

Toward a National Neutron Strategy

in Materials Research with
Neutron Beams

(Part 2)

*Daniel Banks, President, TVB Associates
Representing CNI
CNI-CIFAR Roundtable on a National Neutron
Strategy, Dec 15, 2020*

NEUTRONS.CA



Challenges

Environmental, Social, Health, Economic



CLEAN ENERGY

Producing clean energy and storing it in an efficient electricity grid.



SAFETY & SECURITY

Ensuring nuclear, pipeline and rail safety, and determining fitness-for-service of naval ships.



CLEAN GROWTH

Making parts for clean, light-weight planes, ships, and cars using advanced manufacturing.



HEALTH AND FOOD SECURITY

Understanding the materials of our bodies, designing medical devices, and developing resilient crops.

MISSION INNOVATION

Accelerating the Clean Energy Revolution

www.mission-innovation.net



Neutrons advance all areas of clean energy R&D

Mission Innovation was a multinational commitment at the 2015 Paris Climate Conference to double investments in clean energy research and development (R&D) within five years. It defined 11 areas of qualifying R&D:

INDUSTRY & BUILDINGS

VEHICLES & OTHER TRANSPORTATION

BIO-BASED FUELS & ENERGY

SOLAR, WIND & OTHER RENEWABLES

NUCLEAR ENERGY

HYDROGEN & FUEL CELLS

CO₂ CAPTURE, UTILIZATION & STORAGE

CLEANER FOSSIL ENERGY

ELECTRICITY GRID

ENERGY STORAGE

BASIC ENERGY RESEARCH

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>\$200M

Savings from clean and
reliable electricity generation

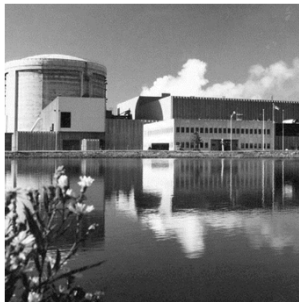
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*Neutron beams were critical to explain, and prevent
downtime from, cracking issues at Canada's fleet of
nuclear power reactors, thereby saving hundreds of
millions of dollars—impacts that outweighed Canada's
cumulative direct investments in neutron beam facilities
to date.*

Pt. Lepreau Nuclear
Generating Station

Impacts

From Neutron Beams for Materials R&D



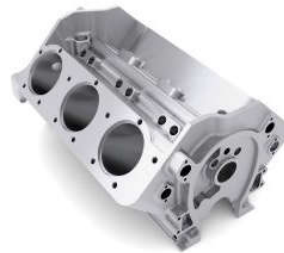
CLEAN ENERGY

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



SAFETY & SECURITY

Neutron beams were critical to explain cracking in aging pipelines and develop standard practices to ensure reliability.



CLEAN GROWTH

Neutron beams were critical to ensuring reliability of light-weight engine parts manufactured with innovative methods.



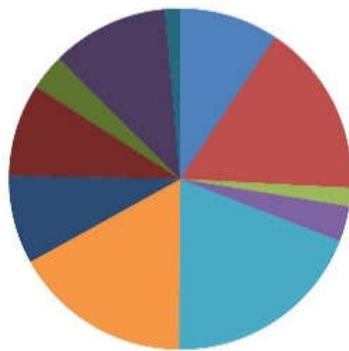
HEALTH AND FOOD SECURITY

Neutron beams revealed workings of medical technology now being pursued for early detection of ovarian cancer.

Stories of research impact:
<http://cins.ca/discover/>

Broad engagement with industry

Distribution of research sponsorship of CNBC users among industrial sectors:



4x
MORE INDUSTRIAL
RESEARCH CHAIRS
THAN REST OF
CANADA

3x
MORE NSERC
COLLABORATIVE
R&D GRANTS



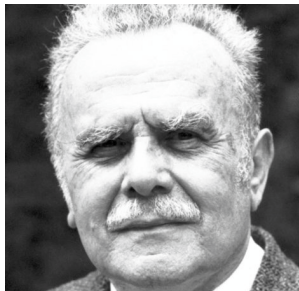
Neutron Beams

Globally recognized as versatile and irreplaceable tools for the 21st century

\$8B

GLOBAL CAPITAL RENEWAL

Innovative nations have committed over \$8B in capital investments in neutron facilities in the past 20 years.



VITAL RESEARCH TOOLS

They are irreplaceable—a reason neutron pioneer Brockhouse was honoured with a Nobel Prize.

EXAMPLE

Using neutron beams, Canadians made major contributions to discoveries that were honored by the 2016 Nobel Prize in Physics and that led to modern understandings of topological quantum materials—knowledge that could lead to breakthroughs in computing.



