs and International Trade (DFAIT) was divided to create two separate departments, the Department of Foreign Affairs and the Department of International Trade. This report covers activity for the former parent department, DFAIT.]

Throughout 2003, the Department of Foreign Affairs and International Trade (DFAIT) focused its departmental resources in S&T through its network of S&T officers abroad, and its Science and Technology Division by:

- building partnerships with other government departments and agencies;
- chairing the Interdepartmental Network on International S&T (INIST);

- helping Canadian technology-based companies and research institutions establish international R&D collaborations, including venture financing, with targeted countries.
- developing new S&T communications tools and products;
- managing strategically key bilateral relation (including four active agreements with Japan, France, Germany and the European Union) and an S&T arrangement with Korea, in partnership with the Canadian scientific and business communities; and,
- enhancing Canada's profile at international events.

Over the course of 2003, the Department continued to work with the INIST as a forum for coordinating international S&T issues of common interest among participating science-based departments and agencies. The INIST held four meetings to discuss bilateral S&T relations, notably regarding Brazil, Japan, Germany, the European Union and Korea, with which bilateral S&T meetings were held during the year, as well as arrangements for a nanotechnology mission from France. A special meeting was held to provide input and direction to the "Geographic Review", a study which the department commissioned to identify priority geographic S&T country targets. The Geographic Review report was received late in the year. Consultations on follow-up to the Review will commence with science-based departments and agencies early in the new year.

The area of R&D business development continued to be quite active with nearly 20 major international technology and venture capital partnering events organized.

Key 2003 Results Achieved by DFAIT's S&T Program

S&T Policy and S&T Relations

Major initiatives conducted with INIST guidance and support include:

Canada-Brazil

On November 4-5, 2004 Canada and Brazil jointly undertook an S&T Roundtable that was hosted by the Ministry of S&T of Brazil, in Sao Paulo. An S&T delegation of 30 Canadian academic, industrial and government representatives

participated in the event, which involved five sectoral working groups in the areas of biotechnology, aquaculture, space, sustainable energy and industrial innovation. An S&T action plan is being devised by Canada and Brazil for 2004.

Canada-European Union

At the Canada-EU Summit held December 19, 2002, Canada and the EU agreed on a list of priority areas for enhancing collaborative research and development between the two regions. A series of thematic workshops are to be launched, starting in the spring of 2004. In addition, Canada, the EU and European Member States are exploring the potential for more effective information exchange about their programs of R&D support and areas of expertise in the aim to accelerate connections between researchers.

Canada-Germany

A successful bilateral Science and Technology Consultation under the Canada-Germany S&T Agreement was held in Ottawa, September 4-5, 2003, where a German delegation of approximately 30 individuals participated in the Consultations and the preceding two-day Workshop for Young Scientists in Photonics Research. Participants of the Consultation agreed to enhance collaborative S&T efforts in a number of new areas including agriculture biotechnology and plant genetics; sustainability and alternative energies; and nanotechnology.

Canada-Japan

The Canada-Japan Joint Committee (CJJC) on S&T Cooperation (CJJC) met in Tokyo October 15-17, 2003. The very successful event included a tour of the Kobe Translational Research Cluster, a series of sectoral meetings, the Joint Panel on Earth Sciences and the Environment meeting, and the full plenary session of the CJJC. A new Panel on Brain Science was formed, and it was agreed to actively pursue further collaboration in the areas of Reproductive and Child Health, Information Communications Technology for Collaborative Research, Forestry, Agriculture and Agri-Foods, Fisheries; and, to continue with the excellent collaboration in Space, the Life Sciences, Biotechnology, the Environment, Information Technologies and Nanotechnology.

Canada-Korea

The first Canada-Korea meeting on Science and Technology was held in Seoul, Korea October 20-22, 2003. Also included was an S&T Forum and visits to various S&T institutes. Specific agreed actions were: to conduct a joint study on S&T cooperation; to strengthen scientific exchanges; and to conduct seminars to promote S&T cooperation in the fields of Biotechnology, Nanotechnology and Space Technology. The meeting and site visits revealed a very advanced and thriving research and development base in Korea.

Canada-Norway

With the establishment of the Canada-Norway S&T Working Group, currently chaired by Norway's Ambassador to Canada, many successful bilateral projects and activities have taken place over the past year in a number of key priority sectors. In November, the Norwegian Embassy hosted a successful S&T Seminar in Ottawa, attended by more than 70 people, which allowed for a broad overview of Norwegian and Canadian innovation and research policy as well as a forward-looking panel discussion.

Multilateral S&T

The S&T Division represented DFAIT in intergovernmental negotiations and participated for Canada in multilateral committees and negotiations, notably: the negotiations for the International Thermo-nuclear Experimental Reactor; the United Nations Committee on Peaceful uses of Outer Space; and, negotiations for Canada's participation in the ESA-EU Galileo Program.

S&T Partnerships Brochure

A 2003 version of the S&T Partnering brochure was produced and published in November. This brochure is the primary promotional tool for the promotion of international S&T partnerships with Canada.

S&T Counsellors' Tour

Canada's five of six S&T Counsellors, from Berlin, Tokyo, Brussels, London, and Paris, as well as trade commissioners with S&T responsibilities from Spain, The Netherlands, and Finland were brought back to Canada April 28-May 9, 2003. They met with science-based departments and agencies, as well as non-governmental organizations, while in Ottawa and

travelled to Eastern Canada (St. John's, Halifax, Québec City and Waterloo) for meetings to meet the S&T community.

Going Global S&T Fund

DFAIT's S&T Division administers the "Going Global S&T Fund" to assist Canadian researchers in establishing new international collaborative R&D initiatives with foreign counterparts. In 2003, 16 projects, many involving groups of researchers from university, industry and government, were supported by this program.

International R&D Business Development

Information and Communications Technology (ICT) Sector

"Information Society Technologies - Europe Canada (IST-EC)" is a two year project (ending in April 2004) involving both European and Canadian organizations, whose objective is to foster collaboration between European and Canadian Researchers in key areas of ICT. As the lead Canadian partner in this project, the R&D Business Development Section was instrumental in organizing three major partnering events in 2003, bringing together Canadian and European ICT researchers in Banff, Alberta, Milan, Italy, and Paris, France. Both events were well attended and provided participating Canadian ICT researchers with excellent opportunities to identify and meet with their European counterparts.

Venture Financing

The Science and Technology Division contributes to the Innovation Strategy objective of increasing the supply of Venture capital available in Canada, by supporting local Venture Capital events. In 2003, the R & D Business Development Section participated in the Investment Future Forum held in Saskatoon in April, the IT Financing Forum in Toronto in May, and the Canadian Venture Capital Association Annual General Meeting in Ottawa in June. In total, over 60 growing Canadian firms were able to present their capabilities and funding requirements to a solid mix of Canadian and Foreign investors, and receive counselling from DFAIT staff on the various support programs to which they have access.

Biotechnology Sector

The S&T Division continued to include biotechnology as a focus for R&D business development activity in 2003. In addition to

biotech for human health, which has been the primary focus in past years, attention is also now being given to the emerging sectors of agricultural and industrial biotechnology. Activities include:

- Biotechnology Partnering Seminar - Lyon, April 9-11, 2003 (Held in conjunction with BioSquare/BioVision 2003)
- Biotechnology Technology Partnering Event - Washington DC, June 22, 2003 (Held at the BIO 2003 Conference and Exhibition)
- Panel session on international financing - Québec City, October 2, 2003 (Held at BioContact 2003)
- Biotechnology Partnering Mission - Frankfurt and Amsterdam, November 17-21, 2003 (Held in conjunction with BioEurope 2003 and followed with a biotech mission to the Netherlands with technology partnering seminar and site visits hosted by the Dutch Ministry of Economic Affairs.

Advanced Materials Sector

The advanced materials sector includes a wide spectrum of new materials technologies that have applications in almost all strategic sectors of the economy such as information and communications technologies, biotechnology, environment (ecomaterials, ecoprocesses and ecodesign), energy and aerospace. The S&T Division's focus in this sector in 2003 was mainly on 3 major fields: nanotechnology, renewable energy and advanced composite materials. Some of the activities are listed below:

- Nanotechnology/Nanomaterials Partnering Mission to Japan, Korea and Taiwan, February 22 March 8, 2003
- Partnership' 2003 - Materials and Manufacturing Ontario's Annual Networking Meeting in Toronto, June 19-20, 2003
- International Conference on MEMS, Nano and Smart Systems in Banff, Alberta, July 20-25, 2003
- International Symposium on Ecomaterials and Ecoprocesses, in conjunction with the 42nd Annual Conference of Metallurgists (COM 2003) in Vancouver, August 24-27, 2003
- Canadian Conference on Nanomaterials Crossroads, Montreal, Québec, October 16-17, 2003

- Canada-US-EU Partnering Workshop on Smart Materials and Structures, Montreal, October 23-24, 2003
- Mission on Renewable Energy Technologies to Germany, France (in conjunction with (POLLUTEC), Belgium and The Netherlands, November 22-December 5, 2003
- First Canada-France *Rencontre technologique* on Advanced Composite Materials, in Ottawa, Montreal and Toronto, December 8-12, 2003.

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FISHERIES AND OCEANS CANADA

The Science Program is the cornerstone of the mandated responsibilities of Fisheries and Oceans Canada (DFO). These responsibilities cannot be successfully implemented without the scientific knowledge and advice that the Science Program produces. The department provides programs and services that:

- support the sound management of commercial and recreational harvesting of living marine resources;
- support sustainable development and the protection of the ecological integrity of the aquatic environment; and
- promote safe and accessible waterways.

Excellence in Science and Technology

DFO continues to be one of the chief Canadian producers of knowledge in ocean and freshwater sciences. For example, DFO scientists helped Canada to rank as the second-largest producer of international knowledge in oceanology and limnology, and the fourth-largest in marine biology and hydrobiology.

Here are just some of the initiatives DFO has undertaken to ensure future excellence in ocean and freshwater sciences:

- The Science Program organized the national Aquatic Science 2020 Workshop. At the workshop, more than 150 members of Canada's scientific and policy communities identified the major science-based issues and science requirements expected to occur in aquatic science in the next two decades. This initiative will help the Department align its activities and resources with the areas identified as priorities for knowledge generation.
- The Canadian Hydrographic Service in the Quebec and Newfoundland and Labrador regions worked with local educational institutions to develop and update educational programs related to hydrography. The objective has been to ensure the transfer of hydrographic expertise to future generations.
- The Department continued to advance a multidisciplinary ecosystem approach to the provision of scientific advice. For example, the Ecosystem Status Report on the Eastern Scotian Shelf Ecosystem provided a comprehensive, integrated assessment of the current status of this large ocean ecosystem relative to previous states. The report reflected expertise in oceanography, habitat ecology, marine genomics research, fisheries research, chemistry, marine biology, benthic ecology and oceans management. The report also used more than 60 data series, most of which date back at least to 1970 (www.dfo-mpo.gc.ca/csas).
- In partnership with a consortium of Canadian universities and federal science-based departments and agencies (SBDAs), the Canadian Coast Guard (CCG) icebreaker Sir John Franklin was converted into a dedicated state-of-the-art Arctic research vessel and renamed the Amundsen. Over the next 10 years, the vessel will support several major multidisciplinary programs designed to advance understanding of climate, oceanic circulation, sea-ice dynamics, biology, biogeochemistry, sedimentology, paleoceanography and geology in the Canadian sector of the Arctic Ocean.
- The Fisheries Science Collaborative Program was developed to bring together departmental scientists and Atlantic fishers to collaborate on priority issues in fisheries science research. The core objectives of the program, which was implemented in 2003, are to increase knowledge of the state of fish stocks, to support decisions on critical conservation issues related to Atlantic marine fish stocks, and to promote and implement collaborative science activities with the Atlantic fishing industry.
- The collaborative efforts of DFO, Transport Canada, World Wildlife Fund Canada, the Canadian Whale Institute, and representatives from the shipping, fishing, and whale-watching sectors made it possible to establish new shipping lanes in the Bay of Fundy. These lanes are designed to protect the endangered North Atlantic right whale population from ship strike. The lanes are believed to be the first in the world that are sensitive to ship strikes.

