National Research Council Canada

2018–19

Departmental Plan

The Honourable Navdeep Bains, P.C., M.P.,
Minister of Innovation, Science and Economic
Development

The Honourable Kirsty Duncan, P.C., M.P.,
Minister of Science and Minister of Sport and Persons with
Disabilities

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Ministers' message

The work of the Innovation, Science and Economic Development Portfolio is as diverse as it is expansive. We are involved in many important areas of our economy, including: making critical investments in innovation and science; supporting the commercialization of research and ideas; providing Canadians with the skills to excel in the digital economy; helping small businesses grow; promoting Canada as a world-leading tourism destination; and integrating science into our investment and policy decisions.

2018–19 will be an exciting year for all of this important work as we seek to make Canada a global innovation leader. We are continuing to implement the next steps of the Innovation and Skills Plan, which will build an economy that works for everyone. Through Budget 2018, we are making the single-largest investment in science in Canadian history to ensure that Canada remains a world leader in research and commercialization. And we are delivering Canada's first Women Entrepreneurship Strategy, to support women entrepreneurs as they start, grow and scale their businesses.

We believe our economy should work for all Canadians. We want to see Canadian businesses, large and small, create high-quality jobs, and we want them to compete in the knowledge economy, driven by creative, boundary-pushing ideas.

The National Research Council of Canada will play an instrumental role in this agenda by advancing knowledge, applying leading-edge technologies and collaborating with innovators across the country to develop creative and sustainable solutions to Canada's current and future economic, social and environmental challenges.

It is our pleasure to present the 2018–19 Departmental Plan for the National Research Council of Canada.

The Honourable Navdeep Bains
Minister of Innovation, Science and
Economic Development

[Mandate Letter](#)[i]

The Honourable Kirsty Duncan
Minister of Science and Minister of
Sport and Persons with Disabilities

[Mandate Letter](#)[ii]

President's message

Last year, through the NRC Dialogue[iii], employees and external expert advisors identified ways to improve how we support business innovation, engage with others in the Canadian innovation system, improve our governance, manage our resources and align ourselves to support the Innovation and Skills Plan. This coming year, NRC will implement the first wave of Dialogue actions and will lay the foundation for the longer-term measures in support of a renewed NRC.

In this regard, over this coming year, we will initiate a number of actions to encourage innovation and research excellence in Canada, including:

- establishing a President's Research Excellence Advisory Committee and an NRC Chief Science Advisor to encourage research excellence at NRC, and actions to develop NRC research talent and capabilities;
- launching a new set of collaborative large-scale, mission-driven, R&D initiatives in priority areas (e.g., Superclusters, emerging technologies), with business, Government and university and college researchers;
- experimenting with NRC Collaboration Centres to provide a presence in the country's most dynamic innovation areas, allowing for closer collaboration with leading scientists performing cutting-edge research, and connecting NRC into regional innovation systems that are aspiring to grow; and
- building deeper international research collaboration and support for Canadian small and medium enterprises (SMEs), under the Canada-United Kingdom collaboration signed by Prime Minister Trudeau and Prime Minister May in September 2017, and our long-standing bilateral science and technology (S&T) agreement with Germany.

We are looking forward to working in partnership with Canada's Chief Science Advisor to make science a part of government policy-making and to promote research excellence across the country.

As we work to renew NRC, we will remain steadfast in our support for Canadian innovation, while effectively managing our talented and dedicated workforce, our facilities and financial resources. At the same time, we will continue to fulfill our existing commitments to our partners and clients.

Mr. Iain Stewart
President
National Research Council Canada
Mandate Letter from the Ministers[iv]

Plans at a glance

Enabling Canada's Innovation and Skills Plan

In support of the federal government's new vision for Canada as a global leader in innovation, anchored by Canada's Innovation and Skills Plan[v], NRC will implement its plans and priorities in 2018-19 with a focus on increasing collaboration and accelerating R&D to support business innovation, deliver solutions to pressing public policy challenges and advance scientific and technological knowledge. NRC will support federal R&D priorities in the digital economy, clean technology, agri-food, advanced manufacturing, bio-sciences, and clean resources - areas where NRC's unique expertise and facilities will have the greatest impact in: 1) solving problems of a national scale; 2) converting Canada's strengths into global advantages; and 3) creating and supporting meaningful jobs in Canada's innovation economy.

