Neutrons Canada

Sovereignty of Research Capability

Ensuring Canadian Access to Neutron Beams for Application to Nation-building Priorities

A submission to the Pre-Budget Consultations in advance of the 2026 Federal Budget

By: Neutrons Canada

April 24, 2026

- **Recommendation 1: That the Government of Canada allocate $74M over the 6-year period starting in April 2027, and $25M per year ongoing starting in 2033, to a national neutron beam program to be managed by Neutrons Canada.**

Neutrons Canada

Sovereignty of Research Capability

Research and innovation for nation-building priorities with neutron beams

DEFENCE
Longer energy storage for mobile forces, radiation-resilient satellites, quantum-secured comms, and life-extension of naval vessels can all be advanced with dual-use neutron beam research.

CRITICAL MINERALS
Extracting critical minerals from primary ores to secure supply chains; Developing new materials that reduce or eliminate critical minerals in key technologies to mitigate Canada's dependence.

ENERGY SECURITY
Developing and testing fuels and materials for Small Modular Reactors, ensuring safety and reliability through precise knowledge of their behaviour in a reactor and long-term storage.

TECH LEADERSHIP
Quantum materials research underpins the development of quantum computers, sensors, cryptography and other leading quantum technologies.

Neutrons Canada can help accomplish nation-building priorities by channeling investment in vital research infrastructure, and development of highly qualified researchers. Access to neutron beams for research is vital for materials innovation for Canadian priorities.

Investment in research with neutron beams has been proven to return more than 300% in social and economic benefits.[1,2] Canadians have led many impactful outcomes.

IMPACT EXAMPLES

ACCELERATED UPTAKE OF ELECTRIC VEHICLES (EVs)
The present value of economic benefits to Canada, cumulative to 2030, attributable to research with neutron beams, is estimated at $1.6 billion, based on a conservative estimate that the research accelerated the development of EVs by just two years.

COMPUTER HARD DRIVES
Canada has realized at least $800 million in economic benefits attributable to neutrons from accelerated hard drive development.

CLEAN ENERGY PRODUCTION
Canada's nuclear power stations avoided losses of hundreds of millions of dollars and prevented gigatons of carbon dioxide emissions.

DEFENCE INFORMATION SHARING WITH ALLIES
Canadian neutron stress analysis of submarine hull repairs was contributed to a multinational Technical Cooperation Program with allies in the UK, Australia, etc.

PUBLIC SAFETY
Canadians enjoy greater safety from neutron-based evidence for regulations of airplanes, pipelines, and railroads.

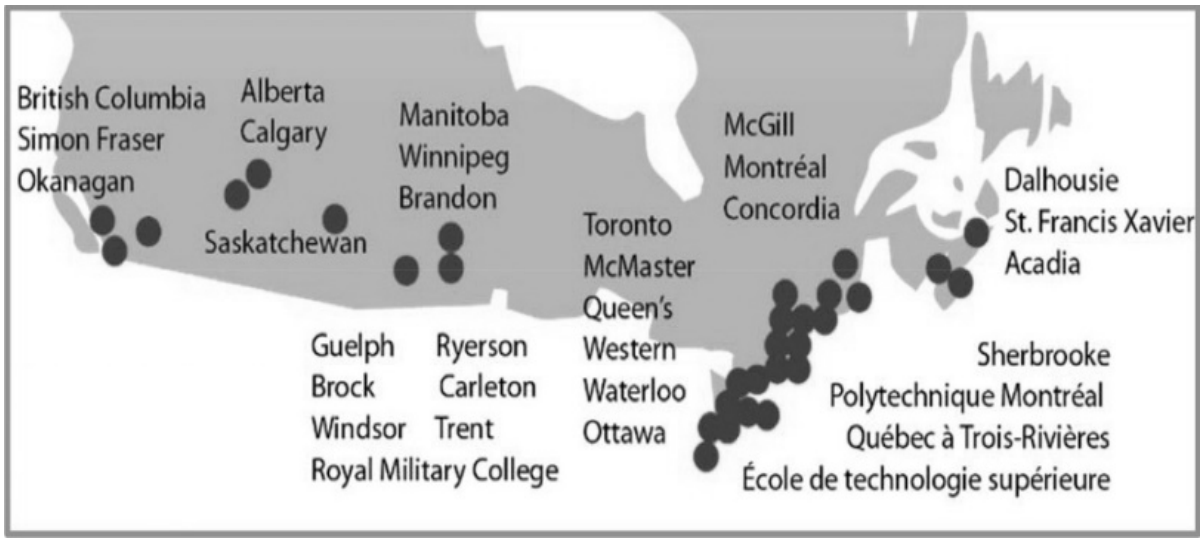
TRAINING LEADERS IN INNOVATION

"Waterloo's Ontario Battery and Electrochemistry Research Centre is developing EV batteries to be more sustainable, safer, less expensive, and longer-lasting, and through this R&D, we are training entrepreneurial young researchers and R&D specialists who will be leaders in gigafactories being built in Canada by Volkswagen, Stellantis, Umicore and BASF. Neutrons are indispensable for analysis of many EV battery materials."
– Linda Nazar, Officer of the Order of Canada, and Tier 1 Canada Research Chair

Over 80% of students trained in research with neutron beams continue on to careers in sectors where high-tech skills and innovation are most needed, including manufacturing, scientific and engineering services, and academia. Over 60% of undergraduates who use neutron beams earned graduate degrees, with two-thirds earning a doctorate. By comparison, only 16% of typical Canadian university graduates proceed to earn graduate degrees.