Effective Linkages in Scientific Research

By partnering with others, DFO optimizes its program delivery. DFO's role as a partner, broker and catalyst in multidisciplinary, multi-institutional and multinational research increases the scope and depth of research; improves the national capacity for aquatic science and technology development and transfer; and leverages available funds.

DFO continued to forge new partnerships, strategic alliances and collaborative arrangements with other federal government departments and agencies; the private sector; universities and colleges; provincial, territorial and municipal governments; international governments; and NGOs.

Below are some examples of DFO's science partnering initiatives in the past year.

- The Canadian Surface Ocean Lower Atmosphere Study Research Network was launched to improve our understanding of interactions between the oceans and the atmosphere, and the implications of those interactions for global climate change. Part of a new international initiative, the Network involves 43 Canadian researchers, including scientists from DFO, 14 partner institutions (universities and government) and five other countries. The Network is currently the largest ocean science project in Canada.
- As part of its ongoing commitment to Arctic research, DFO has also established the National Centre for Arctic Aquatic Research Excellence (N-CAARE) at its Freshwater Institute in Winnipeg. The Centre consolidates expertise under one

umbrella and coordinates the development of DFO Arctic research programs related to marine and freshwater Arctic science issues. Close partnerships have been established with other federal departments, northern advisory groups, universities, industry and international research agencies.

Alignment

To ensure that high-quality, timely and relevant scientific knowledge is provided for DFO's longstanding responsibilities and emerging science-based issues, the department completed a review of its Science Program. Through the review, the Science Program will improve the alignment of its scientific efforts and resources with the needs of today and the future, in support of departmental and government-wide priorities. The review has identified about 30 options and initiatives for optimizing delivery of the program. While the majority of these options and initiatives are currently being evaluated, others are in the early stages of implementation.

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DEFENCE R&D CANADA

Introduction

Defence R&D Canada (DRDC) has undergone significant transformation and has emerged as a revitalized leading Science & Technology (S&T) organization since becoming a Special Operating Agency in 2000. At its six Centres, DRDC delivers excellence in leading-edge research, technology and analysis for the Canadian Forces (CF) so that they can respond to the new realities of military operations and plan for the future.

The Defence Technology Investment Strategy defines our niche areas of Research and Development (R&D) excellence, and is currently being implemented across the organization. The Technology Demonstration Program demonstrates the role of technology in defence solutions while the Technology Investment Fund Program supports research in high-risk high-payoff technology applications. Technology Outlook is providing

foresight and advice on potentially disruptive and emerging technologies that are likely to impact defence and national security.

We are well linked internationally as key players in The Technical Cooperation Program (TTCP) and the NATO Research and Technology Organization (RTO), and through bilateral and multilateral collaborations with the United States, United Kingdom, Australia, France, the Netherlands and Sweden. On the national scene, we play a leadership role in horizontal S&T collaborative initiatives involving other government organizations, industry and universities. After the terrorist attacks of 2001, DRDC added several important initiatives to its counter-terrorism research and development work. The Chemical, Biological, Radiological and Nuclear Research and Technology Initiative (CRTI), which now has 41 collaborative projects is funded from the \$7.7 billion national security program announced in the 2002 federal budget and enhanced in the 2003 budget.

DRDC is now well situated to respond to S&T issues in the areas of defence, security, intelligence, and the national innovation agenda. We will continue focusing on our defence clients and partners. Drawing on our strengths in the core business of defence R&D and Operational Research and Analysis, we will pursue opportunities both nationally and internationally to exploit new concepts and products, and to incorporate new technology into existing systems. To ensure interoperability with allies, the CF of the future must embrace technology-driven warfare as they embark on a major transformation of their combat capabilities based on Knowledge-age technologies. New capabilities will be required to deal with asymmetric threats such as weapons of mass destruction and information and biological/chemical attacks. We are taking a leadership role in the Transformation process by providing assessment, analysis and advice on relevant technologies, and by applying and enabling the adoption of R&D results. We will augment our scientific capacity and provide the CF with more than they pay for by leveraging our capabilities.

Major Achievements

Moving the Boundaries of Science and Technology

The following snapshots illustrate DRDC's work in a few of the niche sectors that we have identified as providing opportunities to excel and innovate.

- **The soldier of the future**

The soldier of the future will be equipped with state-of-the-art sensors, aids for aiming weapons, and computers with visual, auditory and vibro-tactile displays - more like something out of science fiction than a warrior of the past. Developed with the assistance of modelling and simulation tools created by DRDC, these technologies will be delivered to Canadian soldiers in an intuitive, easy-to-use package that will optimize their effectiveness and survivability on the battlefield.

- **Through the wall sensing**

Although still in its infancy, any innovation that allows for increased and safer detection of potential threats will garner a great deal of attention. Through-the-wall technologies offer such benefits, using radar technology to reveal, from a distance, the main contents of another room or space. It is a promising field for DRDC, with current research focusing on the development of different types of capabilities. Distanced radars, mobile radars on robots or drone vehicles, and multi-static configurations that also permit covert listening are being tested.

Innovative Solutions for the Canadian Forces

Neutralizing voice distortion

For diving operations in deep water – such as those made by the Navy as part of drug recovery missions in 1993 and 1995 or when assisting after the 1999 Swiss Air tragedy – a mix of helium and oxygen is used to escape the disabling effects of nitrogen under pressure. The problem with using helium is voice distortion, making communications with the surface difficult. DRDC has been working with the Communications Research Centre (CRC) in Ottawa to counter this problem with a small system that can remove the distortion in the diver's voice.

Reducing ship signatures

Ships and their crews stand a greater chance of survival if they can avoid being detected by weapons activated by a ship's electromagnetic field. DRDC has proposed a new methodology – based on ship degaussing – which decomposes the ship's total magnetization into components, each one related to the orientation of the degaussing coils.

Revising the wind chill using human data

Scientists knew that the wind chill index was not perfect. Following an international workshop on the subject, where DRDC played a critical role, Environment Canada and the U.S. Office of the Federal Coordinator of meteorology decided to develop a Wind Chill Revision Program to update and correct the index using human data. Scientists from DRDC who were involved with a similar program supported by the CF, were invited to take the lead. Using modelling, mannequins, and human testing, a new Wind Chill Index and Frostbite Guide were developed, validated, and launched across Canada and the U.S., attracting much attention.

Protection against snipers

Canadian Forces may soon have better protection against snipers, thanks to technology developed at DRDC Valcartier. FERRET is a passive acoustic system for the detection and localization of small-arms fire. The system is comprised of a three-dimensional microphone array mounted on the rear of the turret on a Coyote. A controller inside the vehicle turret processes the sound signals, and displays the results on a hand-held terminal providing a graphical and numerical display. A successful trial at CFB Gagetown in May 2003 demonstrated the maturity of the FERRET Small Arms Detection System, a key component of the Valcartier Defensive Aids Suite Project.

DRDC and the Environment

Protecting the Right Whale

The concern that underwater acoustic signals could harm marine mammals has increased over the past few years, mainly with regard to military active sonars and seismic surveys. Whether in support of mitigation measures or in the larger context of marine mammal studies, there has been significant research on detecting, locating, and tracking whales. DRDC and

Dalhousie University are finding the best method of tracking Right Whales in the Bay of Fundy near Grand Manan Island – an area that happens to be the endangered Right Whales' preferred habitat as well as a principal shipping lane – and developing collision avoidance techniques and equipment.

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Security and Counter-terrorism

Chemical, Biological, Radiological and Nuclear Research and Technology Initiative

The lead element of the plan to further Canada's national security capabilities is a \$170-million, five-year program called the CRTI, managed by DRDC on behalf of the Government of Canada. This initiative represents a key element in the Department of National Defence/Canadian Forces' Conducting Operations goal to enhance their "overall capability to respond to chemical, biological, radiological and nuclear threats." The aim of the CRTI is to improve Canada's capacity in these areas by encouraging and strengthening leading-edge research and partnerships.

Public Security Technology Program (PSTP)

Following the CRTI initiative, DRDC was asked to develop the PSTP to enhance through science and technology the mutual protection against terrorism along the border area of Canada and the United States and within both countries. This program is well underway with the initialing of an agreement between Canada and the United States. The required treaty to formalize this agreement is underway in Parliament.

The Counter-Terrorism Technology Centre (CTTC)

DRDC's CTTC counter-terrorism efforts tasks include training first responders to handle a biological or chemical incident (detection, identification, handling, and decontamination of live agents). This training consists of practical work in controlled settings. The CTTC also assesses and evaluates equipment for use by first responders, and provides an evaluation site for similar testing by industry.

DRDC's Strategy

We have embarked on an initiative to articulate our strategy and to put in place a system to help us manage the execution of that strategy. DRDC's Strategy Map, shown in the figure below, employs a balanced scorecard with four perspectives: customer, value for money, internal and foundation. There are two or three strategic objectives associated with each perspective; these are the areas where DRDC must excel in order to realize its mission and achieve its vision.

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ENVIRONMENT CANADA

Environment Canada (EC) wants to see a Canada where people make responsible decisions about the environment and where the environment is thereby sustained for the benefit of present and future generations.

To that end, science provides the basis for the Department's policies, programs and services. It is critical for the Department's success that its science and technology (S&T) are of high quality, aligned with departmental and federal goals, linked to Canadian and international S&T capacity, and applied in a way that effectively addresses the needs of Canadians. Our efforts include research, monitoring, assessment and prediction, technology and indicators development, and reporting activities.

The information below provides some examples that demonstrate EC's on-going commitment to the effectiveness of its S&T activities.

Alignment of S&T Activities to meet Environment Canada and Federal Priorities

Environment Canada's on-going planning processes to identify the activities and deliverables of the Department's business lines fully integrate S&T activities, which comprise many of the Department's priority activities.

The Meteorological Service of Canada (MSC), acting on recommendations from an international peer review, has developed a strategic ten year R&D plan. It undertook extensive consultation both inside and outside the Department and used an international panel to review the plan.

The Environmental Protection Service (EPS) published a report – *Environmental Solutions through Technology Innovation and Partnerships* – that illustrates collaborative and practical technology and demonstration work that protects the Canadian environment.

The National Water Research Institute (NWRI) led an interdepartmental effort to develop a federal water research framework and identify priorities for water research collaboration by federal departments. Specific project areas for collaboration within each priority area were concluded in 2003 and collaborative research plans are being developed.

At the same time, EC-led efforts since 2001 have resulted in the formation of the ADM S&T Integration Board, a committee examining how to better mobilize, focus and integrate S&T resources across departments and agencies to address cross-cutting issues important to Canadians. EC co-chairs the Integration Board and is leading several of the issues that the Board is examining for strengthened scientific collaboration.

Collaborations and partnerships

Environment Canada believes that working in partnership with a wide variety of groups such as communities, industry, aboriginal peoples and scientists, is an effective and efficient way of fulfilling its mandate. Through many S&T partnerships, the Department builds synergy with other organizations, levers resources, enhances human resource development, promotes

the use of R&D results, draws on S&T expertise in other sectors, and transfers knowledge.

Under the auspices of the Canadian Council of Ministers of the Environment (CCME) NWRI published the results of an experts' workshop: *Water Quality Monitoring – Current State of the Science/Practice* in 2003. It includes contributions from federal, provincial and territorial governments, and community/NGO, academic and international experts. A Canada-wide Framework for Water Quality Monitoring is under development. Similarly, under the CCME, agreement was reached on the ongoing delivery of the federal-provincial-territorial National Air Pollution Surveillance (NAPS) Network, involving about 800 air quality monitoring stations in Canadian cities.

EC scientists have a long and productive history of working closely with university colleagues. These collaborations encompass many varied arrangements including adjunct professorships, collaborative projects, university research chairs, co-location of staff and facilities on university campuses, and research networks. Two EC-supported wildlife ecology chairs serve as recent examples. In 2003, renewed and increased support was announced for the Centre for Wildlife Ecology at Simon Fraser University, and Dr Ed. Johnson, a prominent scientist in plant community dynamics, was recently appointed to the new G8 Legacy Chair in Wildlife Ecology at the University of Calgary. The Department also continues its collaborations with the granting agencies, the major federal supporters of academic research, with a view to identifying priority areas of environmental research within the academic community.

Changes to the Canadian *Environmental Assessment Act* came into force in October 2003. The renewed legislation provides for more meaningful public participation and will deliver environmental assessments in a more certain, predictable and timely manner. Several changes in the Act will strengthen the inclusion of Aboriginal perspectives into assessments, including the formal recognition of Aboriginal traditional knowledge.