Excellence in science

The user community of the former Canadian Neutron Beam Centre (CNBC) was strong in scientific stature.

Strapolec "Study of CNBC Performance and Impacts" http://cins.ca/docs/Strapolec_2019.pdf

70

YEARS OF
CANADIAN
LEADERSHIP

2,300

RESEARCH
PUBLICATIONS

70%

ABOVE WORLD
AVERAGE IN SHARE
OF HIGHLY CITED
PAPERS

2.3x

MORE CANADA
RESEARCH CHAIRS



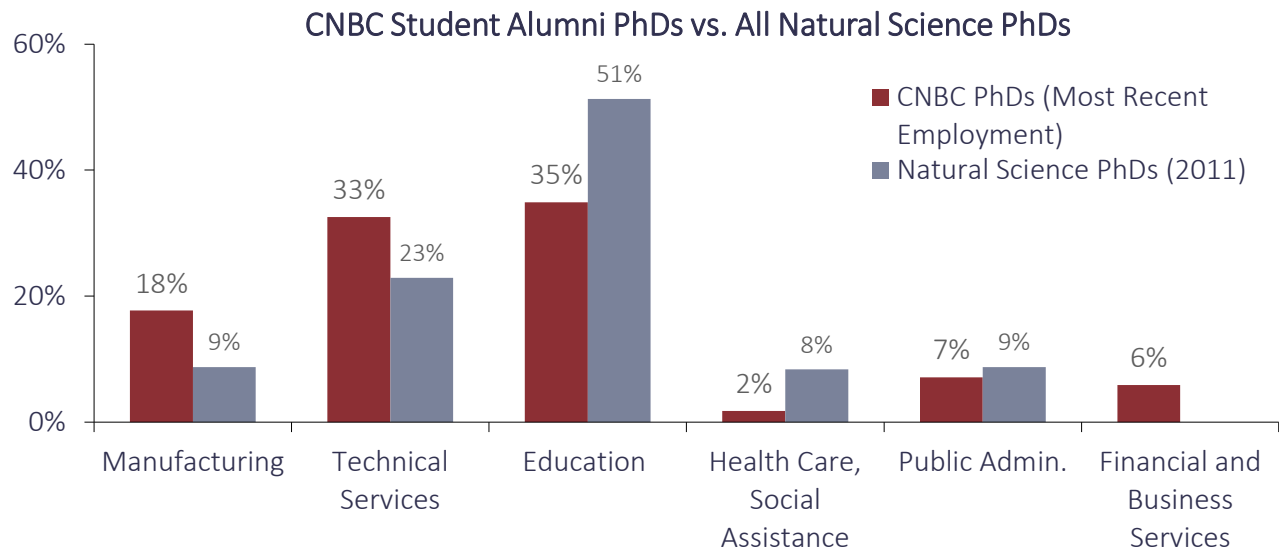
Effectiveness in Training

1,000
STUDENTS AND
POST-DOCS
TRAINED ON SITE
SINCE 1984

60%
OF BACHELOR'S
STUDENTS LATER
EARNED A HIGHER
DEGREE

80%
NOW WORK IN
CANADA'S MOST
R&D-INTENSIVE
SECTORS

Students who were interviewed years later attributed their CNBC training with inspiring them to pursue higher degrees and with practical experience that enabled their career success.



What is “materials research using neutron beams”?

“

A multidisciplinary set of research areas for which beams from a bright neutron source are required to probe the materials and objects under investigation.



A Common Opportunity

To seize the initiative and build anew



NEUTRON SOURCE

Canada's main source of neutrons, the NRU reactor, shut down permanently on March 31, 2018.



CENTRE OF OPERATIONS

The community's coordinating organization, the domestic neutron beam lab, closed in 2019.



FOREIGN PARTNERSHIP

"Canadian Participation in the Spallation Neutron Source" in the USA expired in January 2018.



GOVERNANCE FRAMEWORK

The restructuring of AECL and NRC left no agency responsible to provide neutron beam capabilities.



Policy for Major Research Facilities (MRF's)

Funding, governance, management and operations are evolving toward best practices, including roadmapping and centralized oversight.



**KIRSTY DUNCAN,
FORMER MINISTER
OF SCIENCE**

“Canada’s Fundamental Science Review” commissioned by Min. Duncan recommended “a cradle-to-grave perspective” on MRF’s.



**CFI MAJOR
SCIENCE
INITIATIVES FUND**

Through its MSI Fund, the CFI has encouraged adoption of best practices for governance and management of MRFs.



**MONA NEMER,
CHIEF SCIENCE
ADVISOR**

Dr. Nemer has advised the federal government to take a portfolio approach by designating a central steward to handle oversight and long-range planning of MRF’s.