What are neutron beams? Who uses them?

Neutrons are subatomic particles found inside the nucleus of every atom. Neutron beams are versatile and irreplaceable tools for materials research. They are one of several probes that engineers and scientists need to advance knowledge and improve materials. Neutron beams reveal nanometre-scale details about materials' molecular structures and motions that cannot be seen with other scientific tools. Neutron beams are among a set of complementary probes for materials research that are available only at Major Research Facilities, for example, the Canadian Light Source for X-rays and TRIUMF for muons.



Over 5 years, about 800 engineers, scientists, and students from universities and companies across Canada and abroad, participated in research needing access to the Canadian Neutron Beam Centre, before its closure in 2018.

Why does Canada need to invest now?

Canada's ability to support these research priorities is challenged by the 2018 closure of Canada's primary neutron source, at a time when other G7 nations have invested $9B in neutron source upgrades and have continued to invest $900M annually in operating programs for research with neutron beams (see Table 1). Without sovereign neutron beam infrastructure, Canada's scientific toolkit is incomplete. Since 2018, over 90% of Canadian neutron users have faced strong barriers against accessing alternate sources in other countries. Now, Canadian researchers increasingly avoid research that needs neutron beams. As experts exit the field, Canada's qualified workforce to apply them to advance our innovation agenda is at risk. Failure to invest will compromise Canada's leadership in materials research with neutron beams and ultimately hamper Canada's long-term ability for innovation to meet our defence and security, environmental, and economic challenges.

Table 1 - G7 Investments ($B CAD) in nuclear power, neutron facility upgrades and operation, in the 21st Century

Country	Major Neutron Sources	Scale of Nuclear Power Industry	Neutron-beam Facility Upgrades	Neutron-beam Facility Operating Costs
United States	SNS, NCNR, HFIR	109	3.1	0.40
Japan	J-PARC, JRR-3	38	3.4	0.19
Germany	FRM-II, BENSC (Berlin); Contributions to ILL, ESS	20 (until 2011)	1.4	0.14
United Kingdom	ISIS; Contributions to ILL, ESS	10	0.7	0.10
France	Institute Laue Langevin (ILL); LLB; Contribution to ESS	66	0.6	0.08
Italy	Contributions to ILL, ESS, ISIS	0	0.2	0.01
Canada	NRU until 2018	20	0.0	0.02
		Totals	**9.4**	**0.94**

What is being done to rebuild?

Canada is just beginning to rebuild its neutron beam capabilities. Canadian universities are leading the way by developing a national strategy, creating Neutrons Canada, and securing funding for projects that will (1) develop a modest neutron beam facility at the McMaster Nuclear Reactor and (2) establish modest 6-year partnerships with major neutron sources in the United States and Europe.

Building on several years of consultations across Canada and internationally, the neutron beam community has laid out the next steps in the Canadian Neutron Long-Range Plan for 2025 to 2035 (Neutron LRP). These steps comprise a comprehensive program that will enable Canadian students, scientists, and engineers to address scientific, social, environmental and economic challenges by providing access to versatile and irreplaceable materials research tools. The Neutron LRP outlines the activities of the proposed national neutron beam program, and corresponding investments, required for:

1. Facilitating Canadian participation in world-leading neutron sources;
2. Building and operating domestic capabilities, including the neutron beam lab at the McMaster Nuclear Reactor; and
3. Developing new neutron sources in Canada for the long term.

What investment is required to implement the national neutron beam program?

The top recommendation of the Neutron LRP is that the Government of Canada allocate $95M over a 6-year start-up period, and $25M per year ongoing, to the national neutron beam program to be managed by Neutrons Canada. Approximately $21M of the needed investment has already been secured through a competitive peer-reviewed funding competition of the Canada Foundation for Innovation. The remainder is requested as a new federal investment of $74M from the centre of government.