The Ecological Monitoring & Assessment Network (EMAN) broadened its partnership base in 2003 to over 380 partners from government agencies, academic institutions, community groups and others. The synthesis of monitoring information

generated by EMAN partners allows for the development of integrated assessments of ecosystem change in Canada and informed management decisions.

Within six large ecosystem initiatives, situated in Atlantic Canada, the St. Lawrence and Great Lakes regions, the western boreal region, the Georgia Basin and Canada's North, EC works closely with all levels of government, industry and volunteers from local communities to improve their environments based on scientific evidence. The research provides scientific information on local problems and builds knowledge and capacity in the community. Many of the projects, which relate to issues like climate change, contaminants, and resource use activities, are undertaken jointly by EC scientists and local communities. Also, local participants communicate research results to community members much more effectively than the Department could alone. These very successful initiatives received renewed support in 2003.

Excellence in EC S&T

In response to the STEPS report, EC developed a self-assessment tool for S&T managers to determine how well they are meeting the expectations of STEPS. The tool consists of questions that address each of the elements of the Framework for Excellence that are presented in the STEPS report.

The department's operational laboratory activities are conducted under a quality management system founded in the International Standards Organisation 17025 Quality Standard.

EC continues to be recognised by others for excellence in S&T. NWRI was presented the prestigious "Cannes International Prize for Water and Sciences" in June, 2003 for its work in applied aquatic research. Dr. Ian Stirling, Canadian Wildlife Service, was the 2003 recipient of the Northern Science Award, awarded annually by the Department of Indian and Northern Affairs, for his research on the ecology of polar bears and seals. Dr. Jocelyn Paré, EPS, received numerous prestigious awards including the Public Service of Canada 2003 Outstanding Achievement Award for his work on the Microwave-assisted Process (MAP™) family of green technologies, and Drs. Terry Bidleman, MSC, and Derek Muir, NWRI, were recognised as among the world's most highly cited authors in the field of ecology and environment.

Recognising the need to maintain the quality of its S&T and to plan for the future, EC has instigated a number of initiatives to engender interest in environmental science and to encourage the pursuit of S&T careers within the Department.

The EC Youth Internship Program offers young scientists experience working on environmental projects under the mentorship and coaching of experienced scientists. The MSC Undergraduate and Graduate NSERC Supplements promote research in Canadian universities, to increase contacts with universities, and to promote training of potential candidates for future employment at MSC.

A National Youth Network facilitates collaboration on common priorities concerning young employees including knowledge transfer, learning, career development, and recruitment and retention. Also, an online orientation site for new recruits and an S&T website provide additional information about the department and its science.

The Department encourages its S&T professional staff to maintain their contacts and their standing with their peers through adjunct professorships, and scientific collaborations.

Environment Canada's Management Development Policy facilitates the development of new, current and potential managers. The policy is supported by *Environment Canada's Management Competencies Development Guide*, the *EC Managers' Competency Profile* and the *Management Competencies Self-Assessment Tool*.

Support to ensure S&T effectiveness

S&T cannot be effective unless it has a strong infrastructure to support it by way of management, the best use of resources and modern equipment and facilities. Some examples of EC's commitment are provided below.

Environment Canada is committed to ensuring that its science & technology is relevant, effective, and well-managed. EC's Science & Technology Management System consists of several committees that discuss S&T management issues, develop and implement S&T policies, and provide guidance and advice to the Minister and senior management. The system includes an external advisory board, an executive committee of senior

Department officials, and committees of S&T managers and laboratory co-ordinators.

In March 2003, the Minister announced the investment of \$75 million to allow MSC to improve the quality of its forecasts and service to Canadians. MSC will be able to make improved use of weather data, such as information that is collected from our recently established Doppler radar and lightning detection networks, so they can better detect, understand, anticipate, and forecast extreme weather events.

Improved facilities were recently opened by two EC laboratories: the Environmental Technology Centre (ETC) and National Wildlife Research Centre (NWRC). These facilities include updated laboratories and modern offices. The ETC improvements also include a large industrial space and upgraded emissions -testing equipment for better vehicle testing required under The Canadian Environmental Protection Act. The new NWRC laboratory on the Carleton University campus provides new opportunities for collaboration on the science that is critical to wildlife conservation.

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HEALTH CANADA

Health Canada (HC) performs high-quality research, surveillance and other science activities to help Canadians maintain and improve their health. Scientific information is necessary to support policy development, to regulate increasingly sophisticated products, and to provide the services, information and management essential to affordable and world-class health care.

The department conducts, funds and uses science to address a range of issues. In the past year, HC faced urgent challenges such as Severe Acute Respiratory Syndrome (SARS), Bovine Spongiform Encephalopathy (BSE or 'mad cow disease') and the West Nile Virus. Internal scientific capacity is necessary to

anticipate and respond to emerging challenges like these, and to support ongoing regulatory activities and programs.

HC has recognized science-based challenges in its Corporate Risk Profile and developed a framework to strengthen science planning, evaluation and reporting. The *HC Framework for Science* and the *Framework for Federal Science and Technology* are both based on the same principles, namely, that our science be aligned with our priorities, capitalize on the best expertise through collaboration, demonstrate excellence and innovation, and reflect Canadians' expectations of sound management and stewardship.

Since 2002 when the Executive Committee approved *HC Framework for Science*, we have amassed an inventory of current science activities and a self-assessment of these activities against Framework principles. The department is using the inventory to evaluate current activities and gaps and to support reporting and planning. There is improved understanding within HC of the expertise and evidence base that HC can bring to emerging issues and national research collaborations.

The following paragraphs describe recent HC accomplishments that support the enablers of effective science in the *Framework for Federal S&T*: people, leadership, engagement with stakeholders and citizens, and infrastructure.

PEOPLE

- In November 2003, the Office of the Chief Scientist organized the second HC Research Forum: *From Science to Policy*. All HC scientists have an opportunity to showcase their work and pursue collaborative opportunities with colleagues and stakeholders.
- The BI/CH Development Program is a strategy to improve the recruitment and development of Biologists (BI) and Chemists (CH) to the Pest Management Regulatory Agency (PMRA). The Program offers recruits structured learning and a process for promotion within the Agency.
- HC's Workplace Health and Human Resources Modernization Action Plan includes linking strategic planning for S&T personnel and business objectives and a

National Recruitment Strategy targeting Francophones and S&T.

LEADERSHIP

- To support the fight against SARS, HC hosted a workshop of international regulatory scientists, SARS experts and manufacturers. Participants identified key issues for regulating the clinical testing and licensing of future SARS vaccines and immunotherapy products. This Canadian perspective contributed to the World Health Organization conference on SARS in October 2003.
- In November 2003, HC issued a framework for coordinated action by the public health community, *Preparedness and Response to the Respiratory Infections Season and the Possible Re-emergence of SARS*. HC's investigations of SARS transmission to health care workers contributed to Infection Control Guidelines, which are applied at the regional and local levels. A blood deferral policy for SARS resulted from a scientific review and assessment of risks to the blood system.
- HC and the Canadian Institutes of Health Research (CIHR) co-sponsored the first multi-sectoral workshop on suicide related research in Canada. Participants established themes to guide Canadian suicide research and identified Aboriginal communities as a priority. HC is collaborating with CIHR on a call for proposals and with the Canadian Population Health Initiative to explore why suicide rates are high in some First Nations communities.
- HC and provincial governments convened a National Roundtable on Physical Activity Research in March 2003. The result was a prioritized research agenda to guide initiatives that are linked across jurisdictions.
- In April 2003, HC launched the Natural Health Product Research Program to support its role as product regulator and address research priorities identified by stakeholders. Projects are supported either through Grants in partnership with CIHR (e. g. clinical trials), Contracts (e. g. research on good practices), or Contributions by providing seed funding for the development of proposals.
- The Product Safety Programme led development of the 2003 Canadian Standards Association guideline *Noise Emission Declarations for Machinery*. The Programme

also contributes to noise standards of the International Organization for Standardization (ISO).

- The HC Research Ethics Board ensures the ethical conduct of HC research involving human participants. In its first year, the Board reviewed and provided guidance on 64 research applications. HC also funded education programs of the National Council on Ethics in Human Research, to support the ethical conduct of research involving humans among the wider research community.

ENGAGEMENT

- HC works with the Assembly of First Nations, supporting community-based participatory research on environmental health risks. Federal budget 2003 includes \$4.1 M for research on waterborne diseases and contaminants in First Nations communities. Additional funds will support community-based drinking water quality monitors and Environmental Health Officers.
- The PMRA, provinces and Agriculture and Agri-food Canada (AAFC) are evaluating indicator models for measuring risks of agricultural pesticide use in Canada. A risk indicator will enable stakeholders and the PMRA to assess pesticide risk reduction for a variety of needs.
- *Fungal Contamination in Public Buildings: Health Effects and Investigation Methods* provides guidance to public health inspectors and industrial hygienists who manage the health risks of mold growth in public buildings. HC completed this document in consultation with external experts and provincial representatives.
- HC and provincial and community stakeholders have correlated the patterns of chronic disease and mental health to poverty and exclusion, in a report *Inequity and Disease in Atlantic Canada*. *Cost of Chronic Disease* documents, which report the incidence, cost and impact of disease for each Atlantic province, will be completed in 2004 (NS was completed in 2002).
- HC coordinated a multi-jurisdictional program of surveillance, analytical research, risk assessment, and communications on the West Nile Virus.
- HC signed a Memorandum of Understanding with the United States Food and Drug Administration for efficient

scientific evaluation of therapeutic products. HC collaborates with other regulatory organizations on joint reviews and to share information on test methods and risks associated with new substances and marketed products.

- HC and provincial environment ministries released *From Source to Tap: Guidance on the Multi-barrier Approach to Safe Drinking Water*. It provides guidance on how to apply total quality management to systems for producing and distributing safe drinking water.
- The National Microbiological Laboratory determined a critical DNA sequence of the only non-imported case of BSE in Canada. It supported CFIA's investigation of the case as one acquired through infectious transmission rather than by spontaneous mutation in the affected animal.
- Through extensive consultations over many years, HC developed policies for proposed legislation that would protect Canadians using assisted human reproduction techniques, prohibit unacceptable practices such as human cloning and regulate research involving *in vitro* human embryos.

INFRASTRUCTURE

- HC invested in the *Statistical Profile on the Health of First Nations in Canada*. It is one of several initiatives to improve First Nations and Inuit health information for decision-making on health care policy, program development and costs.
- HC, the Canadian Centre on Substance Abuse and other partners are sponsoring the Canadian Addiction Survey of 10,000 Canadians in early 2004. Updated information about alcohol and drug issues will benefit the renewed Canada's Drug Strategy.
- The Inspectorate's Pharmaceutical Chemistry Laboratory in Longueuil, with the University of Montreal Chemistry Department, has developed reliable methods to detect active ingredients and contaminants in drugs and natural health products using capillary electrophoresis technology.
- HC has developed a world-class research infrastructure and capacity in biotechnology, genomics and proteomics. Laboratory platforms for the manufacture and high throughput analysis of DNA microarrays and for proteomics

research have been assembled and a skilled scientific staff employed. With national and international collaborators, projects are underway to develop biotechnology-based assays for regulatory assessment of human risks, including new assays for gene mutations and tumor promotion.

- HC is phasing in eReview, which will provide a stable electronic environment for accepting and reviewing drug and health product submissions. The Canadian electronic Common Technical Document (eCTD) was posted for comment in preparation for electronic submissions in 2004.
- The Canadian Public Health Laboratory Network, including HC, established PulseNet Canada to quickly detect outbreaks of enteric pathogens so contaminated food can be recalled. The electronic network enables rapid exchange of bacterial fingerprints and other surveillance information.

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NATIONAL RESEARCH COUNCIL CANADA

The National Research Council Canada (NRC) through activity in S&T is a leader in the development of an innovative, knowledge-based economy for Canada.

NRC operates 19 research institutes and a number of specialized technology centres across Canada. Its advances in R&D help build Canada's innovation and technology capacity, supports the growth of Canadian industry, and helps develop solutions for national challenges in health, climate change, the environment, clean energy and other fields.

