TRIUMF Report

CAP Congress
June 14, 2018

Jonathan Bagger
Director
TRIUMF is Canada's particle accelerator centre
What is TRIUMF?  A World-Class Laboratory

TRIUMF is a place where teams of researchers collaborate on projects that are too large and too complex for any single institution.

- TRIUMF is home to a billion-dollar multidisciplinary research infrastructure
- TRIUMF enables the Canadian S&T community to carry out internationally recognized cutting-edge research
World’s Largest Cyclotron
Large-Scale

FY17/18:
$95.2M Total Funding
76% Federal (63% NRC)
535 Employees (407 NRC)
FY17/18:
875 Scientific Users and Visitors
What is TRIUMF? A Network Hub

TRIUMF links leading universities across Canada with each other and with national and international facilities around the world

- TRIUMF is a magnet for people and ideas – for attracting, training, and retaining talent for Canada

- TRIUMF allows Canadians to compete at scale in the global scientific enterprise
20 Member Universities

University of Alberta
University of British Columbia
University of Calgary
Carleton University
University of Guelph
University of Manitoba
McGill University
McMaster University
Université de Montréal
University of Northern British Columbia
Queen’s University
University of Regina
Saint Mary’s University
Université de Sherbrooke
Simon Fraser University
University of Toronto
University of Victoria
Western University
University of Winnipeg
York University
What is TRIUMF? A Global Brand

TRIUMF is unique in Canada, and known world-wide as a Canadian centre of excellence

- TRIUMF serves as a scientific ambassador, advancing Canada’s interests at home and around the world
- TRIUMF is a model for engagement with the commercial sector
Global Destination

FY17/18:
875 Scientific Users and Visitors

Scientific Users and Visitors by Region (FY17/18)

- Canada: 42%
- Asia: 25%
- Americas: 17%
- Europe: 16%
TRIUMF Users
39 Countries
50+ international agreements

- CERN
  - Europe
- KEK / J-PARC
  - Japan
- VECC
  - India
- Helmholtz Association Centres
  - Germany
- Department of Energy Laboratories
  - USA
Commercial Partners

- Advanced Cyclotron Systems, Inc.
- Boeing
- Nordion
- D-Pace
- GE Healthcare
- NASA
- Cisco
- Toyota
- itm
TRIUMF plays a critical role in the Canadian innovation ecosystem.
Five-Year Plan
Purpose

- Articulate TRIUMF’s vision and mission
- Communicate goals and priorities for 2020-2025 & beyond
- Lay out an action plan, including a high level budget
- Secure base funding for operations

Audience

- Community
- International Peer Review Committee
- NRC
- Government of Canada

Timeline

- Consultation and internal planning through 2017
- Main themes defined Spring 2018
- Report to be released in September 2018
Consultation

- Internal strategic planning exercises
- Broad community consultation
  - Science Week 2017 and 2018
  - CAP Congress
  - Submissions to PPAC, Policy and Planning Advisory Committee

Governance

- Executive Committee drives planning
- Steering Committee oversees the process
- PPAC evaluates projects and commitments
- ACOT reviews main elements of the plan
- Board of Management approves the plan
Steering Committee

Jonathan Bagger  Director  TRIUMF
David Castle  Vice President Research  University of Victoria, Vice Chair TRIUMF Board
Rod Clark  Division Deputy  Lawrence Berkeley Lab, Former SAP-EEC Chair
Robert Dunlop  Former ADM (retired)  (Industry Canada)
Kathryn Hayashi  President and CEO  TRIUMF Innovations
Ritu Kanungo  Professor  Saint Mary's University
Oliver Kester  ALD - Accelerator Division  TRIUMF
Suzanne Lapi  Associate Professor  University of Alabama, Birmingham
Kyle Leach  Assistant Professor  Colorado School of Mines, TUEC Chair
Graeme Luke  Professor and Chair  McMaster University
Scott Oser  Professor  University of British Columbia
Nigel Smith  Director  SNOLAB
Brigittte Vachon  Associate Professor  McGill University
Michelle Wong  Director, Research  University of British Columbia
Writers

