



Environment Canada
Environnement Canada



Environment Canada's Technology Role

A Supplement to Environment Canada's Science Plan (2007)

Environment Canada's mandate is to preserve and enhance the quality of the natural environment; conserve Canada's renewable resources; conserve and protect Canada's water resources; forecast weather and environmental change; enforce rules relating to boundary waters; and coordinate environmental policies and programs for the federal government.

Introduction—the Interconnection of Science and Technology at Environment Canada

Science and technology (S&T) are essential to Environment Canada's mandate. Consequently, Environment Canada is one of the most S&T-intensive departments in the federal government, with S&T activities accounting for the majority of the budget and staff.¹ Under the *Canadian Environmental Protection Act, 1999* and the *Department of the Environment Act*, Environment Canada is both mandated and enabled to conduct environmental research on a range of environmental issues. More specifically, under

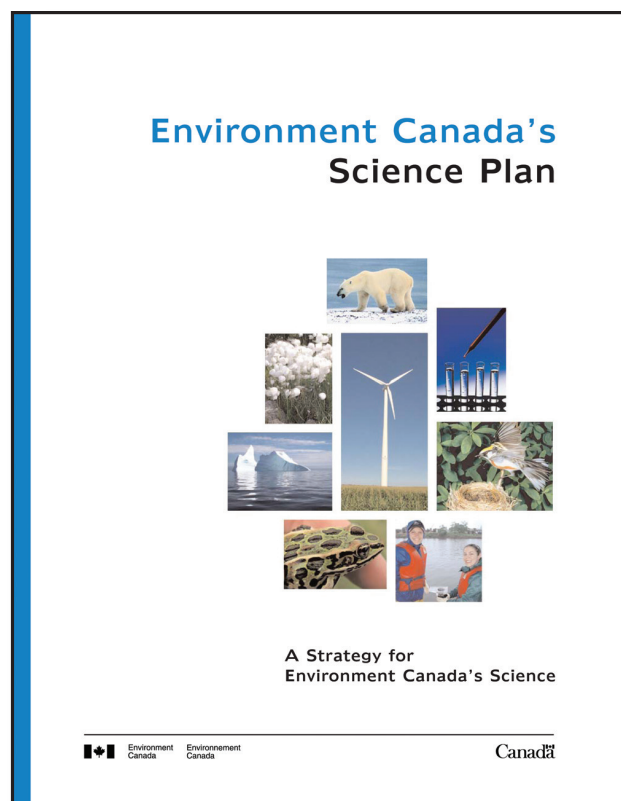
The Minister is obligated under the *Department of the Environment Act* (section 5,a) to "...initiate, recommend and undertake programs, and coordinate programs of the Government of Canada that are designed... (i.) to promote the establishment or adoption of objectives or standards relating to environmental quality, or to control pollution, and (ii.) to ensure that new federal projects, programs and activities are assessed early in the planning process for potential adverse effects on the quality of the natural environment." Many of these projects, programs, and activities involve technology.

The Government of Canada is also obligated under the *Canadian Environmental Protection Act, 1999* (CEPA 1999, section 2,1,i) "**to apply knowledge, including traditional aboriginal knowledge, science and technology, to identify and resolve environmental problems.**" Environment Canada makes valuable contributions to these efforts.

1. For fiscal year 2008-2009, S&T expenditures were \$711 million (<http://www.statcan.gc.ca/pub/88-001-x/2009006/t006-eng.htm>). Total financial resources for Environment Canada for fiscal year 2008-2009 were \$1,120.4 million (<http://www.tbs-sct.gc.ca/dpr-rmr/2008-2009/inst/doe/doe01-eng.asp>).

the *Canadian Environmental Assessment Act*, Environment Canada contributes technical expertise to environmental assessments and assists the Government of Canada in identifying and resolving environmental problems. Environment Canada also makes use of technology to support regulatory initiatives, carries out technology performance scoping studies, and develops methods and devices to support regulation development and enforcement. As a result, technology activities at the Department include more than the computer-based information systems that are a necessary feature of the contemporary organization. Environment Canada's technology role includes the technologies that are critical to meeting the Department's legislated obligations.