NRC works with small and medium sized enterprises through its Industrial Research Assistance Program (NRC-IRAP), which operates in more than 90 communities across Canada. NRC also helps disseminate critical scientific, technical and medical information through the Canada Institute for Scientific and

Technical Information (NRC-CISTI) — Canada's largest science library.

Major Achievements

NRC's Vision 2006 is an integrated, five-pillar strategy designed to help advance Canada's goals in S&T. In 2002-2003, NRC has had substantial achievements relative to its Vision and consistent with the Council of Science and Technology Advisor's recommendations.

Excellence and Leadership in R&D

The creation of valuable, new knowledge is at the heart of NRC's contributions to national priorities. NRC's research strengths are concentrated on key sectors, including life sciences, information and communications technologies, aerospace, advanced manufacturing, ocean engineering and fuel cells.

In the past year, NRC pushed forward into strategically important fields in **alignment** with government priorities, including fuel cells, photonics, nanotechnology, genomics and proteomics, and high performance computing — areas key to the health, well being and economic prosperity of Canadians. Highlights included:

- **Genomics and Health** - With \$24.6 million in total investment, the eight institutes participating in the NRC Genomics and Health Initiative produced 82 publications, struck 42 formal collaborative agreements, generated 22 patent applications. In the past year, two patents were issued, and four licence agreements resulted.
- **Fuel Cells** - Initial funding of \$1 million in 2000 leveraged a total research value of \$4.9 million resulting in 12 projects. To-date the six participating institutes have produced four technologies (patents pending) that can significantly reduce costs and improve performance and durability of fuel cells, key barriers for widespread adoption of this technology.
- **Nanotechnology** - The NRC-National Institute for Nanotechnology moved into its temporary facilities. Six NRC institutes pursue collaborative research in a variety of fields. A ground-breaking result was the development of a single spin transistor, a precursor to the next generation of

small, inexpensive, but extremely powerful computing devices.

- Continued engagement in national science projects and facilities to build capacity including TRIUMF (the Tri-University Meson Facility) in British Columbia and the Canadian Light Source in Saskatoon.
- The publication of some 1133 articles in refereed journals, 796 conference papers and 1794 technical reports.
- The creation of both an S&T Performance Management Network and a Risk Management Network comprising individuals involved in these fields across federal departments.
- Citation rates well above the average of research institutions worldwide (six NRC researchers are among the most highly cited in Canada.) Citation of publications by others reflects the quality and relevance of NRC's work.

Stimulating Community-Based Innovation

Community-based "technology clusters" are recognized as key drivers of innovation and wealth creation. Canada's Innovation Strategy identified the development of globally competitive industrial clusters as a government priority and NRC aligned its efforts in support of this priority.

In 2002-03, NRC worked in close **collaboration** with communities across Canada to support the growth of technology clusters. Key achievements included the opening of a new Industry Partnership Facility (IPF) at the University of New Brunswick to support development of an Innovation Corridor in Fredericton. In total, 95 firms are currently incubating within NRC IPFs across Canada. Successful firms eventually graduate from IPFs and go on to create jobs and wealth within their communities. There are seven NRC IPFs in operation, four under construction across the country and another in the planning stages.

NRC plays a **leadership** role in the following clusters:

- ocean and marine engineering technologies — St. John's;
- life sciences and marine biosciences — Halifax;

- e-business and wireless technologies — Fredericton, Moncton, Saint John and Sydney;
- nutrisciences and health — Charlottetown;
- aerospace, biopharmaceuticals and industrial materials — Montréal;
- aluminium technologies — Ville Saguenay;
- information technology, life sciences and photonics — Ottawa;
- medical technologies and devices — Winnipeg;
- agriculture biotechnology and nutraceuticals — Saskatoon;
- nanotechnologies — Edmonton;
- fuel cells — Vancouver; and
- astrophysics and astronomy — Victoria and Penticton.

Creating Value for Canada

NRC has moved aggressively to ensure the efficient transfer of its knowledge and technology to the marketplace through the **engagement** of partners and stakeholders.

During 2002–03, NRC created three new spin-off companies, bringing its total to 55 since 1995. NRC spin-off companies have created more than 500 jobs and \$252 million in private investments. NRC had more than 1450 private and public sector collaborations in Canada and internationally with a total value of \$425 million over the lifetime of its agreements with various partners. Major collaborations include a \$10 million agreement with Dow Agro Sciences in agricultural biotechnology. These collaborations greatly leverage NRC resources at a ratio of 2:1 or more.

NRC was granted 65 new patents, bringing its total to over 650 patents. It signed 48 new technology licences with Canadian industry and earned \$7.3 million in licensing revenue. NRC also provided expert assistance, advice and services to more than 12 000 Canadian SMEs through NRC–IRAP. NRC–IRAP assistance to SMEs has resulted in 36,600 jobs and \$4.2 billion in sales revenue based on a third party evaluation.

NRC-CISTI maintained 48,835 scientific journals, 691,974 monographs and a large collection of technical reports. Overall,

NRC-CISTI processed 971,509 document orders providing access to scientific, technical and medical information critical to Canada's innovation system. Canadians downloaded 314,000 articles from NRC-CISTI Research Press.

Extending Canada's Global Reach

NRC provides Canada with links to global centres of advanced S&T. NRC has created significant international networks, helping transfer valuable S&T information and market opportunities to Canadian industry and organizations. NRC also represents Canada on dozens of international measurement standards committees, helping remove standards-based barriers to trade for Canadian industry. NRC also provides Canadian researchers with access to major international scientific facilities and opportunities.

During 2002–03, NRC was involved in some 462 research partnerships and collaborations, received some 50 in-coming international missions and co-ordinated 31 out-going missions to other countries. These involved 65 SMEs and resulted in 40 Memoranda of Understanding (MOUs), six contracts, and four partnerships. NRC staff participated in 608 international committees, attended 812 international conferences, and organized 107 international conferences and workshops. NRC has substantially increased the rate of publication with international organizations, moving from 20% of journal publications 10 years ago to over 40%. It signed new or renewed S&T MOUs with the United Kingdom, France, Germany, Spain, the Czech Republic and Japan. Such agreements are critical to ensuring Canada's place in the global knowledge economy.

Outstanding People — Talent for Canada

NRC's success on behalf of Canada lies with its nearly 4000 talented staff. In 2002–03, NRC recruited 445 new **people**, two of whom are leading international scientists recruited under the New Horizons – New Opportunities initiative. NRC invested a total of \$74.7 million in major new equipment and facilities to ensure it has the necessary **capacity** to continue developing world class S&T.

NRC also engaged 927 guest workers from Canadian and foreign universities, companies and public sector organizations. Their work not only helped NRC, but their home organizations

gained equally from the training they received and the transfer of knowledge and know-how from NRC. NRC also contributed to the national demand for a well-educated and skilled work force for Canada. In the past year, 239 postdoctoral fellows participated in NRC student programs, valuable training in preparation for future positions in universities, industry, etc. NRC Outstanding Achievement Awards were given to 101 employees while 122 employees received external awards. The Persons with Disabilities Recruitment Program attracted four new employees to NRC.

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NATURAL RESOURCES CANADA

NRCan's S&T contributes to our understanding of Canada's landmass and supports the sustainable development and use of Canada's forests, minerals and energy resources and the competitiveness of our resource-based and related industries. In-house S&T is performed by four science-based sectors – Earth Sciences, Energy, Minerals and Metals, and the Canadian Forest Service. NRCan strives to be a high performance, issues, outputs and outcomes-driven organization, aligned with government priorities, and renowned for excellence.

S&T Highlights - 2003

Leadership, Management and Capacity

"The Future of Science and Technology at NRCan" Study presented recommendations concerning the future vision, organization and delivery of NRCan's S&T within the evolving national innovation system. Progress on recommendations includes: laying the foundations for a departmental S&T information system, establishment of a Laboratory Coordinating Committee, and undertaking a Resource Demand Analysis for S&T programs.

A Chief Scientist was appointed by the Deputy Minister to position NRCan as a leader in the performance of S&T, which

will require the development of a strategic vision and strategic plan. The new office will place particular emphasis on developing effective management and planning approaches to ensure the excellence and relevance of NRCan's laboratories and science programs.

Alignment

Government priorities such as greenhouse gas emissions-reduction, increased energy efficiency and improved air quality were met with a realignment of energy R&D activities to hydrogen, industrial energy efficiency and bioenergy. The Climate Change Technology and Innovation Initiative instigated long-term R&D programs to develop cost-effective transformative technologies in five strategic areas: cleaner fossil fuels; advanced end-use efficiency technologies; decentralized energy production, including renewables; biotechnology; and hydrogen economy.

The Industry Steering Committee of the Canadian Lightweight Materials Research Initiative (CLiMRI) launched a new four-year plan for R&D of materials and processes for weight reduction in transportation applications to reduce greenhouse gas emissions through improved vehicle efficiency. In 2003, the program developed a pilot scale process for seam welding aluminium tubes; facilitating increased use of lightweight materials in vehicles.

Under Climate Change Action Plan 2000, the Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) initiative is exploring the viability of large-scale afforestation as a response to Canada's climate change commitments, with the results being used in the development of climate change policy recommendations.

In response to the Government priority to reduce Canada's vulnerability to climate change, the Climate Change Impacts and Adaptation Program has funded 148 cost-shared research projects since 1998; delivering new Canada-wide insights on the implications of climate change for communities, natural resources, food supply, health, transportation and tourism.

Supporting the government's agenda for enhanced safety and security, NRCan continued research on the marking of explosives to improve detection at airports and other public

locations, as well as testing window anchors for blast effect mitigation, which will reduce incidence of injury to building occupants in the event of an explosion.

The Budget 2002 Targeted Geoscience Initiative funded 29 partnered field projects to stimulate mineral exploration activities, resulting in 3000 claims staked. Budget 2003 added a further \$10 million over 2 years, extending TGI in Canada's North and including energy-related geoscience; laying the foundation for sustainable northern self-sufficiency and strong communities.

Linkages

A 2003 Industry Canada survey identified NRCan as "top collaborative lead" among federal SBDAs for interdepartmental cooperation. NRCan's innovative partnerships include:

- Establishment of the Canadian Forest Innovation Council (CFIC) in partnership with Industry Canada, the three national forest research institutes, the forest industry, provincial and territorial governments, and universities. CFIC's mandate is to ensure that the innovative capacity of the Canadian forest sector is maximized to promote sustainability, including components of industry profitability, environmental quality and community sustainability.
- GeoConnections, a national partnership across all levels of government, and including industry, academia and NGOs, makes Canada's geographic information accessible via the Internet by developing the Canadian Geospatial Data Infrastructure (CGDI). Over 1100 geospatial holdings are currently accessible. Related GeoInnovations projects resulted in an additional \$12 million for the Canadian geomatics industry, who have created new world-class technologies.
- In conjunction with NSERC, McMaster University and 8 other co-applicant universities, NRCan launched the Major Facilities Access Program. The program will provide co-applicant universities with access to the largest research centre in Canada dedicated to metals and materials fabrication, processing and evaluation; permitting safe industrial-scale testing without incurring the costs of building or maintaining such a facility.

- The Weyburn Project, in which NRCan is one of six international government sponsors, nine international corporations and 20 international research providers partnering to determine the feasibility of underground storage of CO₂ in geological formations. The technology and understanding developed will be of enormous significance to the establishment of geologic sequestration as a viable option for GHG emissions control.
- In cooperation with other government departments and industry stakeholders, NRCan led the continuing development of a Clean Coal Technology Roadmap to identify technology pathways to allow coal to be used as a competitive, environmentally clean energy resource for the production of electricity.

Excellence

NRCan's exceptional performance in S&T was recognized with awards:

- The \$28 million Mallik Gas Hydrate Research Well Program, led by NRCan with international funding and partners, received the Public Service Award of Excellence. Mallik-2 demonstrated for the first time that gas production from hydrates is technically possible.
- Three 5NR Science Awards for outstanding contributions in federal science for sustainable development were awarded to NRCan scientists and research teams for work on the carbon budget model, renewable energy technologies R&D, and leadership in developing a Canadian Framework for Collaboration in Groundwater.

S&T Advice

NRCan relies on external advisory councils to provide direction for S&T activities. For example, in 2003, the NRCan Advisory Board on Energy Science and Technology (NABEST) provided input regarding climate change, renewable energy and the importance of the government participating and responding to the international community on energy issues.