Strategic Plan
- Clare Walker
  - Editor for the Naylor report and numerous Council of Canadian Academy reports

Implementation Plan
- Ian O’Neill
  - Science-communicator-in-residence for recent ICFA meeting in Ottawa
  - PhD astrophysics, science communicator, and science journalist

Facilities, Collaborations and Science Highlights
- Jacob Berkowitz
  - Virtual Writer-in-Residence at the Institute for Science, Society and Policy at the University of Ottawa
## Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>January, 2017</td>
<td>Town Hall Meeting – ARIEL PPAC RFP</td>
</tr>
<tr>
<td>May, 2017</td>
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<tr>
<td>July, 2017</td>
<td>Science Week</td>
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<tr>
<td>October, 2017</td>
<td>PPAC Deadline</td>
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<tr>
<td>November, 2017</td>
<td>PPAC Review</td>
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<td>December, 2017</td>
<td>PPAC Report</td>
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<tr>
<td>January 15</td>
<td>All Hands Meeting – 50th</td>
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<tr>
<td>February 2</td>
<td>Town Hall Meeting – PPAC</td>
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<tr>
<td>February 6</td>
<td>Questionnaire</td>
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<td>February 9</td>
<td>FYP Steering Committee</td>
</tr>
<tr>
<td>April 6</td>
<td>Board Teleconference</td>
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<tr>
<td>April 17</td>
<td>Community Report</td>
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<tr>
<td>April 18</td>
<td>FYP Steering Committee</td>
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<tr>
<td>April 20</td>
<td>ACOT – NRC</td>
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<tr>
<td>May 31</td>
<td>Board Meeting</td>
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<tr>
<td>June 6</td>
<td>ACT – Interagency Review</td>
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<tr>
<td>June 14</td>
<td>CAP Congress / Community Feedback</td>
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<tr>
<td>July 16-19</td>
<td>Science Week</td>
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<tr>
<td>September</td>
<td>Board Approval</td>
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<tr>
<td>September</td>
<td>Plan Release</td>
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<td>Late September</td>
<td>FYP Steering Committee</td>
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<td></td>
<td>Red Team Review</td>
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<td>October 2-3</td>
<td>Ottawa Lobbying Day</td>
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<tr>
<td>November</td>
<td>ACOT – NRC</td>
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<tr>
<td>November 30</td>
<td>Board Meeting</td>
</tr>
<tr>
<td>November 13-15</td>
<td>International Peer Review</td>
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Science Week 2018
July 16 – July 20

This year, will include

- 50th Alumni Event
- 50th Science Symposium
- ARIEL Science Workshop
- TRIUMF User’s Group Annual General Meeting

Daily Highlights:

- **Monday, July 16th**
  - 50th Anniversary Alumni Event

- **Tuesday, July 17th**
  - 50th Anniversary Science Symposium and Celebration

- **Wednesday, July 18th**
  - ARIEL Science Workshop

- **Thursday, July 19th**
  - TRIUMF User’s Group Annual Meeting
International Peer Review

International Peer Review Committee

Chaired by Dr. Julia Phillips,
former VP and CTO at
Sandia National Laboratories

November 13-15, 2018
Vision
Our vision is for Canada to lead in science, discovery, and innovation, improving lives and building a better world.

Mission
Our mission is to serve as Canada’s particle accelerator centre. We advance isotope science and technology, both fundamental and applied. We collaborate across communities and disciplines, from nuclear and particle physics to the life and material sciences. We discover and innovate, inspire and educate, creating knowledge and opportunity for all.
Values

Excellence & Integrity

• We have a passion for excellence in all that we do.
• We are decisive, bold, courageous, and compassionate.
• We take responsibility for our actions, our commitments, and our contributions to the larger community.

