

# Accelerating Excellence

Canada's Competitive  
Advantage in Science,  
Technology, and Innovation

2019 Pre-Budget Submission by TRIUMF

**Discovery,  
accelerated**

## RECOMMENDATION

The Government of Canada should invest \$320M to implement TRIUMF's Five-Year Plan 2020-2025 and ensure the delivery of Nobel-calibre science, the training of world-class talent, and the positioning of Canada as a global innovation leader — all for the benefit of national competitiveness and prosperity.

## INTRODUCTION

TRIUMF is Canada's particle accelerator centre and an international hub for discovery and innovation. For 50 years, we have advanced fundamental, applied, and interdisciplinary research for science, medicine, and business. Owned and operated by a consortium of 20 Canadian universities, we are located at the University of British Columbia in Vancouver.

TRIUMF supports Canadian prosperity by unleashing discovery, supercharging innovation, and nurturing talent. We have a tradition of excellence in fundamental and applied sciences, with core programs in particle and nuclear physics, nuclear medicine, and quantum materials. We also translate science into innovations that benefit Canada — from transferring technology to industry to developing life-saving medical isotopes for patients. Over the decades, we have trained generations of discoverers and innovators, equipping them with the skills to keep Canada competitive in the global knowledge economy.

Today, TRIUMF is home to more than 500 staff and students, whose scope and expertise allow us to address questions that are beyond the reach of any single Canadian institution. Our record of excellence is the product of federal and provincial investments into the core infrastructure of the laboratory. Our accelerator complex — featuring the world's largest cyclotron and the most powerful superconducting electron linear accelerator — is the foundation upon which our competitive advantage is built. It is a magnet for attracting leading talent to Canada.

TRIUMF's network brings together a diverse set of stakeholders, including many of Canada's top research universities, funding agencies, and large research facilities, which include the National Research Council, Perimeter Institute, and SNOLAB. We are also a conduit for integrating Canada with the global scientific community through participation in world-leading projects like the Large Hadron Collider at CERN.



***[TRIUMF is] at the very forefront of the frontier of knowledge and yet you are very practical. You are so important to help people every day and for this I hope you are very proud.***

Her Excellency the Right Honourable Julie Payette, Governor General of Canada

## A HISTORY OF DELIVERING ECONOMIC IMPACT

Although rooted in fundamental science, TRIUMF drives research that solves problems and delivers real-world impact. Since the laboratory's founding 50 years ago, TRIUMF researchers have applied state-of-the-art technology to deliver tangible benefits to Canada. This sets TRIUMF apart from most other major research investments in Canada and even our international peers. TRIUMF is a clear leader in realizing socioeconomic benefits in sectors as diverse as medicine, natural resource extraction, and aerospace. TRIUMF's innovations and technologies reverberate across the Canadian economy.

TRIUMF is a major pillar in Canada's science and innovation landscape. In a national ecosystem that struggles to capitalize on ideas and innovations, TRIUMF is moving scientific and technological breakthroughs to market. From 2012-2018, TRIUMF was responsible for \$1.1B in gross economic output, resulting in over \$600M in GDP activity. Additionally, from 2013-2017, TRIUMF generated almost \$15.5M in commercial revenue; a 67% increase as compared to 2008-2012.

Central to this success has been a 40-year partnership with BWXT (formerly Nordion) that has delivered over 50 million patient doses of medical isotopes for use around the world. Having produced over 9.5 million doses of medical isotopes in the last five years, we are improving the lives of Canadians. Through ongoing research and development of next-generation cancer treatments, TRIUMF is also providing Canada with a competitive advantage in this important global market, offering new hope to patients.

TRIUMF delivers additional impact through its Proton Irradiation and Neutron Irradiation Facilities, which offer world-class test capabilities for space-radiation effects on electronics. Catering to an array of domestic and international clients, this facility places Canada in important global supply chains in the areas of avionics, microelectronics, and information communications technologies. Over the last five years, TRIUMF has tripled the number of companies using these facilities, forging relationships with partners such as MDA, Cisco Systems, and Boeing.