NRC's Industrial Research Assistance Program (IRAP) has proven to be an effective resource for growing Canadian companies and innovative entrepreneurs. This program is well positioned to support funding for larger projects above the current contribution threshold. In recognition of this, Budget 2018 announced new on-going funding to support hard-working Canadian entrepreneurs and create jobs as they grow and expand their companies. In addition, NRC will increase assistance to clients seeking to expand into international markets, and will broaden its actions to provide Canadian companies with easier access to government programs that will enable them to grow and compete in global markets such as in Germany and the United Kingdom – countries with whom Canada has collaborative S&T agreements.

In support of the Ministers' mandates, and as announced in Budget 2018, NRC will reduce pricing for its specialized infrastructure and expertise to make the NRC more accessible to small businesses and improve access to the NRC's facilities / equipment, scientists, and technical services. Lower access fees and improvements to NRC's intellectual property regime will enhance collaboration and facilitate the diffusion of new innovations to high-growth firms.

Looking to the future, NRC will develop a five-year Strategic Science and Innovation Plan (2019-20 to 2023-24) that will articulate how the organization will achieve a defined set of goals, objectives and intended results, in alignment with Government of Canada priorities, including the Innovation and Skills Plan. NRC's Strategic Science and Innovation Plan will act as a guidepost for decisions across the organization, helping to focus activities and resources in high-value, targeted areas where the organization can have the greatest impact for Canada.

Science and Research Excellence

NRC's ability to deliver value for Canada through its unique advantages is predicated on the organization being renowned for research excellence. Budget 2018 announced new ongoing funding to enable NRC to act as a collaborative platform and bring together innovators from

post-secondary institutions and businesses into multi-party research and development programs, with the aim of catalyzing transformative, high-risk, high-reward research with the potential for game-changing scientific discoveries and technological breakthroughs. This platform will be modelled after the US-based Defense Research Projects Agency, a highly successful program that tackles complex, high-risk challenges. Through this, NRC will contribute meaningfully to Canada's reputation in global research excellence through its strong science capacity and ability to convene national teams of researchers that will deliver collaborative large-scale and mission-oriented R&D initiatives in support of Government priorities, such as the Innovation Superclusters Initiative[vi]. These initiatives will be designed to be multi-disciplinary in nature, and to be delivered within a specific timeframe. To advance disruptive technologies that will lead to technology platforms of the future, NRC will also launch collaborative R&D initiatives that could potentially include such areas as artificial intelligence, new generation sensors, quantum, next generation materials, synthetic biology, and breakthrough clean energy. An internal process is underway to select an initial 3 to 4 initiatives to launch in 2018-19. These R&D streams will encourage open innovation and enable development of novel products and services that will lead to socio-economic benefits for Canada. NRC will also forge new alliances with universities, including the development of Collaboration Centres, for growing Canada's skilled workforce and for translating scientific ideas and discoveries to new technology platforms.

Budget 2018 also provided new ongoing funding to help NRC establish competitive Ideation funding for researchers, students and teams of scientists to explore high-risk, creative and innovative R&D ideas, and validate those ideas that will fuel knowledge generation, future collaborative NRC R&D programs, and intellectual property.

In further support of the organization's science and research excellence goals, NRC will establish its own Chief Science Advisor role and a new Researcher Community of Practice buoyed by the President's Research Excellence Advisory Committee.