Safety & Accountability

• We respect the health and safety of our workers, our visitors, and our neighbours.
• We build quality into our processes and seek continual improvement in all of our systems.
• We embrace transparency and authenticity, and hold ourselves and each other accountable.

Equity & Inclusion

• We empower our workforce and foster an inclusive work environment, enriching our science and our community.
• We value teamwork and open communication to ensure that everyone belongs and all voices are heard.
• We respect each other, take care of each other, and support the success of all.
PPAC Summary

• Prioritize ARIEL and IAMI as foundational for the future of TRIUMF
• Focus on the existing multi-disciplinary, high-impact science portfolio, including strong on-site and off-site components
• Make balanced investments into core infrastructure, science support, and selected new opportunities, to maximize the benefit from ARIEL and IAMI
• Position TRIUMF for its long-term future by further developing particularly promising new ideas without affecting the efforts on ARIEL and IAMI
NRC Funding History: 2000-2020
TRIUMF delivers value to Canada across three critical dimensions

- Science and Technology
- People and Skills
- Innovation and Collaboration
This funding delivered impact …

- Science and Technology
- People and Skills
- Innovation and Collaboration
... and positions Canada to seize the moment

- **World-Class Facilities**
  - ARIEL and IAMI at TRIUMF

- **Great Scientific Opportunity**
  - Nuclear Astrophysics, Particle Cosmology, Nuclear Medicine, Quantum Materials, Data Sciences, Quantum Computing

- **Canadian Values**
  - Global leadership in science and technology
NRC Request

- $320M over five years (bottom-up calculation; $5M/year increase over inflation)
  - This investment will increase impact along all three dimensions …
    - Science and Technology
    - People and Skills
    - Innovation and Collaboration
  - … and position TRIUMF and Canada for decades more impact to come
Science and Technology

- **Goal:** Make groundbreaking discoveries across TRIUMF’s multidisciplinary research portfolio
  - *Why? To strengthen Canadian leadership in science and technology*

- **Goal:** Reinforce TRIUMF as a globally leading particle accelerator centre
  - *Why? To make Canada a destination of choice for talent, ideas, and international partnerships*
Science and Technology

- Complete and operate ARIEL – Advanced Rare Isotope Laboratory
  - > $150M facility – most powerful of its type in the world
  - Supported by CFI, 5 provinces, and 21 universities
  - Will triple TRIUMF’s rare isotope capabilities, enabling more science, more training, and more commercial activity
Science and Technology

- Launch IAM – Institute for Advanced Medical Isotopes
  - > $35M research and production facility supported by WED, INFC, British Columbia, and institutional partners
  - TR-24 cyclotron with state-of-the-art laboratories
  - Will create a global centre for nuclear medicine research and development
Science and Technology

- Strengthen TRIUMF itself
  - Ensure equity, diversity, and inclusion underpin every activity
  - Create programs to attract, retain, and develop talent
  - Renew site infrastructure to improve productivity (cyclotron, ISAC, beamlines for materials and commercial applications)
Science and Technology

SAP Science Priorities

- Complete ARIEL and ramp science program up to full capacity (triple RIB production)
- Support high-impact science
  - On site: ISAC/ARIEL, UCN, Theory
  - In Canada: DEAP, SuperCDMS, nEXO at SNOLAB
  - Abroad: ATLAS, ALPHA, NUPRISM/HyperK/DUNE
- Make balanced investments into core infrastructure, science support, and selected new opportunities, to maximize the benefit from ARIEL and IAMI
  - ISAC, Cyclotron, BL1A, Detector Facilities, Site Master Plan
- Position TRIUMF for its long-term future by further developing particularly promising new ideas without affecting the efforts on ARIEL and IAMI
  - To be determined via community initiatives in future CFI competitions
Science and Technology

- **Nuclear Medicine**
  - Alzheimer’s Disease
  - Parkinson’s Disease
  - Addiction
  - Traumatic Brain Injury
  - Cancer