Toward a National Neutron Strategy



To Rebuild Canadian Capacity for Materials Research
with Neutron Beams

National Strategy

To Rebuild Canadian Capacity for
Materials Research with Neutron Beams



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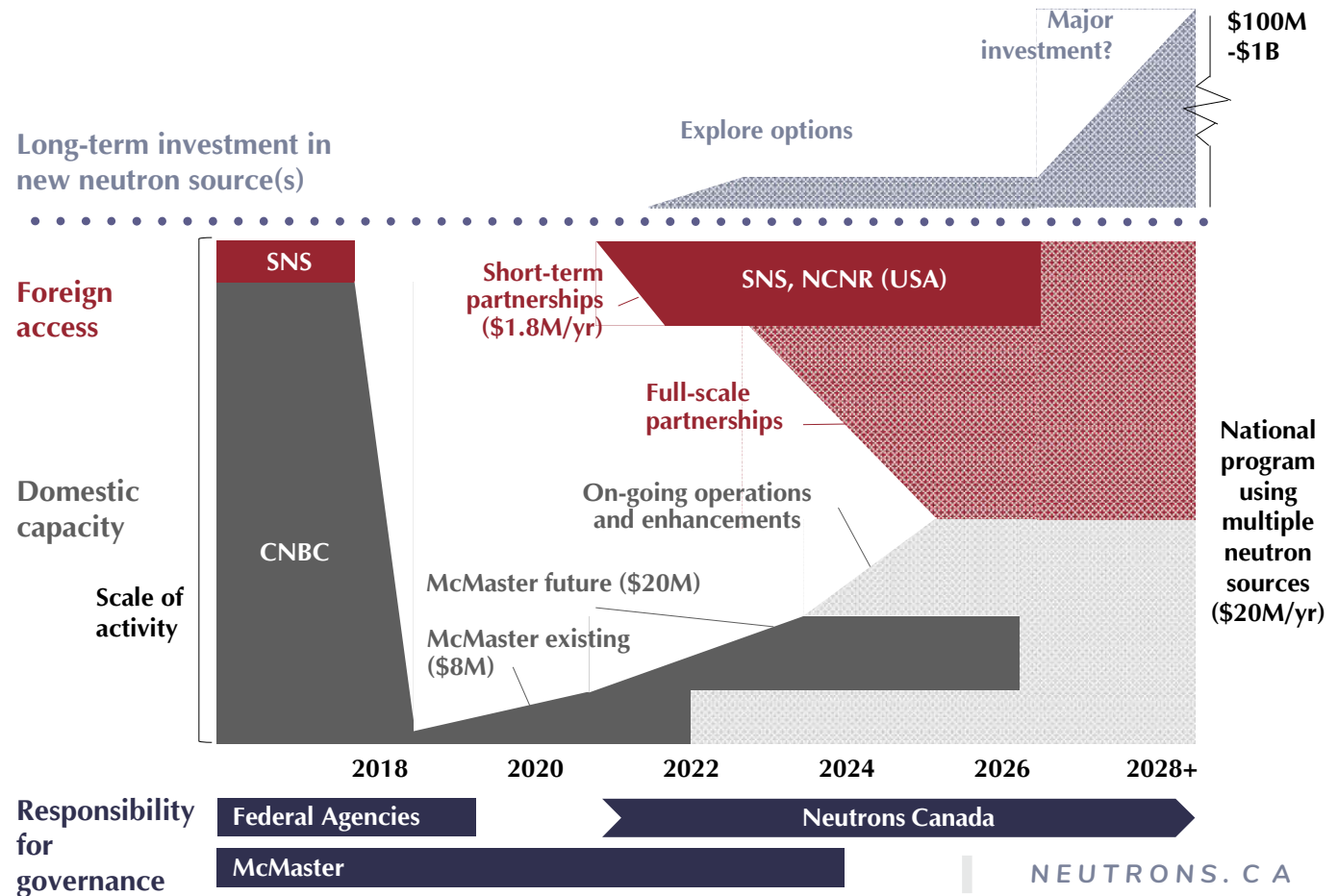
Through consultation with stakeholders over the past few years, the CNI has identified four key objectives that are essential for a national neutron strategy:

- 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.*

National Strategy

Illustrative timeline to indicate scale of activities

1. *Forge foreign partnerships*
2. *Build on existing domestic capabilities*
3. *Explore new neutron sources for the long term; and*
4. *Create a new governance framework*



Thank You

KEEP THE
CONVERSATION GOING



*Your ideas and feedback on a National
Neutron Strategy and the establishment of
Neutrons Canada are welcome.*

Contact: Daniel.Banks@tvbassociates.ca

