TOWARD A NATIONAL NEUTRON STRATEGY

Canada's social, environmental and economic challenges require a complete twenty-first century scientific toolkit for research and innovation in materials.

Because everything is made of materials, innovation in materials underpins nearly all technology advances for national priorities, including:

A CLEAN ENVIRONMENT

Producing clean, reliable, and renewable energy and storing it for an efficient electricity grid.

A CLEAN GROWTH ECONOMY

Transforming manufacturing for clean and energy-efficient, light-weight planes, ships, and cars.

SAFETY AND SECURITY

Aiding nuclear non-proliferation, ensuring pipeline and rail safety, and determining fitness-for-service of naval ships.

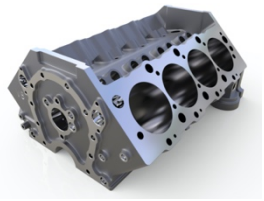
HEALTH AND FOOD SECURITY

Understanding the materials in our bodies on the nanoscale, designing medical devices, and developing resilient crops for global food security.

Engineers and scientists apply many probes to advance knowledge and improve materials, and **neutron beams are versatile and irreplaceable tools for materials research.** Canadians have led in this field for over 70 years, applying these tools to make major socio-economic impacts, such as those described at cins.ca/discover. One particular impact—**saving hundreds of millions of dollars** by reducing downtimes of Canada's fleet of nuclear power stations—outweighed Canada's cumulative investments in neutron beam facilities to date.

The importance of neutron beams as research tools that provide insights about materials that cannot be obtained by other scientific techniques is recognized globally: **other nations are investing in multi-billion-dollar neutron sources, yet neutron beams are now missing from Canada's scientific toolkit**, hindering our long-term ability to innovate to meet our social, environmental and economic challenges.

Neutron beams were vital to explain, and prevent downtime from, leaks at Canada's fleet of nuclear power reactors.



Neutron beams were critical to ensuring reliability of car engine parts manufactured with innovative methods.

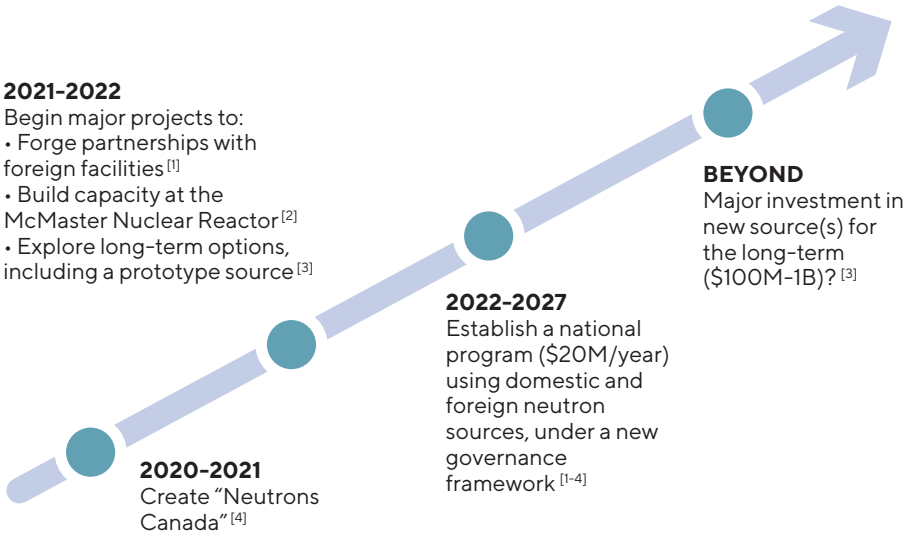
Neutron beams were critical to explain cracking issues in Canada's aging pipelines and develop industry standard practices to ensure reliability.

Neutron beams are being used at the University of Saskatchewan to advance global food security.

Canadian universities are leading the way through the Canadian Neutron Initiative (CNI) to develop and implement **a new national neutron strategy** to rebuild Canadian capacity for materials research with neutron beams.

In consultation with stakeholders over the past few years, the CNI, an executive-level working group for strategy development and coordinating action, has identified **four key objectives** that are essential to put into place the **required infrastructure and governance framework** to enable Canadians to use neutron beams:

1. Forge partnerships with high-brightness neutron sources in other countries;
2. Build on existing domestic capabilities, including full exploitation of the McMaster Nuclear Reactor (MNR), a medium-brightness neutron source;
3. Explore and invest in developing new neutron sources for the long term; and
4. Create a new, national governance and management framework for these activities.



With a complete twenty-first century scientific toolkit, Canadians can accelerate the pace of innovation. New insights into the relationships between the structure and properties of a material and its manufacturing methods will drive technological progress, resulting in innovations that could range from enabling advanced manufacturing of clean and energy-efficient vehicles using light-weight materials and energy sources such as hydrogen, to ensuring safe and reliable clean energy production through high performing materials in power stations, to fighting diseases such as Alzheimer's and COVID-19 through better understandings of their molecular mechanisms. Canadians will also lay foundations for breakthroughs in new materials with greatly enhanced performance that will have a transformative influence on many technologies—and with such innovations come the promise of **enhanced quality of life for all Canadians**.

"World-class research and innovation require large, national-scale science facilities that are accessible and maintained at the state-of-the-art. Neutron beam facilities are critical tools for materials research and technology development in areas such as clean energy, clean transportation, health, and food security. The Canadian Neutron Initiative proposes a single program for orderly stewardship of Canadian access to neutron beam facilities."

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