Ensuring sound science advice and information for decision-making is key to the services NRCan provides to policy-makers and citizens. In 2003:

- NRCan conducted research on the validation of the OECD Transformation and Dissolution Protocol (T/DP) to measure the rate and extent of the release of soluble bioavailable metal ions by metals and alloys to aquatic environments. Results will provide policy-makers and regulators with a more accurate assessment of potential hazards, and will generate data for the United Nations Globally Harmonized System of Classification of Chemicals.
- Water quality and the relationship between forests, water, and human activities have long been a focus of forestry research in Canada. Watershed data collected over a 25-year period is providing a better understanding of these interactions and is contributing to more informed decision-making relating to the quality and quantity of the water supply.
- The GeoConnections Sustainable Communities Initiative launched 24 new community-based and -led projects. The Atlas of Canada website with new content, maps and on-line map creation capabilities served over 300,000 visitors per month. Version 1 of GeoBase provides free access to geospatial information, including road networks, administrative boundaries, landform/topography, place names, geodetic network and satellite imagery.
- NRCan's Minister and the provincial forestry ministers released a revised Criteria and Indicators (C&I) framework for measuring, monitoring and reporting Canada's progress towards sustainable forest management in support of the national and international forest policy agenda. Continued work in 2003 and projected work to 2006 on the National Forest Information System, supports the implementation of C&I, and will enable Canadians to access integrated forest information on the Internet.
- NRCan is leading the interdepartmental development of the Government's S&T Cluster; a portal on the Canada web site that will provide high-quality S&T information of the government and its partners to Canadians.
- NRCan is participating in the ResEau project, which integrates water-related online resources from across jurisdictions, and has initiated a range of innovative e science activities through NRCan's Laboratory Coordinating Committee.

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NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL OF CANADA

The Natural Sciences and Engineering Research Council of Canada (NSERC) is the primary federal agency investing in postsecondary research and training in the natural sciences and engineering (NSE). In 2002-03, NSERC invested \$616.0M – in people, discovery, and innovation – in order to build a strong Canadian economy and improve the quality of life of all Canadians.

NSERC invests in people directly through scholarship and fellowship programs for student researchers from the undergraduate to the postdoctoral level. NSERC supports the discovery process by providing funds for excellent university-based researchers to conduct basic research in all fields within the NSE. Finally, project-based research involving partnerships with industry and government takes advantage of Canadian postsecondary institutions' potential for innovation.

Investing in People

Canadians, equipped with the skills and knowledge required to create value, will enable Canada to be competitive in the global knowledge economy of the 21st century. Canada's future capabilities in science and technology depend on today's graduate students and new faculty. Students and postdoctoral fellows trained with NSERC funding have the skills required to pursue rewarding careers across all sectors of the economy.

NSERC offers direct support to more than 7,500 students and postdoctoral fellows every year. In addition, an estimated 10,000 additional students are supported indirectly through NSERC's grants and partnerships programs; for example, professors may hire graduate students using funds from their Discovery Grants.

The Canada Graduate Scholarships (CGS) program, announced in Budget 2003, is administered by the three federal granting agencies. NSERC awarded almost 300 CGS scholarships in 2003, in addition to the approximately 3,500 students supported through NSERC's ongoing postgraduate scholarships programs.

NSERC also undertakes outreach efforts to encourage a science culture in Canada and to generate interest in science and engineering among Canada's youth. By funding science promotion activities and through media relations activities, NSERC is able to enhance the public profile of both science issues and Canadian researchers.

Funding the Discovery Process

NSERC Discovery Grants offer Canadian professors the opportunity to contribute to and to access the latest international research in order to extend the boundaries of our knowledge in all areas of the natural sciences and engineering. Annually, more than 9,600 professors are supported in their programs of basic research through NSERC.

NSERC has experienced a sustained increase in qualified first-time applicants for Discovery Grants since the 1997 Budget, when federal re-investment in university research began. In 2003, one-third of all applicants were applying to the program for the first time – almost 900 new researchers establishing their careers in Canadian universities. The number of applicants in 2004 is over 1,000, and NSERC will respond by ensuring funds are available to cover both the new and returning applicants who demonstrate excellence in their fields.

NSERC unveiled a new Special Research Opportunities program in 2003. This program enables researchers to pursue new and emerging research opportunities at the time they become apparent, or investigate and develop potential new collaborations necessary to respond to national and international opportunities.

In 2003, the Canadian Light Source (CLS) synchrotron facility in Saskatoon, Saskatchewan was completed and began operations. NSERC, NRC, and CIHR are funding the operation of this facility constructed with funds from the Canada Foundation for Innovation. In addition to the CLS, many other

world-class Canadian research facilities' operational costs are funded through NSERC's Major Facilities Access program. This support ensures Canada's researchers have access to the research environment necessary to make discoveries.

NSERC also began administering the federal government's contribution to the Perimeter Institute for Theoretical Physics. This community of researchers is dedicated to investigating fundamental issues in theoretical physics, and is funded primarily by private donations.

Helping Canada Innovate

To improve their competitive positions, Canadian industries need to take full advantage of the country's capacity for science-based innovation. NSERC's Research Partnerships Programs facilitate the development and exchange of knowledge, technology and people across all sectors to build an innovative economy. Through NSERC support, university professors and college faculty can connect with users of new knowledge with the goal of enhancing Canada's capacity for innovation. In 2003 NSERC partnerships involved close to 700 ongoing projects with over 800 industry and government partners.

The discoveries made at Canada's universities can sometimes be developed into intellectual property of value to Canadian industry. However, the path from the creation of new knowledge to a marketable product requires skilled management and advice. NSERC's Intellectual Property Management program facilitates the commercialization of university research results; for example, by providing seed funding for the development of technology transfer specialists. In 2003 NSERC also announced the Idea to Innovation program as a flexible, two-phase funding arrangement to nurture discoveries to a commercially viable position.

NSERC's New Vision

In addition to its continuing commitment to funding its core programs, NSERC adopted a new Vision in 2003 that will have it acting increasingly as a national agency. One aspect of NSERC's Vision is the opening of five regional offices to deliver its mandate effectively throughout Canada, and NSERC's first two regional offices will open in the summer of 2004. The new Vision will address several key national challenges through a flexible series of pilot initiatives including: developing the

research capacity at smaller universities; enabling colleges to better assist in innovation at the community or regional level; and funding research centres to improve the quality and impact of science and math teaching and learning in Canadian schools.

Finally, NSERC is developing – in conjunction with NRC – a framework for evaluating “Big Science” – large-scale science projects that may cost tens or hundreds of millions of dollars over the life of the project. Utilizing experience and expertise from within NSERC and NRC, and from experts throughout Canada and abroad, the framework will provide a guide for both those proposing and those evaluating such significant potential commitments.

Collaboration with government departments

NSERC has a strong reputation for establishing effective collaborations with other departments and agencies. For example, NSERC’s Research Partnerships Agreements with NRC, DND, AAFC, NRCan, and SSHRC create synergy between the private sector, researchers in universities and federal departments and agencies. Other programs, such as Strategic Project Grants, also encourage collaboration between government, private sector, and university scientists. In 2003, NSERC-funded research supported collaboration with 18 federal and 20 provincial government departments and agencies.

In addition, the close ties between NSERC, SSHRC and CIHR allow the three granting agencies to develop effective and consistent policies, such as ethics in research and scholarship and ethical conduct for research involving humans. The three agencies also jointly administer Canada’s investments in the Canada Research Chairs, Canada Graduate Scholarships, Indirect Costs, and Networks of Centres of Excellence – in which Industry Canada is also a partner.

External Advisory Processes and Peer Review

NSERC is governed by a Council (a Board of Directors) whose 22 members are drawn from universities as well as from the private and public sectors, and appointed by the Governor-in-Council. Council receives external science advice on policy and programming matters from several standing committees, which are also tasked with the continued monitoring of the almost 80

Selection Committees that make specific funding recommendations.

Each year, NSERC sends over 13,600 requests to experts in all disciplines, throughout Canada and the rest of the world, in order to receive impartial, expert assessments of research proposals. A typical grant application will be sent to several reviewers, whose comments are an important part of the Selection Committee deliberation process.

Working Towards a 21st Century Canadian Economy

The climate is favourable for Canada to build on its research successes. NSERC will continue its important investments in people, discovery and innovation in order to better the lives of Canadians, and will continue to base its funding and policy decisions on the credible and relevant advice provided through its advisory committee structure and from the science community at large.

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PARKS CANADA

Parks Canada’s mandate is to protect and present nationally significant examples of Canada’s natural and cultural heritage, and foster public understanding, appreciation and enjoyment in ways that ensure the ecological and commemorative integrity of these places for present and future generations. Parks Canada manages three major programs: national parks, national historic sites and national marine conservation areas.

Science Advice

Ecological integrity and commemorative integrity are the key management goals for the agency, and are enshrined in law and policy. To ensure the protection, maintenance and restoration of ecological and commemorative integrity, Parks Canada is developing its science capacity for all its program areas. In 2002, Parks Canada adopted a science-based conservation strategy and initiated its implementation in 2003.

The Science Strategy will ensure the presence of sound science advice at the management table, provides objectives and results for the next five to ten years and outlines priority activities for the next one to five years.

Science in National Parks

National parks act as long-term ecological research sites, serving as ecological benchmarks for the study of natural environments and their components in a relatively undisturbed state. Park-based research is not only of value in assisting park management and interpretation, but contributes to the growing body of scientific knowledge on our natural world. Scientific studies in parks are seen as increasingly important because they can help reveal changes occurring in ecosystems as a result of human intervention on nature. The following are some highlights of a range of studies carried out in Canada's national parks over the last one year.

Spatial Mapping - Web Tool for Access to Spatial Topographic Data for all Canadian National Parks

To effectively manage Canadian Parks that are interspersed all over the country, knowledge of location of things and events is important for management of geographic space. Parks Canada has developed a tool that uses a web-enabled Geographic Information System (GIS) that serves topographic data at the 1:250 scale for all National Parks. The new tool allows users to access, manage and analyze spatial data in a highly accessible environment at a significantly reduced time. It is a cost effective approach to sharing geospatial information in terms of licensing of data and technology. This tool is accessible to all Parks Canada employees and is being used for a variety of spatial reasoning processes such as geo-locating occurrences. A signed agreement with NRCAN allows the use of the data within Parks Canada using one license and the data only has to reside in one location within the organization, minimizing problems and expenses associated with duplicated data. Parks Canada plans to acquire more 1:50K data for National Parks and National Historic Sites and to build the link between the base topographic data and the Biodiversity Management System.

Wildlife disease research in Riding Mountain national park

Research into the prevalence, distribution and ecological effects of bovine tuberculosis caused by *Mycobacterium bovis* continued in 2003 in Riding Mountain National Park. As

diagnosis of *M. bovis* in free-ranging cervids is difficult and costly using traditional methods, Parks Canada has used several new blood tests including a polymerase chain reaction, lymphocyte stimulation test, gamma interferon and fluorescent polarization assay to diagnose its occurrence in elk. These tests are currently being validated through the capture and testing of 150 elk that are also being radio-collared and monitored as part of an ongoing habitat use study. The same tests are also being used for the first time to test for the presence of the disease in packs of wolves which prey on elk to determine the role of large carnivores in the maintenance and spread of the disease. If these tests prove useful in the diagnosis of *M. bovis* in wildlife populations, they will have great application in the future management of the disease throughout the world.

Climate Change

In 2003 Parks Canada published a comprehensive report on climate change scenarios for each of 41 national parks, three national marine conservation areas (NMCAs) and six proposed national parks. Annual, seasonal and monthly temperature and precipitation projections were presented in tables and graphs for twelve general circulation model and emission scenario combinations, each combination for three periods in the 21st Century. Daily weather scenarios were also presented for three parks. The tabular data in spreadsheet was formatted to facilitate its use in ecosystem management studies. Consequently, although the report was catalogued in one of Parks Canada science paper series, it appears exclusively as a CD-ROM, a first for Parks Canada. The CD also contains text and graphical reports on the ecological impacts likely to occur at each park, and some of the adaptation options available to park managers. It also contains a report on Canadian biome changes that could occur under climate change. This research at the national level is matched at the park level. Across the 44 parks and NMCAs there are now 45 distinct monitoring programs that, in part, track hydrological or ecological responses to climate. This scientific effort is yielding results in park management. Nearly two thirds of the parks and NMCAs address climate change in their management planning, and indicators of climate change are being selected as part of Parks Canada's ecological integrity monitoring framework. The next phase of this work is to identify appropriate adaptation strategies for national parks.