Managing Talent and Resources Effectively

Following an extensive engagement process completed in 2017-18 (the NRC Dialogue[iii]), NRC will develop a comprehensive strategy to implement the first wave of Dialogue actions covering such areas as talent, facilities, engagement, management, governance, and optimizing internal services to support achievement of NRC results. Priorities will include:

- harnessing research excellence and fulfilling the potential of all employees by providing opportunities for professional development and leadership that invests in staff, recognizes the value of diversity and builds an inclusive workforce that incorporates excellence into all that NRC does;

- increasing the depth and diversity of NRC's workforce through such initiatives as targeted outreach activities by leading female researchers, mentoring initiatives for high-potential female hires, increased student placements, and continuation of NRC's post-doctoral fellowship initiative;
- defining a more rationalized delivery model for internal services;
- building on processes for environmental stewardship to enable proactive assessment and management of environmental issues and fulfill compliance obligations;
- developing a 3-year strategy to revitalize NRC's buildings and real estate to align with future R&D initiative needs and in line with the new vision of science and research in Canada;
- conducting a 3-year review of NRC facilities to establish condition, functionality, utilization and ability to respond to present and future research needs; and
- providing enhanced IT capabilities by working with Shared Services Canada and exploiting the benefits of cloud and high-performance computing for NRC employees.

To support these plans, the federal government will be converting the NRC's longstanding temporary funding (since 2000) into on-going permanent funding. This investment will enable NRC to undertake long-term planning and prioritization of research activities.

These actions will be undertaken while continuing to fulfill NRC's existing commitments to clients and partners.

For more information on NRC's plans, priorities and the planned results, see the "Planned results" section of this report.

Planned results: what we want to achieve this year and beyond

Core Responsibility

Science and Innovation

Description

Grow and enhance the prosperity of Canada through: undertaking, assisting and promoting innovation-driven research and development (R&D); advancing fundamental science and Canada's global research excellence; providing government, business and research communities with access to scientific and technological infrastructure, services and information; and supporting Canada's skilled workforce and capabilities in science and innovation.

Planning highlights

NRC has three departmental results for tracking and reporting against its core responsibility:

- innovative businesses grow;
- scientific and technological knowledge advances; and
- evidence-based solutions inform decisions in Government priority areas.

Highlights of selected key initiatives that support the achievement of these objectives are provided according to the key components of NRC's Core Responsibility.

<u>Innovation-driven R&D</u>

NRC's approach for managing its R&D initiatives will be more collaborative and focused on delivering benefits to Canada in alignment with Government of Canada priority areas. NRC will implement a new process for generating research ideas and selecting, developing and funding a targeted set as new R&D initiatives. NRC will engage external R&D collaborators in these new R&D initiatives to complement NRC capabilities, and will make greater use of independent external reviewers and advisors to ensure relevance of the initiatives from strategic, research and business perspectives. The new approach will lead to fewer but larger-scale, mission-oriented R&D initiatives, focused on supporting current Government of

> **Departmental Result:**
> **Innovative businesses grow**
>
> NRC will support:
>
> - increased firm growth and competitiveness by helping them bring innovative products, services and processes to market;
> - greater firm investments in R&D through enhanced access to NRC R&D services and S&T infrastructure; and
> - increased skilled S&T jobs in Canada through innovative firm growth.

Canada priorities and advancing disruptive technologies that will be critical to the economy of the future.

NRC will remain committed to applying the Government of Canada's Gender-Based Analysis Plus (GBA+)[vii] analytical tool to ensure that gender and other identity factors are considered when planning new major new initiatives. Consistent with this, NRC will leverage its past successes in designing state-of-the-art language translation software to launch a three-year project to develop an information technology platform that will convert Indigenous speech to text. This will be done in collaboration with indigenous stakeholders to support the promotion and preservation of Indigenous languages.

NRC will help innovative businesses address key R&D-related challenges and will help firms grow and scale-up to access and be competitive in global markets. Between 2014-15 and 2016-17, NRC advanced at least 55 new technologies to the point of industrial clients expressing their intents to deploy or commercialize them. During the same period, IRAP supported an average of 10,812 high-quality jobs in SMEs per year while 82% to 88% of assisted SMEs reported that they experienced a growth in either jobs, revenues, or net operating profit due to support from IRAP. Examples of how NRC will build on these successes in 2018-19 are as follows:

- As a proven enabler of innovation, NRC will support industry-led consortia developing Innovation Superclusters aligned with the government's priority areas (e.g., advanced manufacturing, agri-food, bio-sciences, digital technologies, clean resources) to accelerate economic growth in highly innovative industries, while positioning Canadian firms for global leadership.