Scientific progress and development of technology are highly interdependent—the very term S&T acknowledges the close relationship between the two. Environment Canada has a science plan, published in 2007. *Environment Canada's Technology Role* was prepared to complement *Environment Canada's Science Plan*² by making clear the links between science and technology within Environment Canada, and highlighting the ways in which Environment Canada accesses, develops, supports, and verifies environmental technologies. *Environment Canada's Technology Role* does not have the scope of the Science Plan. Rather, it provides a foundation for integrating the technology role into the Science Plan during a comprehensive five-year review, scheduled for 2012.



Environment Canada's Science Plan

Environment Canada's Science Plan

articulates a ten-year vision for three strategic directions that contribute to the Department's mandate and legislated responsibilities, and it sets out the management processes needed to achieve them.

Science Plan Strategic Directions:

1. Developing an integrated environmental monitoring and prediction capability;
2. Understanding cumulative risks; and
3. Managing risks, optimizing opportunities, and building resilience.

Three complementary functions have been identified. Together, these functions comprise the Department's technology role:

1. Access and/or develop the technology needed to monitor and comprehend the environment;
2. Understand the environmental impacts of technology use; and
3. Generate and maintain the technical knowledge and foresight needed to develop environmentally sound regulations, programs, and policies.

2. Environment Canada. 2007. *Environment Canada's Science Plan: A Strategy for Environment Canada's Science*. Science and Technology Branch. 21 p. + x. (<http://www.ec.gc.ca/scitech/default.asp?lang=En&n=9FA49B9A-1>). Referred to hereafter as the Science Plan.

ENVIRONMENT CANADA'S TECHNOLOGY FUNCTION 1:

Access and/or develop the technology needed to monitor and comprehend the environment

Environment Canada is on the leading edge of technologies to monitor and understand the environment. Such technologies promote expansion and refinement of scientific knowledge and improve policies to generate information on the environment and changes to it over time. These technologies enable the

development of an integrated environmental monitoring and prediction capability. To integrate different measures of environmental quality effectively, Environment Canada scientists need access to the best possible monitoring and prediction instruments. Emission measurement technologies and protocols, for instance, provide the Department with the required knowledge to assess current and future regulated emissions from various sources. Together, science and technology enable integrated, detailed analysis of environmental status.