Ecological Monitoring and Reporting

Monitoring and reporting are key to our Agency's top priority of maintaining or restoring ecological integrity. This initiative builds on our ongoing ecological monitoring to communicate to managers and the public on the state of health of our National Parks. A variety of scientific measures of biodiversity, ecosystem function and human influences in the park ecosystems are summarized in a small set of indicators for each of our 41 parks. Indicators and trends will be communicated through our "Status of Parks and State of Protected Area Reports". Science-based thresholds and ecological models will serve to interpret the data. Emphasis throughout is on statistical design, data management, co-ordination with researchers and stakeholders, and communication with the surrounding communities. Canadians will gain a clearer picture of the health of their national treasures over the next five years as the program is implemented.

Recovering the wood turtle in La Mauricie National Park

The largest known population of the wood turtle in Canada resides within the Shawinigan River, at the southern periphery of La Mauricie National Park, Québec. In collaboration with the Société de la Faune et des Parcs du Québec - the province's agency responsible for animal species at risk - a local environmental group, and graduate students from McGill University and Université du Québec à Trois-Rivières, biologists at La Mauricie have surveyed the population and radio-tracked a number of adult turtles. They found that 40% of the females nest in a small area close to the park's boundary. This nesting site is considered the most important in Canada and has since been protected. Park biologists and volunteers have monitored the nesting and protected the nests, allowing more than 700 of hatchlings to safely reach the Shawinigan River in the past three years. The riparian buffer of the river is now protected through stewardship resulting from a well-targeted public education program. Park biologists at La Mauricie are now using demographic, genetic, and habitat use data to plan the release of juvenile turtles within the park. It has been determined that augmenting the population within a protected area while securing the residence and main habitat of the species outside the park represents is the most promising strategy for maintaining this fragile population. This strategy illustrates the need to consider the "Greater Park Ecosystem" when planning the recovery of a species at risk. Park biologists will rely on a

well-developed monitoring protocol to regularly evaluate the outcome of their interventions on the population status.

New Funding

Parks Canada received new resources for the management and restoration of Ecological Integrity (EI) in national parks. The new funding, \$75 Million over five years, will be invested to: establish an *EI Innovation Fund*, address *Priority Themes and Issues*, and fund *System-Wide Priorities*. The *EI Innovation Fund* will provide resources for projects in a number of parks for better park management, greater park ecosystem partnerships, active management of ecosystems and heritage presentation initiatives. A small group of parks will receive funding related to *Priority Themes* to address significant EI challenges. To enhance the implementation of EI throughout the National Parks System, new *System-Wide Priorities* investments will be made to enhance national policy guidance; science capacity and partnerships; monitoring, reporting and indicators of EI; fire management; human dimension of parks use; training and development for employees; and informing, influencing, and involving Canadians. Tangible results from these investments will become apparent next year.

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PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Public Works and Government Services Canada (PWGSC) has earned an excellent reputation for its successful management of sophisticated scientific contracts with Canadian suppliers of products such as of the space shuttle's Canadarm. Equally important, PWGSC is recognized in North America, and beyond for its program of applied research within Real Property Program.

PWGSC has been involved with science and technology since 1974 when the Treasury Board (Minute 722298, March 21, 1974) confirmed the department's role "to undertake research and development in support of its operational objectives". Since

1985, this role has been concentrated in the Technology Directorate (now identified as Innovations and Solutions Directorate) of Real Property Branch (RPB), which has become one of the leading research organizations in the design, construction, preservation and maintenance of buildings and indoor environments. The Directorate has gained both national and international recognition for this expertise. It is a major contributor of innovations in the construction sector, of advancements in the science of the workplace environment and of leading edge research in building technologies.

Challenges and Opportunities

RPB has been participating in the National Steering Committee on Innovation in Construction. This private sector-led initiative aims to establish a permanent focus for the Canadian construction industry to support innovation and increase the competitiveness of Canadian companies in the global marketplace. Through the work of this committee, it has become clear that the industry is fragmented and needs a focus.

Despite abundant use of science and technology (S&T) in the construction sector, there is no recognized leadership to promote this sector's activities in the government's agenda of innovation, sustainable development and quality of life for Canadians. This topic is rarely raised at federal S&T community meetings.

PWGSC–RPB is one of the largest real property holders in Canada. It has knowledgeable, skilled and experienced personnel in architecture, engineering, trades, IM/IT technologies and other professions. It could champion the issues of S&T with respect to the construction sector.

PWGSC can explore and expand its service-base abroad through liaison with the S&T Network of Department of Foreign Affairs and International Trade (DFAIT). Trade counselors have already expressed their interest to promote Canadian expertise and provide contacts with foreign governments and industry in the field of innovative technologies, construction materials and other aspects of real property management.

The Innovations and Solutions Directorate

The Innovations and Solutions Directorate is the national centre of real property science and technology expertise for PWGSC

and a major contributor to advancements in building sciences in Canada. The directorate is the innovator developing solutions for technological challenges related to the design, construction, maintenance, use and operation of the real property assets managed by the department.

The directorate researches, develops, demonstrates, promotes and transfers leading edge technologies to provide value-added services to the RPB and its clients.

The directorate sets its research focus in line with government policy priorities and strategies as expressed in the Speech from the Throne, the business plans, senior management decisions, major government funding initiatives such as the Program of Energy Research and Development (PERD) as well as client needs across the country.

The directorate carries out its program of applied research programs in collaboration with the private sector, universities and other national and international research organizations. It is part of an informal network of research organizations that recognize each other's expertise and pool their resources and leverage their efforts to achieve results.

Research and Innovation

Since 1974, the department has been a major government player in the research and development of innovative construction technologies. In 1985, the Innovations and Solutions Directorate was established through the amalgamation of all existing R&D activities in the department. It has earned a national reputation for its research, demonstration and transfer of leading edge technologies related to physical infrastructure. The directorate has made significant breakthroughs primarily in energy efficiency, life-cycle management, workplace environments and in adapting existing technologies to innovative applications in building science. It has implemented new technologies in actual projects to demonstrate their effectiveness. It has also shown a unique ability to work with the private sector to transform research innovations into products and practices that significantly impact building design, construction methods and the work environment to the benefit of all Canadians.

The applied research of the directorate is grouped under seven program priorities. These are described below.

a. Energy efficiency and sustainability

The directorate conducts comprehensive research to increase energy efficiency in buildings and reduce greenhouse gas emissions and other environmental impacts in support of government initiatives.

b. Improving the workplace environment

A supportive workplace environment means appropriate lighting, heating and cooling levels, managed noise, sense of daylight and good air quality. Research by the directorate has made a significant difference in the design of the office environment.

c. Facility life cycle management

Innovations and Solutions Directorate extends the useful life of buildings by increasing the integrity of their components and systems through research and the implementation of new technologies.

d. Asset management tools

PWGSC, as the custodian of the federal government's office space inventory, is Canada's largest landlord. Innovations and Solutions Directorate has developed tools and practices to simplify the property management and stewardship process and to make the operation of buildings more cost-effective.

e. Developing standards and best practices

Standards and best practices in the building industry are maps for better construction methods and for higher quality end-products. Innovations and Solutions Directorate is at the forefront of the development of building standards in Canada.

f. Sharing innovations

New knowledge only becomes valuable when it is applied. Innovations and Solutions Directorate takes advantage of all media to make its innovations available to interested users beyond RPB.

g. Innovative applications

Innovations and Solutions Directorate has proven time and again that it can adapt existing technology to applications that are unique to building science.

National Scientific Program

The directorate works closely with the Natural Sciences and Engineering Research Council of Canada (NSERC) on joint research programs such as the monitoring of the Confederation Bridge. The directorate participates in reviewing grant applications related to the building industry with NSERC, the Canada Foundation for Innovation (CFI) and other government organizations.

The directorate participates in numerous activities of the Program of Energy Research and Development (PERD) that reflects government energy policy.

It also participates in the Canadian Commission on Construction Materials Evaluation that sets national policy and procedures for the evaluation of new construction materials and products.

Strategic Partnerships

Innovations and Solutions Directorate partners with federal departments, provincial governments, municipal governments, universities, research foundations and industry in building science research and development. It participates with the National Research Council (NRC) and NSERC in joint research projects, on various federal committees and in science and technology policy discussions.

The directorate collaborates in research with universities, government

laboratories and interdepartmental programs related to science and technology. Among these are the Natural Resources Canada, the Interdepartmental Network in Science and Technology (INIST) and the science and technology partnership programs of Canada's Federal S&T Network.

The department established the Technology Transfer Task Force Committee for sharing information, transferring innovations and developing strategic alliances in research projects related to real property assets. The directorate chairs

the Committee that includes representatives from all major Canadian universities and from key industry associations with an interest in construction, buildings and real estate.

In addition, the directorate is a member of several other government-industry-university work groups and transfer forums. It is also a member of the Research Protocol Development Committee of the General Services Administration (GSA) in the United States.

Internationally, the directorate conducts and participates in joint workshops with overseas real property research centres, universities and real property organizations. Most recently the directorate has signed Memoranda of Understanding for a variety of research projects with the Japanese Building Research Institute, with the National Center for Research in Earthquake Engineering, Taiwan, and with the California Department of Transportation.

Industry Associations and Standards Bodies

The directorate is a member of committees for standards developed by the Canadian Standards Association (CSA), Construction Specifications Canada, the International Organization for Standardization (ISO) and the American Society for Testing and Materials.

It actively participates in national associations such as the Canadian Construction Research Board, Construction Specifications Canada, the Association of Consulting Engineers of Canada, the Building Owners and Managers Association Canada, Canadian Construction Association and the Royal Architectural Institute of Canada.

Internationally, the directorate has affiliations with the Illuminating Engineering Society of North America, the International Commission on Illumination, the International Energy Agency, the Information Technology Council, the International Facility Management Association, the International Society for Facilities Executives, the Workplace Productivity Consortium, and the Civil Engineering Research Foundation.

Canadian Science and Technology Policy

Innovations and Solutions Directorate has excellent knowledge of the capabilities of the building industry in Canada, of the

needs of real property managers and of the improvements that would benefit building occupants in the Canadian climate. This is the expertise the Directorate brings to science and technology policy discussions.

The directorate is a member of several policy-setting committees including the Expert Panel on Canada's Role in International Science and Technology, the Canadian Commission on Construction Materials Evaluation, and the Program of Energy Research and Development.

Recognition of Expertise

The directorate has earned national and international recognition for its research in building science and technology — most significantly, in the development of new standards based on its work.

In Canada, the CSA has used the findings of the directorate as a foundation for national standards related to buildings and construction. Encouraged by the Standards Council of Canada, some of these national standards have become the basis for ISO standards. Such initiatives benefit Canadians by eliminating the need to adapt to new international specifications in export markets.

Another form of recognition is the numerous invitations the directorate receives each year to have its experts deliver keynote addresses at prestigious international conferences, as well as the invitations to participate and chair international building related committees, such as:

- The first International Workshop on Structural Health Monitoring of Innovative Civil Engineering Structures
- The Aquifer Thermal Energy Storage Conference, and the International Energy Implementing Agreement on Energy Storage.

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SOCIAL SCIENCES AND HUMANITIES RESEARCH COUNCIL OF CANADA

The Social Sciences and Humanities Research Council of Canada (SSHRC) is the federal agency responsible for supporting advanced research and research training in the social sciences and humanities. The Council also charts directions for the Canadian research effort in these fields. SSHRC funds research in over 30 disciplines, ranging from business, economics, education, environmental studies, ethics, history and law, to literature, management studies, philosophy, psychology, religious studies and sociology. The Council supports basic research, the training of highly qualified personnel, targeted research on social, economic, cultural and intellectual issues of importance to Canadians, and the broad dissemination of research-based knowledge for the benefit of Canadians.

Supporting Innovation Through Advanced Research and Research Training

In 2002-2003, SSHRC invested \$63.2 million in programs to support basic research and \$32.2 million in research training. During that time, the Council supported over 2,100 basic research projects, more than 1,400 doctoral students and over 230 postdoctoral fellows.