- Findings from the 2017-18 IRAP evaluation, confirm IRAP's important and unique role in supporting SME innovation in Canada. In particular, IRAP's ability to leverage other federal and provincial programs to meet the needs of SMEs was acknowledged. To help companies grow, IRAP will continue its collaboration with Global Affairs Canada through its CanExport Program to help SMEs expand into international markets by enhancing their understanding of exporting techniques and opportunities.

- To enhance SME competitiveness in world markets, NRC will continue to support international R&D partnerships through EUREKA[viii] and the Canadian International Innovation Program. In conjunction with the Business Development Bank of Canada and other lenders, IRAP will explore the potential for a scale-up stage working capital loan initiative to help bridge innovative clients to larger-scale growth funding. Helping IRAP clients with better access to global value chains in international markets such as in Germany and the United Kingdom will also be targeted.

- Aligned with the federal priority of Health and Bio-sciences, NRC will work with industry and others to accelerate the development of new medicines (biologics, neuro-biologics, immuno-therapeutics, and vaccines), developing new and improved technology platforms to help get products to clinical development and increase market valuation.

- NRC's Construction Program[ix] will expand its collaboration with Infrastructure Canada[x] to identify opportunities for advancing ultra-energy-efficient technologies in non-residential buildings. Building on earlier successes for residential buildings, this expanded collaboration will increase energy savings and reduce greenhouse gas emissions on a national scale, expand market opportunities for Canadian firms in the energy retrofit sector, and advance Canada's action on climate change.

- In 2018-19, NRC will be working to facilitate access by high growth firms to new technologies and NRC Intellectual Property (IP), their value reflected through $8.0M generated in 2016-17 through firm investments. NRC will improve flexibility in dealing with IP through collaborating with the Privy Council Office (PCO), Justice Canada (DoJ), and ISED to make appropriate changes to the IP and Property provisions of the NRC Act, in alignment with Canada's Intellectual Property Strategy [xi] announced in Budget 2017.

Fundamental sciences and global research excellence

NRC will advance the frontiers of scientific and technical knowledge by carrying out collaborative research with universities and other research partners in Canada and internationally. These collaborations will lead to the advancement of technology platforms of the future, and science-based solutions that address problems of national importance. Examples of related initiatives include:

- To ensure research excellence, NRC will establish a new Chief Science Advisor role to work closely with the Government of Canada's Chief Science Advisor, appointed in 2017. Science and research excellence will be further supported through a New Researcher Community of Practice as well as through the President's Research Excellence Advisory Committee comprised of senior research professionals from across NRC.

> **Departmental Result: Scientific and technological knowledge advances**
>
> NRC will advance scientific and technical knowledge and support global research excellence through:
> - publishing scholarly papers;
> - creating intellectual assets; and
> - creating opportunities for attracting and retaining a talented and diverse pool of STEM leaders for tomorrow.

- NRC will update its management model for its R&D initiatives to enable developing novel foundational opportunities in disruptive technology areas. These initiatives will advance scientific knowledge and build NRC's long-term capability. Areas under consideration include quantum, nanotechnology, cybersecurity, sensors for the Internet of Things, and artificial intelligence. Quantum technologies are expected to have a significant impact on industries in the future. Findings from the 2017-18 evaluation of the Security and Disruptive Technologies Program confirmed the importance of the Quantum Photonic Sensing and Security initiative's continued efforts to engage partners and help coordinate and further develop a Canadian quantum ecosystem.

- NRC's Energy, Mining, and Environment Program[xii] will work collaboratively to conceive a new research initiative for developing new renewable fuels and economically-feasible "clean" fuel production processes that will help meet Canada's 2030 and 2050 targets for greenhouse gas emissions in accordance with Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy[xiii].

- The 2016-17 evaluation of the Herzberg Astronomy & Astrophysics (HAA) Program revealed that most stakeholders perceive the Program as vital in supporting Canada's performance in astronomy. Remaining committed to continuous improvement, NRC will implement the recommendations of the evaluation. This will include investigating

mechanisms for establishing a formal consultation process for Canadian astronomers to provide strategic advice on HAA's scientific activities and priorities.