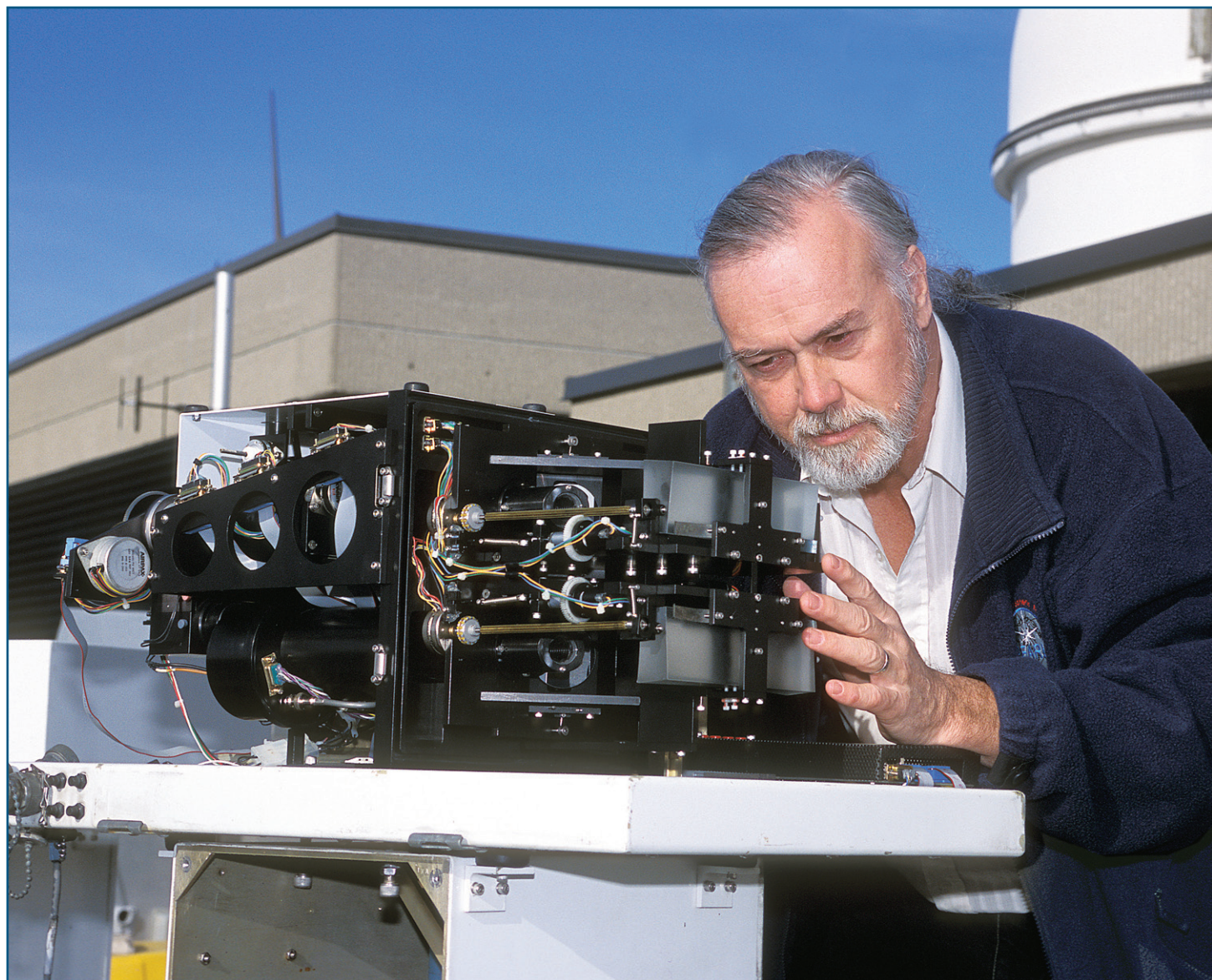


Photo: © Photos.com, 2010

Dr. Tom McElroy, with a Brewer ozone spectrophotometer, on the roof of Environment Canada's ozone observatory in Toronto.

Technology to Support Integrated Monitoring and Prediction

Canadian science and technology have been at the forefront of efforts to protect the ozone layer from depletion. The **Brewer Ozone Spectrophotometer**, developed by Environment Canada scientists, is the standard instrument for ground-based ozone and surface ultraviolet (UV) measurements. The supercomputer at the Canadian Meteorological Centre in Dorval uses data from Brewer stations across the country to produce a forecast of the thickness of the ozone layer, expressed as a number on the UV index. Worldwide, nearly 200 Brewer instruments are in use, the largest network of ground-based UV-measuring instruments in the world. Brewer Ozone Spectrophotometer networks and ozonesonde networks in Canada and other countries are critical to our ability to understand the evolution of the ozone layer and to monitor its recovery.



Photo: © Photos.com, 2010

Isotope tagging makes it easier to track the paths of migrating monarch butterflies.

Tracking the movement of migratory wildlife has always been a challenge, particularly when tracking small species, which are not easily tagged, and when tracking over remote areas. Environment Canada research scientists developed **Isotope Tagging**, to track the paths of migrating species over long distances. This technique uses forensic stable isotope analysis technology as an intrinsic marker to track migrant species. This approach and technology are widely recognized and have been adopted by key wildlife migration monitoring and research programs in several countries.



Photo: © Bob Rowsell

Integrated Measurement Platforms (IMPs) automatically monitor climate and water quality parameters from remote deployments and transmit the data to a central collection location.

Weather and environmental monitoring and forecasting are among the Department's most visible public services. These services depend upon complex technological systems to monitor and analyze atmospheric and hydrological data from across the country, predict environmental conditions, and communicate forecasts to Canadians. These technologies include **monitoring capabilities (in situ, radar and space-based), high performance super computing, and forecasting tools**. Some of this technology is developed wholly in-house and much of that purchased from external suppliers is adapted or augmented by the Department's staff. International partnerships to create and test advanced technologies are important to supplement Environment Canada's capacity.