Finally, TRIUMF is also an engine for innovation, generating intellectual property that fuels the creation of new technologies and spin-off companies. Supported by TRIUMF Innovations — a commercialization platform discussed below — the laboratory is intensifying

its efforts to bring discoveries to the marketplace. Having filed 30 patents in the last five years, TRIUMF is actively working to realize the commercial potential of its research. In recent years, TRIUMF has incubated five spin-off companies that have attracted a total of \$8M in private sector funding, with several already boasting international customer bases.

## TRAINING CANADA'S LEADERS AND INNOVATORS

TRIUMF contributes to Canadian competitiveness by training and developing world-class talent. As the nation's portal into a global network of major research facilities, TRIUMF allows Canada to compete at scale, enabling Canadian researchers to make major contributions to some of the world's most challenging intellectual problems — both at home and abroad. With this capacity, TRIUMF helps ensure that Canada has the innovators it needs to thrive in the global knowledge economy.

Within Canada, TRIUMF offers a unique training ground for innovators. It provides industry-relevant training in which postdoctoral research fellows, graduate students, and undergraduates work side by side with scientists, engineers, technicians, and tradespeople. Over the last five decades, TRIUMF has welcomed thousands of students; interest and demand continue to grow. In 2017, the laboratory trained a total of 250 highly qualified personnel, of whom 126 were associated with TRIUMF's undergraduate co-op program — one of the largest and most competitive programs in Canada. This program, along with TRIUMF's other training initiatives, gives students the practical skills they need to move into industry, preparing the next generation of Canadian leaders in fields ranging from data science to advanced manufacturing.

Furthermore, TRIUMF is also a magnet for international talent, helping Canada attract and retain the best and brightest. Welcoming hundreds of international scientists and students each year, the laboratory has a reputation for excellence that makes Canada a key node in the global exchange of talent, cultures, and ideas — all elements that are critical to ensuring continued international competitiveness.



## TRIUMF'S FIVE-YEAR PLAN 2020-2025: LEVERAGING CANADA'S COMPETITIVE ADVANTAGE IN SCIENCE, TECHNOLOGY, AND INNOVATION

Moving ahead, TRIUMF is poised to realize even greater impact for Canada. Leveraging more than a decade of infrastructure investments, TRIUMF offers Canada competitive advantages in key areas, ranging from breakthroughs in fundamental research to the commercialization of next-generation technologies. Our plan also supports our efforts to build an equitable, diverse, and inclusive laboratory. These values are integral to excellence and enhance our ability to accomplish our mission.

TRIUMF's future is firmly grounded in the launch and convergence of three new platforms:

- **Advanced Rare Isotope Laboratory (ARIEL):** *With construction supported by the Canada Foundation for Innovation, as well as five provinces and 21 universities, ARIEL stands as the most powerful facility of its type in the world. ARIEL will triple TRIUMF's rare isotope production, enabling more science, training, and commercial activity.*
- **Institute for Advanced Medical Isotopes (IAMI):** *IAMI will enable research into next-generation medical isotopes and radiopharmaceuticals, placing Canada on a very select list of countries with such capacity. With this facility, TRIUMF will capitalize on fast-moving advances in personalized nuclear medicine and deliver this benefit back to Canadians.*
- **TRIUMF Innovations:** *A newly launched business-facing platform, TRIUMF Innovations takes research from the lab to the marketplace. It spearheads all commercial activities and serves as our interface to the private sector, translating scientific excellence to economic prosperity.*

Supported by these platforms, TRIUMF is charting a course to be a global leader in isotope science across all its facets, which will boost Canadian competitiveness in science and innovation. However, the window to seize this opportunity is closing as international competition roars ahead.