- In 2018-19, NRC will continue to support advanced research in sub-atomic physics through stewardship and contribution payments of $55.3M to TRIUMF[xiv].

<u>Providing communities access to S&T infrastructure, services and information</u>

NRC will provide R&D communities (from industry, other government departments and universities) access to the S&T infrastructure, services, and information required by an advanced knowledge-based economy. For example:

- The 2016-17 evaluation of NRC's Ocean, Coastal and River Engineering (OCRE)[xv] Program found that its objectives and activities were aligned with federal government priorities for Canada's north. OCRE will seek to align its Arctic research initiative with the evolving Federal Arctic Policy Framework[xvi]. In consultation with Northern communities and stakeholders, the revised initiative will focus on such areas as energy autonomy, remote health and adapted buildings.

> **Departmental Result: Evidence-based solutions inform decisions in Government priority areas**
>
> NRC will invest in collaborative work with other federal government departments to advance priority areas and publish relevant work to:
> - help address grand challenges,
> - increase Canadian competitiveness; and
> - inform evidence-based policy decisions.

- NRC will invest in developing normative standards and technologies for cannabis processing and testing to support government policy and the quality and safety of cannabis supply.

- Working with provinces and territories, NRC will explore alternative funding models for making available via the internet free and harmonized building codes[xvii] across Canada. This will reduce the cost of construction in Canada while helping increase compliance to regulations that are based on the building codes. It will also improve the ease of doing business - a key tenet of the Innovation & Skills Plan.

- Experimenting with new approaches to applying technologies in new ways, NRC will trial more accurate remote time dissemination services to keep pace with emerging technologies and more demanding user requirements. NRC anticipates investing approximately $265K in 2018-19 for this experimentation.

- NRC will launch a new Aircraft Cabin Comfort and Environmental Research Facility in 2018-19. This unique facility will allow industry clients to simulate the travelling passenger's flying experience from end to end, with the aim of creating innovations and business opportunities that will improve efficiency, safety and comfort.

Supporting the skilled workforce of the future

NRC will contribute to building a skilled Canadian workforce that is strong, sustainable, inclusive and diverse. For example:

- Consistent with the Government of Canada's commitment to diversity and employment equity, NRC will enhance diversity and equality in its workplace, with a focus on supporting women in science and management positions. Based on the results of a study on the recruitment and retention of women at NRC, it will seek to address the identified gap in representation of women through such initiatives as: hiring of an additional 100 undergraduate students per year with a focus on STEM disciplines and under-represented groups; striving for equity in hires of post-doctoral fellows supported in part through outreach activities; and involving women on every selection board moving forward. Opportunities for further action will be explored, including planning a study across NRC Programs towards understanding and improving the dynamics of men-women relationships to support attraction and retention of women in STEM.

> **Departmental Result:**
> **Scientific and technological knowledge advances**
>
> NRC will advance scientific and technical knowledge and support global research excellence through:
>
> - publishing scholarly papers;
> - creating intellectual assets; and
> - creating opportunities for attracting and retaining a talented and diverse pool of STEM leaders for tomorrow.

- NRC will establish research consortia with universities, industry, and other stakeholders. These groups will serve as hubs to bring together participants from the entire value chain - from raw material manufacturers to major prime contractors - to solve common industry challenges through pre-competitive research projects while providing opportunities for the skilled workforce of the future. Furthermore, as part of its experimentation on new approaches, NRC will launch new Collaboration Centres with partner universities in areas of leading-edge technology. These Centres will provide training opportunities for students and graduates in a wide variety of priority fields and will be assessed on their ability to support development of highly-skilled applied researchers and the next generation of Canadian entrepreneurs, and in delivering technologies that support the growth of Canadian companies. For 2018-19, NRC estimates an ability to invest a minimum of $0.5M per Collaboration Centre subject to review as they become operational and achieve early successes.

- IRAP will support job creation in Canadian companies by financially supporting the placement of at least 1000 graduates through Canada's Youth Employment Strategy[xviii]. The 2017-18 IRAP evaluation pointed to the Youth program as a source of success in increasing staffing levels in funded firms. In fact, many firms reported that youth participants were still working with their companies after their internship.