ENVIRONMENT CANADA'S TECHNOLOGY FUNCTION 2:

Understand the environmental impacts of technology use

Environment Canada conducts technology assessments to support federal technology policies and regulations, as well as technology investment decisions. These assessments also contribute to the Science Plan's second Strategic Direction, **understanding cumulative risks to the environment**. The Department conducts several types of assessments that analyze and characterize the interrelated risks posed by particular technologies. These include state of the S&T assessments and co- and dis-benefits studies, which examine a technology's intended and unintended benefits and consequences. Currently, Environment Canada is developing a suite of sustainability metrics for specific industrial sectors. These constitute a set of tools for understanding the environmental performance of renewable energies (such as

biofuel, wind, solar, or ocean) or aspects of cleaner fossil fuels (such as carbon capture and storage). Tools such as these can also serve to analyze a wide range of other technologies, including building or vehicle technologies, highly efficient industrial technologies, or waste and wastewater handling.



Photos: © Photos.com, 2010

Understanding the environmental impacts of technology use.

Technology to Support Understanding of Cumulative Risk

Environment Canada is assessing the overall benefits and impacts of increased use of biofuels in the transportation sector through its **Renewable Fuels Strategy**. Understanding the cradle-to-grave environmental impact of biofuels demands highly coordinated skills and specialized methodologies. Environment Canada is leading a proactive research agenda to examine the life cycle of biofuels in order to inform the design, monitoring, and refinement of regulations. The Department works closely with other government departments to advance biofuels development in an environmentally sustainable manner.

Quantifying the environmental sustainability of different technologies allows Environment

Canada to monitor Canada's progress on the road to achieving desirable environmental outcomes. The Department is establishing **Environmental Sustainability Metrics for comparing technologies within the energy sector**, which make use of available environmental data sets: for example, greenhouse gas emissions, acid deposition and water use. The protocol for implementing these metrics integrates several formal methods of assessment, including Life Cycle Assessment (LCA), Environmental Impact Assessment (EIA) and the Sustainability Assessment Framework and Tool (SAFT). Science-based departments, academic institutions, federal funding programs and other interested stakeholders have been engaged as part of this process.

ENVIRONMENT CANADA'S TECHNOLOGY FUNCTION 3:

Generate and maintain the technical knowledge and foresight needed to develop environmentally sound regulations, programs, and policies



In order to provide high-quality, unbiased advice about S&T, the Department needs to maintain expert technical knowledge and foresight. The Department does this in a variety of ways. It works with industry, government and non-government groups to identify best practices and best available technologies. It sets policies, programs and sometimes regulations to improve environmental performance and to encourage the development of technologies to address environmental problems. It supports sophisticated data management and technologies for the public good. It participates in interdepartmental steering committees that prioritize and govern funds to support the development of innovative environmental technology. Throughout, the Department provides expert advice, helps establish criteria to guide funding decisions, and evaluates environmental outcomes of funded projects. By encouraging innovative, environmentally sound technologies and in verifying their claims, Environment Canada is building a broad capacity to support the third direction of the Science Plan: **managing risks, optimizing opportunities, and building resilience**. In this way, Environment Canada helps reduce environmental risk, creates opportunities from potential threats, and contributes to an overall resilience in adapting to a changing environment.

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Technology to Support Managing Risks, Optimizing Opportunities, and Building Resilience

Sustainable Development Technology Canada

(SDTC) is a not-for-profit foundation created by the Government of Canada to finance and support development and demonstration of clean technologies. SDTC operates two funds: the \$550 million SD Tech Fund™, which supports projects that address climate change, air quality, clean water and clean soil; and the \$500 million NextGen Biofuels Fund™, which supports establishment of first-of-kind large demonstration-scale facilities for production of next-generation renewable fuels. With Natural Resources Canada, Environment Canada provides oversight of SDTC's operations to ensure they comply with funding agreements and founding legislation.

Environmental Technology Verification Canada

is a not-for-profit organization that offers, on behalf of Environment Canada, an assessment process for verifying the environmental performance claims of technologies. Technology vendors apply to the ETV Program. If their technology is successfully verified, it receives an internationally recognized



"Verification Certificate" backed by the Government of Canada. Environment Canada administers and oversees the domestic and international components of the program.

Hydraulic research at Environment Canada formed the basis for **improved concrete pipe and maintenance hole design** for municipal stormwater drainage systems. Environment Canada scientists have also provided conceptual designs of oil and grit separators. These separators capture oil and suspended solids in urban stormwater before they enter stormwater ponds or other aquatic environments. This kind of public good science reduces environmental risk, builds environmental resiliency, and enhances the capacity of the Canadian environmental technology industry.