TRIUMF's Five-Year Plan 2020-2025 positions the laboratory's world-leading capabilities front and centre, maximizing impact for Canada. Requiring \$320M in operational funding over five years, this plan leverages past investments by government and



builds on TRIUMF's strong brand and global network to deliver top-tier science, technology, and innovation to Canada. Built along three key dimensions — each brought to life with specific goals — this plan will position TRIUMF to drive Canadian competitiveness and prosperity for decades to come.

## Science and Technology: Seizing Opportunity, Expanding Frontiers

### Goal 1 Make ground-breaking discoveries across our multidisciplinary research portfolio

As an incubator for creative ideas and technologies, TRIUMF will pursue discoveries across a range of disciplines, from nuclear and particle physics to the life and material sciences. Our work in this area will include developing new radiopharmaceuticals to diagnose and treat disease, as well as making new world-leading discoveries with quantum materials.

### Goal 2 Strengthen our position as a world-leading particle accelerator centre

TRIUMF excels in building and operating high-performing, unique accelerator systems that drive multidisciplinary research, from nuclear and particle physics and quantum materials to nuclear medicine, telecommunications, and aerospace. We will leverage the laboratory's new state-of-the-art platforms — and refurbish older ones — to drive science and innovation, attract and retain leading talent, and build a modern, sustainable, and inclusive organization.

## People and Skills: Developing Talent, Increasing Access and Equity

### Goal 3 Become a hub for interdisciplinary education and training

To thrive in the new knowledge economy, Canada must continue to develop and attract a well-educated, highly skilled, and flexible workforce. TRIUMF is committed to increasing our efforts to diversify and deepen Canada's talent pool, with a strong focus on broadening the science, technology, engineering, and mathematics (STEM) pipeline to provide opportunities for all Canadians. The laboratory's world-class, multidisciplinary research programs will provide people with the skills and experience to succeed in the economy of the future.

### Goal 4 Inspire Canadians to discover and innovate

Canada's economic future depends on a diverse array of brilliant, curious minds trained in the STEM disciplines. This means we must inspire, engage, and empower young Canadians today — individuals from all backgrounds and communities. TRIUMF will stimulate curiosity about the natural world and the power of technology, fostering creativity, inquiry, and scientific literacy. In this way, we can help prepare the next generation of problem solvers, critical thinkers, discoverers, and innovators.

## Innovation and Collaboration: Connecting Science to Society and Canada to the World

### Goal 5 Translate science and technology into innovation

Canada's continued prosperity depends on the knowledge economy. TRIUMF will strengthen Canadian competitiveness through increased support for innovation and commercialization. In particular, TRIUMF Innovations will translate our world-leading scientific expertise into new technologies that will help solve issues of national importance, as well as generate social and economic benefits for Canadians. TRIUMF will also deepen industry engagement, and work to foster a culture of entrepreneurship among our staff and students — many of whom will become Canada's next generation of leaders.

### Goal 6 Drive national and international collaboration in research, technology, and innovation

Partnerships and collaboration are catalysts for scientific discovery and technological innovation, so TRIUMF will continue to build and foster such linkages for the benefit of Canada. With our global reputation for excellence, TRIUMF will leverage the power of our national and international network to bring breakthroughs to Canada, helping ensure that Canada remains at the cutting edge of research, discovery, and innovation.

## CONCLUSION

The outlook for TRIUMF for the next five years, and the decades beyond, is remarkably bright. The stars are aligned: our science is rich with opportunity, our people are first-rate, and our large-scale research infrastructure is unique and at the leading edge. Supported by the platforms of ARIEL, IAMI, and TRIUMF Innovations, and bolstered by our efforts to develop our people and renew our infrastructure, TRIUMF will propel Canadian science and innovation into a new era.

However, we must act with haste. Global competition is intensifying and the landscape is constantly changing. For Canada to strengthen its competitiveness and accelerate its economic growth, we must seize the moment. Our plan sets out exactly what must be done.