- NRC will enhance the number of student placements across the organization by creating 100 additional undergraduate and graduate student training opportunities. Further, NRC will continue to expand its post-doctoral fellowship initiative that was initiated in 2017-18.

- To support NRC's enhanced integration with research communities and provide young researchers with an opportunity to tackle concrete complex problems, in collaboration with the Fields Institute for Research in Mathematical Sciences and the University of Ottawa, NRC will host an Industrial Problem-Solving Workshop, bringing together academic researchers and graduate students to address challenges and problems submitted by NRC researchers.

Planned results

Departmental Result Indicators	Target[1]	Date to achieve target	2014–15 Actual results	2015–16 Actual results	2016–17 Actual results
Departmental Result 1: Scientific and technological knowledge advances					
I1. Citation score of NRC-generated publications relative to the world average	Greater than 1.50[2]	March 31, 2019	1.47	1.50	1.53
I2. Number of unique intellectual assets (e.g., patents, disclosures, publications) generated by NRC research leaders	1140	March 31, 2019	1,357	1,094	1,093
I3. Percentage of the NRC workforce made up of underrepresented groups relative to Canadian average labour market availability in Science, Technology, Engineering, and Mathematics (STEM)3	1.0	March 31, 2019	0.95	0.97	0.99
Departmental Result 2: Innovative businesses grow					
I4: Percentage revenue growth of firms engaged with NRC (research and development-engaged firms) [4]	TBD	TBD	N/A	N/A	N/A
I5: Percentage revenue growth of firms engaged with NRC (IRAP-engaged firms)	Greater than 25%[2]	March 31, 2019	17%	18%	26%
I6: Percentage growth in Canada's S&T related jobs through NRC supported firms (research and development-engaged firms)[4]	TBD	TBD	N/A	N/A	N/A
I7: Percentage growth in Canada's S&T related jobs through NRC supported firms (IRAP-engaged firms)	Greater than 12%[2]	March 31, 2019	18%	14%	11% over
I8: Firm investment in NRC research and development services and scientific and technological infrastructure	Greater than $80M annually	March 31,2019	$65.1M	$77.0M	$82.5M
Departmental Result 3: Evidence-based solutions inform decisions in Government priority areas					
I9: NRC investment in collaborative work with other federal government departments in Government priority areas	Greater than $70M annually	March 31, 2019	$43.4M	$51.4M	$74.9M
I10: Number of scientific and other publications (e.g., technical papers, committee proceedings, reports) generated by NRC research leaders in Government priority areas	1640	March 31, 2019	1,938	1,593	1,475

[1] The targets for 2018-19 are based on a general increase in performance trend since 2014-15.
[2] Measured over a period of 2 calendar years and lagging by 2 years by nature of the measurement methodology.
[3] The indicator is focused on the workforce representation of women until 2019-20, and represents a ratio.
[4] New indicator methodology and baselines to be reviewed, with targets for 2019-20 to be established as part of the development of the Departmental Plan for 2019-20.

Budgetary financial resources (dollars)

2018–19 Main Estimates	2018–19 Planned spending	2019–20 Planned spending	2020–21 Planned spending
907,545,876	917,284,562	772,512,495	714,833,977

Human resources (full-time equivalents)[5]

2018–19 Planned full-time equivalents	2019–20 Planned full-time equivalents	2020–21 Planned full-time equivalents
2,560.0	2,535.3	2,535.3

Note: Main Estimates, Planned spending and Full-time equivalents figures do not include Budget 2018 announcements. More information will be provided in the 2018–19 Supplementary Estimates and Departmental Results Report, as applicable.

Financial, human resources and performance information for NRC's Program Inventory is available in the GC InfoBase[xix]. This includes additional details on the Departmental Result Indicators, their rationale, and their measurement protocol.

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[5] The FTE counts in this table pertain to NRC's Program Inventory only. NRC's total FTE (3,871) is provided in the Planned Human Resources Section (page 19) and represents 3,700 staff.