In Budget 2003, the Government of Canada announced the creation of the *Canada Graduate Scholarships (CGS)* program which, when fully implemented in 2006-2007, will support, each year, 2,000 master's and 2,000 doctoral students in all fields. The CGS program helps to train Canada's researchers and leaders of tomorrow and is administered by the three federal granting agencies. Sixty per cent of CGS awards are allocated to social sciences and humanities students. In 2003, SSHRC launched the master's component of the CGS Program and offered scholarships to 815 human sciences students.

Addressing Knowledge Gaps and Building Partnerships

SSHRC is continuously developing new programs and initiatives to enhance research and promote innovation and partnerships with users of research. An important objective is to support multidisciplinary research in key socio-economic and cultural areas. Specifically, SSHRC designs strategic programs to fill knowledge gaps and creates joint initiatives in partnership with

government departments, agencies and other organizations to connect producers of knowledge with users of knowledge.

Initiative on the New Economy (INE)

A five-year, \$100-million program launched in 2001, the INE supports research that helps to keep Canada at the forefront of the knowledge economy. This program explores the challenges and opportunities of the new economy in four major research areas:

- the nature of the new economy;
- management and entrepreneurship;
- education; and
- lifelong learning.

The new knowledge generated by INE-supported research helps decision-makers in the public, private and not-for-profit sectors to better understand the new economy and to devise new policies and practices that enhance Canadians' success in the new economy.

To date, the INE has awarded 208 grants ranging from \$20,000 to \$3 million. Research projects examine a broad range of topics, such as: the impact of the new economy on workplace education and learning; the impact of Internet stock message boards on international financial markets; and the legal and ethical aspects of privacy and authentication on the Internet. Through these grants, over 400 partnerships have been developed with public, private and not-for-profit organizations. Finally, INE programs provided almost \$32 million in funding for student salaries and stipends, with an additional \$5.6 million for postdoctoral researchers.

Community University Research Alliances (CURA)

In 1999-2000, SSHRC launched the CURA pilot program to develop knowledge and expertise for community development through broad research alliances between universities and local or regional groups. Because of the high level of interest shown by researchers and community partners in this program, SSHRC's Board adopted CURA as a mainstream program. Representative CURA projects include: sustaining rural communities in Nova Scotia; developing a recreation and tourism industry in mid-northern Quebec; countering the effects

of climate change on water resources in Ontario; and the effectiveness of the law enforcement and justice systems in addressing domestic violence on the Prairies. Fifteen new CURAs were established in 2003, representing a five-year investment of \$14.8 million.

Targeted Research on Specific Social, Economic, Cultural and Intellectual Issues

SSHRC currently has five priority areas, which govern the direction and form of new strategic programs in the coming years:

- Aboriginal Research
- Environment and Sustainability
- Culture, Citizenship and Identities (including the sub-priority area Official Languages);
- Image, Text, Sound and Technology; and
- Northern Research.

In 2003, SSHRC renewed four joint initiatives and developed and launched the following six new joint initiatives:

The *CESC-SSHRC Education Research Initiative* (INE) promotes education research that utilizes the specialized survey data compiled by the Council of Ministers of Education, Canada (CMEC) and Statistics Canada.

- The *Essential Skills* program (partner: Department of Human Resources and Skills Development) supports multidisciplinary research that will help Canadians acquire workplace and general life skills; it also offers special funding mechanisms to support the transfer of knowledge produced through research funded by the program.
- *Homelessness and Diversity Issues in Canada* (partner: National Secretariat on Homelessness, Human Resources and Skills Development) supports policy-relevant research on homelessness in Canada as it relates to ethnic and cultural diversity.
- *Multiculturalism Issues in Canada* (partner: Multiculturalism Program at Canadian Heritage) promotes innovative research on multiculturalism issues in Canada and

facilitates the generation, dissemination and transfer of research-based knowledge;

- The *Skills Research Initiative* (INE; with Industry Canada and Human Resources and Skills Development) supports policy-relevant research on issues related to skills development in the context of the new economy; and
- *The Canada Project* (INE; partner: Conference Board of Canada) promotes policy-relevant research that will help leverage Canada's comparative advantages and improve access to North American and global markets.

Since 1989, SSHRC has launched over 45 joint initiatives, the partners in which have contributed more than \$67 million in additional funding for social sciences and humanities research.

Supporting Excellence and Building Research Capacity

Canada Research Chairs Program

SSHRC administers the \$900 million *Canada Research Chairs* program on behalf of the three federal granting agencies. Established in 2000, this program supports the creation of 2,000 chairs in all fields of research, 20 per cent of which will be in the social sciences and humanities. *Canada Research Chairs* enable Canadian universities, together with their affiliated research institutes and hospitals, to achieve the highest levels of research excellence, and to become world-class research centres in a global, knowledge-based economy. One key objective of the program is to create more opportunities in Canada for world-class Canadian researchers who are not currently working in the country. The overall proportion of *Canada Research Chair* holders recruited from abroad presently stands at 26 per cent, with a considerably higher percentage in the most recent cohort.

To date, 1033 leading-edge researchers have been appointed to *Canada Research Chairs* in fields such as genetics, printmaking, global governance, environmental risk management, computational molecular modelling and mental and behavioural disorders. Of these, 233 are in the social sciences and humanities.

The Indirect Costs Program

Budget 2003 announced a new permanent program to support the indirect costs associated with research in institutions that receive funds from any of the three federal granting agencies. The \$225-million-a-year Indirect Costs program extends and expands the one-time Indirect Costs payment of \$200 million, announced by the Government of Canada in 2001, from the original 79 to currently 113 eligible universities, colleges and affiliated research hospitals. The *Canada Research Chairs* secretariat administers the *Indirect Costs* program, which helps universities, colleges and affiliated research hospitals and research institutes create an environment which maximizes their use of federal investments in academic research. The *Indirect Costs* program also helps smaller institutions, which cannot benefit from the economies of scale realized by large institutions, to increase their research capacity.

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STATISTICS CANADA

In Canada, provision of statistics to all levels of government and to the public is a federal responsibility. By means of the Statistics Act, Parliament has designated Statistics Canada as the central agency responsible for producing and co-ordinating with the provinces and territories such information.

Agency data are used in support of statutes and regulations. Uses include:

- the distribution of federal funds to provinces (Federal/Provincial Fiscal Arrangements Act), including the apportioning of federal–provincial collections (Harmonized Sales Tax);
- indexing both federal payments to beneficiaries and income tax credits (Income Tax Act);
- determining eligibility for supplementary benefits (Employment Insurance Act);

- determining the distribution of parliamentary seats among provinces and defining federal electoral districts (Electoral Boundaries Readjustment Act);
- designating federal bilingual services areas (Official Languages Act); and
- measuring the prevalence of sub-populations which are the focus of the federal employment equity program (Employment Equity Act).

Historically, Statistics Canada's program has been structured to provide information on the macroeconomy, the micro-economy and the socio-demographic structure of Canada. Statistical information is also provided on the nation's public institutions and programs. This constitutes the Agency's core program, which continues to be relevant. However, with issues continually emerging, the Agency must be ready and able to respond to evolving requirements for new information, the complexity of which is ever increasing.

Among the areas requiring more information and analysis to assist public and private decision makers in understanding the issues they face are: the new federal–provincial fiscal arrangements, the health of Canadians and the systems that support it, the factors affecting economic performance in the new knowledge-based economy, skills and learning, economic growth, the micro-economic factors affecting competitiveness, social cohesion, social capital, global opportunities and challenges as well as the outcomes of social programs. Maintaining the relevance of the Statistics Canada program by meeting such information needs and maintaining the integrity of the core program continues to be the primary goal for the Agency.

To accomplish this, Statistics Canada relies on two pivotal instruments. These are (a) the advice and guidance it receives from external consultative bodies; and (b) the Agency's planning and performance monitoring system and processes.

Science Advice

The external consultative bodies are the National Statistics Council; 14 professional and scientific advisory committees (including the Advisory Committee on Science and Technology Statistics); bilateral relationships with key federal departments;

and the Federal-Provincial Consultative Council on Statistical Policy.

Active partnerships are maintained by Statistics Canada with the Provinces and Territories. Of particular interest are special initiatives in the areas of Health, Education and Justice.

Planning and Performance Monitoring

Statistics Canada recognizes that there exists an ethical responsibility to report on dimensions of performance that are not visible from outside the Agency. It is also of the view that there are four primary dimensions of performance that are paramount to a national statistical agency and each can be linked to a particular stakeholder group that has an interest in its performance. These are: the **users** of the information products, the **funders** of the activities, the **respondents** to the surveys, and the **employees** on whom the Agency depends. Each of these stakeholder groups is addressed in regular reports to Statistics Canada's internal management committees.

There are six aspects of information quality that are pertinent to the use of information: relevance; accuracy; timeliness; accessibility; interpretability; and coherence. Some of these aspects can be quantified in numerical indicators; some are best described qualitatively, while others can be assessed only in terms of the processes followed by the Agency.

S&T Achievements

Information System for Science and Technology Project

As well as being the largest social science department or agency in the federal government, Statistics Canada maintains a growing program of S&T statistics as part of the *Information System for Science and Technology Project*. The project conducts surveys of the activities of R&D, invention, innovation, technology diffusion and related human resource development, measures and analyses of linkages among actors in the S&T system, and analyses of outcomes.

The program is progressing towards the analysis of the impact of S&T activity and it is guided in this by *Science and Technology Activities and Impacts: A Framework for a Statistical Information System 1998* (Cat. No. 88-522-XIB). The plan takes the program from its developmental stage, funded by Industry

Canada from 1996 to 1999, to a new level as an integral part of the work of the Agency. The funding for this strategic development for 1999-2004 is part of a package, coordinated by the federal Policy Research Initiative, to reduce gaps in the statistical system.

The surveys of federal science activities provide information on what the government spends on S&T, where it spends its S&T resources (sector and region), and on what its resources are spent (socio-economic objective). Longer-term objectives of this and the rest of the S&T statistics program are to demonstrate what the government gets for its S&T spending. Working papers and research documents are available free of charge on the Statistics Canada Web site.

Recent releases highlight: future directions in measuring innovation, the post-graduation plans of recent doctorate recipients, the characteristics of biotechnology firms and the commercialization of research. Selected research is summarized in the *Innovation Analysis Bulletin* (Cat. No. 88-003-XIE), available free of charge on Statistics Canada's Web site as are all related working paper series and questionnaires.

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TRANSPORT CANADA

Transport Canada (TC) is actively involved in transportation S&T/R&D. Through its Transportation Development Centre, it manages a multimodal R&D program that focusses on improving safety, security, energy efficiency, environmental sustainability, and accessibility. This work is augmented and complemented by specific R&D conducted by the department's modal groups.

Highlights of Research Achievements

Security and Counterterrorism

TC continues to work to improve aviation and marine security through technological innovation. The department works closely with federal partners through the Chemical, Biological, Radiological and Nuclear Research and Technology Initiative, and the Public Security Technology Program, and with U.S. security authorities. Advanced, reliable and efficient technologies continue to be developed on a priority basis for the detection and containment of explosives and other threats, integrated security systems, and human-machine interfaces.

Air Safety

TC is an international leader in winter operations research, focussing on critical safety issues such as aircraft icing, runway operations and de-icing, and the development of an international runway friction index.

Research into cabin safety issues involves flammability, emergency evacuation procedures, fire detection and suppression, and incident/accident analysis. Full-scale simulations were underway to determine factors that affect the ability of passengers to rapidly evacuate an aircraft cabin.

Four Canadian airlines have initiated flight data monitoring programs, which will be key components of the TC-encouraged Safety Management Systems.

R&D in aerodrome operations included the examination of new technologies and strategies to prevent runway incursions, new technologies to reduce the incidence of aircraft bird strikes, and ways to improve aircraft braking performance on wet runways.

Marine Safety

Following up on previous R&D involving continuous water injection technology, an in-house-designed system is undergoing trials along with a sophisticated system for monitoring engine performance.

Preliminary performance-based guidelines were developed, and model testing was conducted, with the goal of creating new design standards to be used to evaluate evacuation systems for offshore platforms.