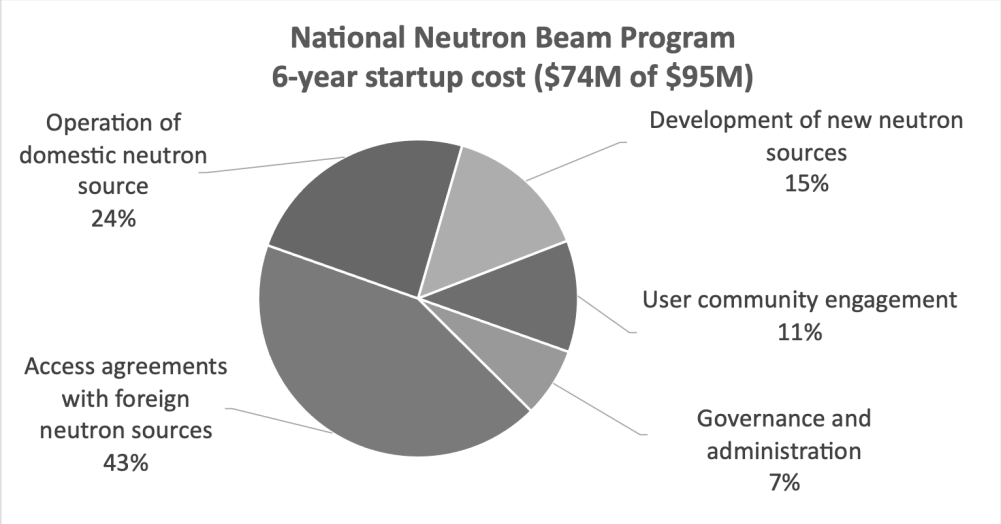


Figure 2. Breakdown of functions in the national program for research with neutron beams

Table 2 – Gradual ramp-up of funding to operate the national program for research with neutron beams

($M)	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	Ongoing
Neutron Beam Program	4.6	9.6	11.3	14.1	15.5	18.9	25.0

Has FINA endorsed funding for this program previously?

The House of Commons Finance Committee (FINA) endorsed the recommendations of the Canadian Neutron Initiative to establish a national neutron beam program in its reports leading up to the 2018 and 2019 federal budgets.[3] Subsequently, the Canadian Neutron Initiative focused on laying further groundwork for this national program by completing the

national neutron strategy and establishing Neutrons Canada under the *Canada Not-for-Profit Corporations Act*. Neutrons Canada Member institutions collaborated to secure research infrastructure funding from the Canada Foundation for Innovation (CFI) for a McMaster University-led project, described earlier. This project is a critical seed for the national neutron beam program. Neutrons Canada is now ready to begin implementing the program, if funded in Budget 2026.

Summary Vision

With a complete 21st-century scientific toolkit, Canadians can accelerate innovation in dual-use technologies, clean and energy-efficient vehicles, clean energy production, and fighting diseases such as Alzheimer's and cancer. Canadians will also lay the foundations for breakthroughs in new materials, such as biomaterials and quantum materials that will have a transformative influence on many technologies. It is with such innovations that the promise of enhanced quality of life for all Canadians can be achieved, and economic growth will be realized.

General Description of Neutrons Canada

Neutrons Canada was established in 2022 as a not-for-profit corporation whose membership is comprised of 16 research institutions across the country: 15 universities and one industry member (Canadian Nuclear Laboratories). Neutrons Canada is led by an independent board of directors,[4] composed of experts in science policy, corporate governance, and research facility management who will oversee the requested funds and implementation of the national neutron beam program.

Neutrons Canada's intended purpose is to govern, manage, and represent Canada's infrastructure program for research and development with neutron beams. Neutrons Canada has the national perspective and specialized knowledge of the neutron beam field to channel the requested federal government investment to maximum effect across three mission elements including investment in capital and operation of neutron-beam infrastructure in Canada, creating partnerships with European and American neutron-beam facilities, developing innovative neutron-beam methods and expanding the workforce of qualified people for materials research with neutron beams.

As a paying client, Neutrons Canada will ensure that major international neutron beam facilities and the modest neutron beam facility at the McMaster Nuclear Reactor are accessible to all Canadian researchers and are responsive to Canada's needs. In turn, Neutrons Canada will maintain a watch on the needs of Canadian researchers through a cooperative partnership with the Canadian Institute for Neutron Scattering, a volunteer-based organization that represents the neutron-beam user community.

Recommendation:

That the Government of Canada allocate $74M over the 6-year period starting in April 2027, and $25M per year ongoing starting in 2033, to a national neutron beam program to be managed by Neutrons Canada.

Endnotes

[1] These impacts, and many others, are documented on our website with explanations of the calculations of return on investment based on international studies: https://neutrons.ca/#impacts; https://neutrons.ca/canada-3x-investment/

[2] For example: Walsh, A. C., Nienow, S., Merker, J. M. S., Decker, E. C., Strack, C. N., Salem, M. E., Martin, G., Shaw, B. (2024). *Assessment of the Retrospective and Prospective Economic Impacts of Investments in U.S. Neutron Research Sources and Facilities from 1960 to 2030*. RTI International Report Sponsored by the National Institutes of Standards and Technology. https://www.rti.org/publication/assessment-retrospective-prospective-economic-impacts-investments-u-neutron-research-sources-facilit

[3] *Driving Inclusive Growth: Spurring Productivity and Competitiveness in Canada*. Report of the Standing Committee on Finance. December 2017. https://neutrons.ca/wp-content/uploads/2022/09/FINA_2017.pdf; *Cultivating Competitiveness: Helping Canadians Succeed*. Report of the Standing Committee on Finance. December 2018. https://neutrons.ca/wp-content/uploads/2022/09/FINA_2018.pdf

[4] Neutrons Canada Board of Directors: https://neutrons.ca/board-of-directors/