Internal Services

Description

Internal Services are those groups of related activities and resources that the federal government considers to be services in support of programs and/or required to meet corporate obligations of an organization. Internal Services refers to the activities and resources of the 10 distinct service categories that support Program delivery in the organization, regardless of the Internal Services delivery model in a department. The 10 service categories are: Management and Oversight Services; Communications Services; Legal Services; Human Resources Management Services; Financial Management Services; Information Management Services; Information Technology Services; Real Property Services; Materiel Services; and Acquisition Services.

Planning highlights

In 2018-19, NRC's internal services will support the implementation of the NRC Dialogue[iii], actions. Efforts will include preparing implementation plans plus a change management and communication strategy as well as planning and delivering a Dialogue implementation "one-year update" with stakeholders (including Ministers, NRC Council, NRC executives, the Departmental Audit Committee, and the Dialogue working groups), to identify progress, gaps and opportunities for continued improvement.

NRC will review its internal services to identify potential gaps and areas for process improvements. For example, NRC's investment management process will be reviewed with a focus on governance, process efficiency, and pro-active monitoring. A client advisory board will also be established to ensure a more rationalized service delivery model that is aligned with NRC's business needs and research requirements. Streamlined processes and structures will ensure effective and efficient, client-focused provision of these internal services.

NRC will continue to focus on providing its workforce modern, robust, secure and fully-integrated information technology systems as required by a leading science and innovation organization. NRC will adopt enterprise services from Shared Services Canada and will modernize its IT infrastructure by accessing such technologies as cloud computing and high-performance computing.

NRC will develop a three-year strategy to revitalize NRC buildings and real estate, aligned with the New Vision for Science and Research in Canada[xx] and Budget 2017[xxi]. The exercise will be coordinated with an on-going review of key facilities with NRC's buildings. Understanding whether a building can meet NRC's R&D initiatives' future needs will enable NRC to make the best decisions about which buildings to maintain, renovate, repurpose, dispose, and rebuild.

To provide more timely delivery of information to the public, NRC will continue to experiment with the use of public blockchain technology in proactive disclosure of IRAP's contract agreements, with a longer-term view of applying this technology to other applications at NRC and facilitating its adoption across the Government of Canada. Approximately $47K of IRAP resources and one full-time equivalent will contribute to this experiment in 2018-19.

NRC will enhance its processes for ensuring sound environmental stewardship including implementation of its organization-wide Environmental Management System to enable proactive assessment and management of environmental issues and to meet compliance obligations. NRC will continue to monitor, risk-manage and/or remediate its contaminated sites in accordance with the Treasury Board Policy on Management of Real Property and in a manner consistent with the Federal Approach to Contaminated Sites[xxii] and ensuring appropriate application of the Precautionary Principle.

Budgetary financial resources (dollars)

2018–19 Main Estimates	2018–19 Planned spending	2019–20 Planned spending	2020–21 Planned spending
119,473,705	122,587,640	116,002,531	116,085,049

Human resources (full-time equivalents)

2018–19 Planned full-time equivalents	2019–20 Planned full-time equivalents	2020–21 Planned full-time equivalents
883.9	883.9	883.9

Note: Main Estimates, Planned spending and Full-time equivalents figures do not include Budget 2018 announcements. More information will be provided in the 2018–19 Supplementary Estimates and Departmental Results Report, as applicable.

Spending and human resources

Planned spending

	2015–16	2016–17	2017–18	2018–19	2019–20	2020-21
☐ Statutory	205.6	237.7	269.7	233.1	232.8	232.7
■ Voted	739.5	811.0	789.9	806.8	655.7	598.2
Total	945.1	1,048.7	1,059.6	1,039.9	888.5	830.9