- **Quantum Materials**
  - UBC Quantum Matter Institute (CFREF)
  - Proposed Pan Canada Laboratory for Quantum Materials and Devices

- **Data Sciences / Quantum Computing**
  - ATLAS – CERN
  - Helmholtz Association – Germany
  - Various industry partners
People and Skills

- Goal: Become a hub for interdisciplinary education and training
  - Why? To prepare Canadians to compete in the knowledge and innovation economy

- Goal: Inspire Canadians to discover and innovate
  - Why? To increase access and opportunity, and strengthen Canadian society
People and Skills

- Strengthen Canada’s STEM pipeline
  - Expand TRIUMF’s unique post-secondary education programs, broadening eligibility and offering a quality, hands-on, real-world experience
    - Undergraduates, Engineers in Training, Apprentices …
  - Promote diversity and inclusion, especially women, indigenous peoples, and other under-represented minorities
    - Targeted recruiting
    - Special scholarships
    - Relationship building
People and Skills

- Strengthen Canada’s STEM pipeline
  - Better prepare postdocs and graduate students for careers outside academia
    - Entrepreneurship education
    - Communications training
    - Project management experience
    - Data science training
  - Leverage partnerships to attract international students and postdocs to Canada
People and Skills

- Empower future generations of discoverers and innovators
  - Take TRIUMF’s outreach program nationwide
  - Establish TRIUMF as a hub for science communication and public engagement
    - Partner with like-minded organizations to carry TRIUMF’s story into communities across Canada
    - Join with the BC Digital Supercluster to use VR and other digital technologies to engage urban and rural communities
    - Offer professional development experiences to teachers, science communicators, as well as students and postdocs
Innovation and Collaboration

- **Goal:** Translate knowledge and discovery into innovation
  - **Why?** To develop new technologies to support business-led innovation and improve the lives of Canadians

- **Goal:** Increase national and international collaboration
  - **Why?** To strengthen Canadian competitiveness in global discovery and innovation
Innovation and Collaboration

- Expand TRIUMF Innovations into a national centre for commercializing disruptive technologies that cross multiple verticals
  - Medicine and drug development
  - Materials development and testing
  - Accelerator and detector technologies
  - Mining and natural resources
  - Border security
  - Oil and gas exploration
  - Data sciences

Example: PET Rock, using PET medical isotope technologies to improve mineral processing and metal extraction
Innovation and Collaboration

Example: Alpha therapies for cancer treatment, joint venture between TRIUMF Innovations and Canadian Nuclear Laboratories. Currently in talks with Nordion, Centre for Drug Research Development, and others….
Innovation and Collaboration

- Expand TRIUMF’s national and international networks
- Leverage TRIUMF’s networks to create teams to solve real-world problems and deliver tangible benefits to Canadians
  - Universities
  - Sister laboratories
  - Nongovernmental entities
  - Federal and provincial governments
  - Industrial partners
Summary

- TRIUMF's $320M plan leverages past investments by government and builds on the laboratory's strong brand and global network to deliver more top-tier science, training, and innovation to Canada.

- The plan will support TRIUMF’s efforts to build an equitable, diverse, and inclusive laboratory. By fully exploiting ARIEL and IAMI, it will take TRIUMF to the next level and advance Canada along all three critical dimensions:
  - Science and Technology
  - People and Skills
  - Innovation and Inspiration

- The plan ensures that TRIUMF will remain a jewel of which Canada can be proud.
“It matters, what I have just seen in a very few minutes here at TRIUMF. I knew about TRIUMF and it still amazes me seeing you today, that you are 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.”

March 22, 2018
Backup
Does not include new contributions from province, philanthropy or business partnerships

Total: $501M
Includes $30M of potential new contributions from province, philanthropy or business partnerships

Total: $531M
Projected Revenue by Use (2020-2025)

Total: $501M

- NRC: 64%
- CFI: 9%
- NSERC: 5%
- CFI-IOF: 2%
- Operations: 13%
- Sponsored: 1%
- Capital: 1%

Total: $501M