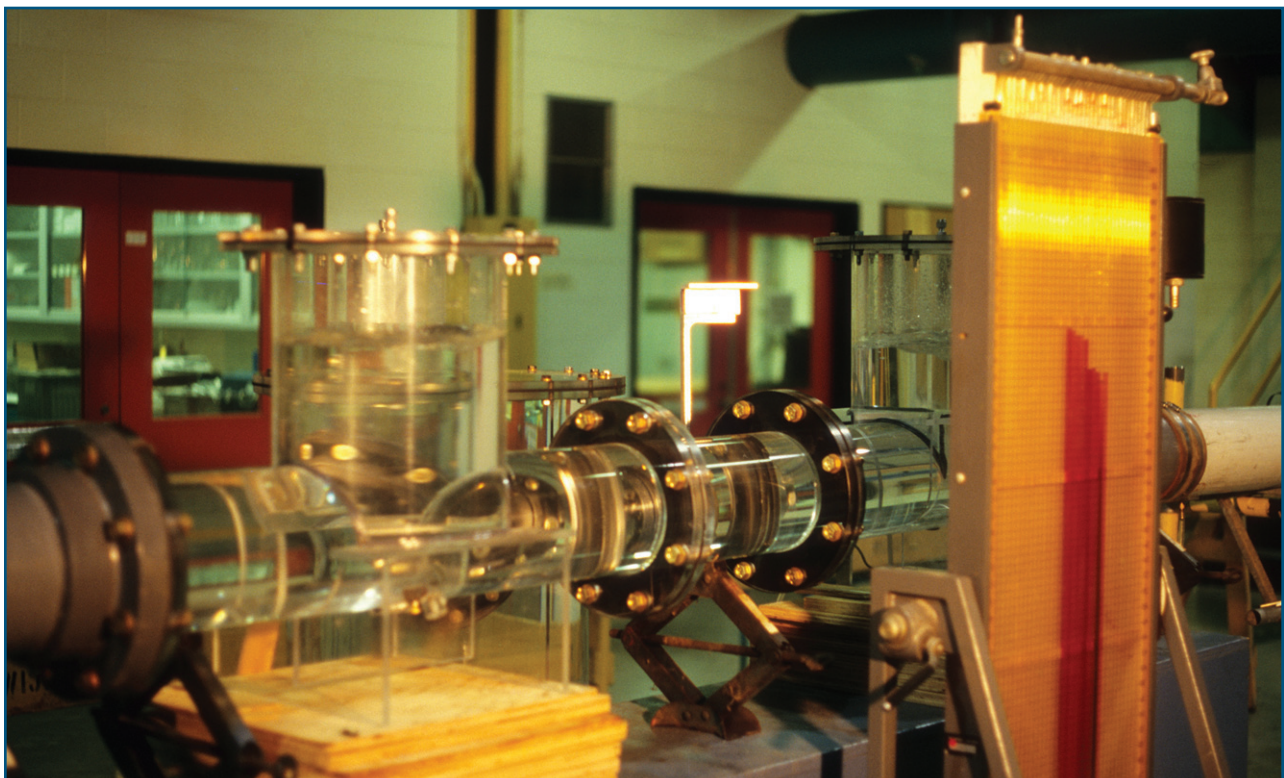


Photo : © J. Marsalek
Laboratory scale model used for studying hydraulics of sewer pipe junctions.



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Conclusion

Environment Canada's technology role enables the Department to have access to the tools necessary for scientific work, to be a valued partner in domestic and international initiatives, and to fulfill legislated responsibilities. The Department's technologies and technology activities are well-aligned with its strategic directions for science, and will be further integrated with the Science Plan during a five-year comprehensive review in 2012.

Technology and technological activities enable the Department to deliver its mandate. The Science Plan states Environment Canada's commitment to the recruitment and retention of the best people, to the collaborative and multidisciplinary approaches that best address complicated environmental problems, to the unique infrastructure needs of S&T, to accountability for the financial resources of S&T activities, and to the science communication and knowledge brokering that makes S&T knowledge accessible to those who need it. Environment Canada's technology role supports the Department in meeting these commitments. The examples in this document point to a powerful overall story about technology. It is a vital part of Environment Canada's capacity to anticipate and address complex environmental issues.

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