Laboratory and field testing of life rafts and materials has suggested that the costly annual process of life raft inspection could safely be extended to as much as five years.

An integrated advanced radar system combining several new technologies has undergone a series of trials aboard a shuttle tanker that is in regular service to an offshore oil platform.

Tests were performed in a scale mock-up, with the goal of examining firefighting systems for tunnel areas of self-unloading bulk carriers — one of the most difficult areas to reach with some fire equipment.

Road Safety

Planning was underway for the in-service testing portion of a pilot evaluation of commercial vehicle on-board recorders and associated technologies. On-board recorders and similar technologies, such as smart cards, could replace traditional recording devices and create electronic files, storing important information with ease.

TC's school bus crash-avoidance program is evaluating and testing technologies to protect pedestrians around school buses. Evaluation criteria have been developed and weighted, and data collection is underway to determine the effectiveness of two prestop warning systems.

Advanced pedestrian-protection systems, including a system that warns if a child is in the danger zone at a bus stop, have been evaluated. The results of this research will be used to support the development of new regulations.

Rail Safety

Direction 2006, a cooperative venture between TC and various other organizations, aims to reduce incidents at highway-railway-grade crossings by 2006. A wide range of projects have been undertaken recently involving the placement of locomotive horns, a model for estimating accident risk at specific grade crossings, and methods of warning of a second approaching train.

TC assisted in organizing a workshop to review the state of R&D on ground hazards. This program has been developing a

risk-based approach and analytical tools to predict and prevent accidents from natural hazards.

Transportation of Dangerous Goods

A cooperative research venture between TC and the U.S. Department of Transportation's Federal Railway Administration examined the effect of low-temperature impacts on tank cars. New coupling equipment, or draft gear, may be designed to help attenuate these forces. Another study attempted to develop a system for monitoring longitudinal and vertical coupler forces in tank cars.

A revised thermal model was developed that can analyze defects in the insulation that protects tank cars from fire in an accident, with work continuing to improve the software and increase its capacities.

A recently completed project tested the performance standard for steel drums, and determined whether all new packaging is capable of meeting the performance levels required by the tests. The study results will be presented to the International Organization for Standardization to help in the choice of a standard drop test.

Intelligent Transportation Systems

Research into dedicated short-range communications (DSRC) and advanced traveler information systems continued. One project tested the use of transponder-equipped vehicles as traffic-monitoring probes; another study investigated whether DSRC could be used to provide real-time, location-sensitive information on traffic and routing matters. A program of research and testing of transponders for DSRC applications has produced prototypes of a new multi-application transponder. Potential applications and test sites are being investigated.

The evaluation of a tracking beacon that could be integrated into mobile phones has proceeded as a follow-up to the examination of cellular telephone technology as a low-cost localizing and tracking system.

Accessibility

Work is currently underway, in cooperation with the Canadian Institute for the Blind, on standards for acceptable pedestrian

crossings. Also, a joint TC-industry project examined safety concerns related to personal use vehicles. In the field of air accessibility, one project studied the boarding equipment and practices used on smaller regional aircraft, and performed tests on common aircraft types.

Human Factors Research

A fatigue-management program for marine pilots has been developed. It addresses the issues of dealing with heavy workloads in stressful environments, and includes training modules to teach pilots coping strategies.

An important joint agreement has been signed between TC and various Canadian provincial and U.S. authorities to continue research into recommended practices for the management of commercial driver fatigue. The program incorporates fatigue/wellness education, screening for sleep disorders, and the development of scheduling guidelines and policies to manage fatigue effectively.

Sustainable Development

TC's commitment to reducing the impact of transportation on human health and the environment involves:

- reducing emissions;
- increasing fuel efficiency;
- investigating new fuels and new propulsion technologies;
- increasing the integration of urban transit systems; and
- increasing the overall efficiency of the system.

TC's multifaceted electric and hybrid-electric vehicle evaluation program is examining the current state of the technology, and includes work to develop a battery temperature control system for electric vehicles in cold climates. To date, a prototype system has been installed in a postal van. Also, a prototype of a lightweight, hybrid, accessible taxi has been developed, and a multimode electric bus prototype under development has undergone vehicle performance tests.

Research into advanced bus technology continues. Reducing the weight of a bus is one method of reducing fuel consumption and GHG gas emissions, and results have shown that a 20-

percent weight reduction is possible using advanced materials for the structure of the bus. The results of a preliminary study also suggest that the use of lightweight metal matrix composite materials in brake materials would reduce weight and be more cost-effective.

Climate Change

TC's involvement in the Government of Canada's Action Plan on Climate Change includes five research programs:

- Urban Transportation;
- Freight Transportation;
- Vehicle Efficiency;
- Future Fuels; and
- Fuel Cell Vehicles.

The programs take a balanced approach towards vehicle and fuel technology, behaviour change, and infrastructure. In the new Technology and Innovation Initiative Advanced End-Use Efficiency, TC is leading the Expert Group on Transportation Research and Development.

Technology Transfer

TC hosted several workshops and other technology-transfer events during the past year, including those on accessibility, highway-railway grade crossing research, locomotive emissions, aircraft de-icing, and anti-icing. A review of TC's intellectual property and licencing agreements was also undertaken.

Transport Canada's Strategy

In helping to prepare Canada's transportation system to optimize transformative technological opportunities in the 21st century, TC conducted a study of the department's S&T/R&D activities. As a result, the department will adopt a more coordinated and strategic approach to broaden and strengthen support for S&T/R&D activities and knowledge flows. To this end, TC will realign and enhance existing departmental capacities and approaches, and encourage innovation to benefit transportation users. The kind of forward thinking and innovation that drives TC's S&T/R&D activities is helping to meet the

department's goal of creating "the best transportation system for Canada and Canadians."

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WESTERN ECONOMIC DIVERSIFICATION

Western Economic Diversification (WD) is an active supporter of innovation in western Canada. WD meets its' strategic objective of "strengthening western Canada's innovation system" through enhancing technology commercialization, strengthening knowledge infrastructure, increasing linkages between innovation system players, enhancing skills, and focusing on community innovation.

WD recently commissioned an independent study of WD's role in innovation in the West. Some of the key findings of the report, "*Western Diversification: A Catalyst for Innovation in western Canada.*" include:

- WD has played a strong role in promoting innovation, through providing financial support, through formulating partnerships and developing initiatives, and by acting as a facilitator and catalyst that makes strategic investments. The roles undertaken by WD are highly valued by other innovation systems players.
- WD is effective in promoting innovation due to its flexibility to deliver and tailor programming, and its skilled and knowledgeable staff, and its role as a neutral broker in facilitating partnerships.
- WD has directed resources to build the foundation for future growth through encouraging additional resources in innovation, strengthening research capabilities, strengthening linkages between innovation system players, increasing access to skilled workers, and by bringing attention to the importance of innovation in rural areas.

- WD's actions and investments have contributed to the formation of clusters, which will provide the basis for continued economic growth and prosperity in the West. Key sectors for the West include:

- British Columbia - new media, fuel cells, genomics/proteomics;
- Alberta- wireless, health technologies, micro/nano technologies,
- Saskatchewan - telehealth, climate change technologies, synchrotron, and
- Manitoba- design engineering, health, and composite materials.

While WD is not a science based department, many of the innovation initiatives supported by WD reflect the principles and best practices of the BEST and STEPS reports of the CSTA. In particular, WD is a catalyst and leader in innovation in the West, WD's investments are based on collaboration with a variety of stakeholders to build capacity, and WD works to align priorities among innovation players through forums such as the Deputy Ministers of Economic Development and the Senior Officials Forum on Innovation. The following initiatives are examples that demonstrate these best practices and the range of WD's priority sectors and initiatives.

Canada West Health Innovation Council (CWHIC)

WD created the Canada West Health Innovation Council (CWHIC) to champion the agenda of capturing economic and social benefits from health research. Led by prominent western Canadians such as Dr. Henry Friesen and Dr. Aubrey Tingle, CWHIC has developed a strategy of "managed networks" of expertise among provinces to achieve critical mass. Priority areas include Functional Foods and Nutraceuticals, Infectious Diseases, Medical Devices and Imaging, and Clinical Trials. These offers the potential for significant improvements in health care and the technological breakthroughs may present substantial economic benefits (new investment, export opportunities, and the creation of skilled jobs and new enterprises). CWHIC has consulted widely in western Canada and nationally to promote the important linkage between health innovation and economic development including a presentation to the National Innovation Summit in November 2002.

www.cwhic.ca

http://www.wd.gc.ca/mediacentre/accesswest/2003_01/3_e.asp

VIDO – Vaccine & Infectious Disease Organization

The Vaccine & Infectious Diseases Organization is located at the University of Saskatchewan, but serves all of western Canada. VIDO conducts research into new and improved animal vaccines and is a global leader in research into the diseases that afflict food animals. It developed the world's first genetically engineered vaccine to combat shipping fever in cattle, and continues to develop vaccines and needle-free delivery systems that have implications for animal and human health. WD assisted VIDO in increasing its research capability by expanding and equipping its building facilities.

<http://www.vido.org/>

http://www.wd.gc.ca/mediacentre/2003/mar03-01a_e.asp

Wireless E-health Monitor

This project is developing new physiological monitors and integrate them for the purpose of e-health monitoring, wellness management and illness prevention. The project is a private and public partnership conceived and coordinated by the University of Alberta. It involves two Japanese companies, Seiko Instruments and MI Laboratories Co. [a Sony spin-off], Televital Inc. [US] and nine other local organizations. The new generation of e-health solutions or Wireless Wearable Physiological Monitors [WWPM] will help track the health condition of humans and animals 24 hours a day. The WWPM will continuously collect and store health data, issue regular data reports and follow up on monitoring triggers caused by extreme variations in the individual's physiological data. Monitors will assist individuals to better manage their own health, increase efficiency of health-care services and help save lives. WD contributed 20% of the project costs.

http://www.wd.gc.ca/mediacentre/2002/sept06-02a_e.asp

The WestLink Innovation Network

WestLink was established in May 1999, with core funding from WD, to accelerate technology transfer in Western Canada through collaboration, skill building and targeted, 'gap-filling' programs and services. WestLink's membership includes a network of 25 western Canadian universities, colleges and

research institutes. WestLink has created linkages among venture capital firms, university spin-off companies, industry and the legal profession. WestLink offers services in facilitation and communication, skill development and training, and technology bundling in the areas of medical devices and software. Members share best practices

WestLink's Technology Commercialization Internship program (TCIP), sponsored by WD, NSERC, industry and the four western provinces, is an example of an initiative that increases the skills and experience of youth, builds linkages among the innovation system players and enhances technology commercialization. Eighteen interns (educated in science and business) completed their two-year program in spring 2003 after specialized training in all aspects of technology commercialization and experience in a technology commercialization office, a venture capital firm and a start-up company. The program is continuing with 20 new western interns, and is connected to a similar program being offered in Atlantic Canada.

www.westlink.ca

http://www.wd.gc.ca/mediacentre/facts/pan/pan3_e.asp

http://www.wd.gc.ca/mediacentre/accesswest/2003_01/8_e.asp

http://www.wd.gc.ca/mediacentre/2002/sept23-01a_e.asp

Fuel Cells Canada

Fuel Cells Canada was created to advance Canada's world-leading fuel cell industry. WD contributed funds to assist in the implementation of FCC's five-year strategic and operational plan. FCC priorities include the development of a national fuel cells commercialization strategy, support of a skilled workforce to meet industry requirements and the promotion of fuel cell technology. Over the past several years, WD has made major investments in the Fuel Cell cluster in Vancouver including a fuel cell testing facility, demonstration projects for fuel cell use in various applications such as vehicles and portable stand-by fuel cells for remote sites as well as supporting infrastructure for the fuel cell industry.

http://www.wd.gc.ca/mediacentre/2003/jun09-01a_e.asp

Vehicle Technology Centre

WD contributed funds to establish a Vehicle Technology Centre at the University of Manitoba, which will work towards the development of a world-class vehicle and transportation equipment cluster, including manufacturing, supply of parts, engineering, research and development and testing. This organization will make linkages between industry and supporting infrastructure in Manitoba and will benefit Manitoba's bus and coach industry as well as other vehicle makers in western Canada.

http://www.westest.ca/PDFs/April_VTC%20&%20%20MAST_%20by%20WD.pdf

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