(in millions of dollars)
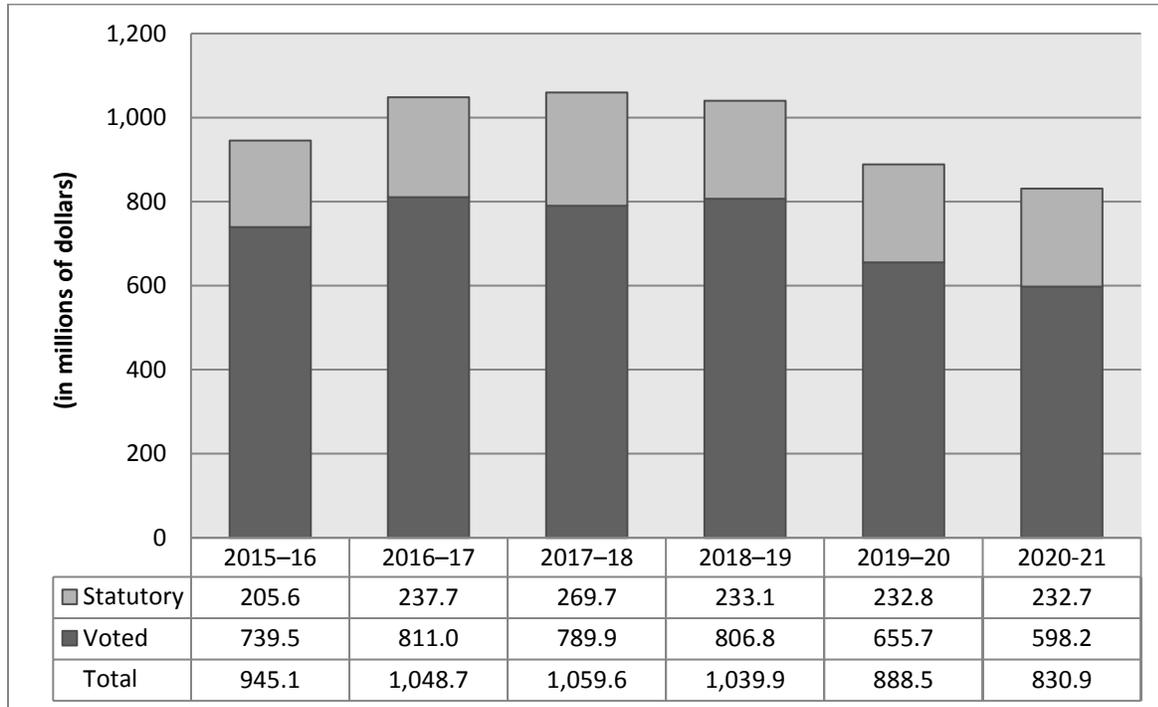
Total spending in 2017-18 ($1,059.6M) has increased by $10.9M in comparison to authorities used in 2016-17 ($1,048.7M). This is due principally to increases in statutory revenue spending ($27.3M), in capital expenditures ($20.5M), as well as operating expenditures ($14.3M), and offset by a decrease of $55.8M in grants and contributions expenditures. The increase in capital expenditures is attributable mainly to an increase of $17.9M in capital carry-forward, $10.3M for 2016 Federal Infrastructure Initiative funding, offset by a decrease of $9.6M for 2014 Federal Infrastructure Initiative funding. The increase in operating expenditures is due primarily to a conversion of $18.3M of operating funds to grants and contributions funds that occurred in 2016-17 for IRAP ($10.0M) to invest further in areas where SME client demand is high for increasing economic benefits to Canada, as well as for the International Astronomical Observatory Program ($8.3M). The decrease in grants and contributions expenses is attributable mainly to sunsetting of the additional funding that NRC received in Budget 2016 ($50.0M) for Contributions to Firms, which was announced in Budget 2016.

Total spending in 2018-19 ($1,039.9M) is expected to decrease by $19.7M in comparison to 2017-18 ($1,059.6M). The majority of this decrease is due to reduced statutory revenue spending ($27.0M), the sunsetting of the funding to sustain NRC operations ($59.6M), which is

anticipated to be renewed but is not included in the planned spending, the sunsetting of 2016 Federal Infrastructure Initiative ($13.7M), offset by the reprofile of the Thirty Meter Telescope funding of $80.3M due to delayed project activities associated with Canada's contribution to the Thirty Meter Telescope (TMT) initiative.

Total spending in 2019-20 ($888.5M) is expected to decrease by $151.4M in comparison to 2018-19 ($1,039.9M). The decrease is due principally to a reduction in funding for the TMT ($109.1M), the sunsetting of the Canada Accelerator and Incubator Program ($17.1M), the sunsetting of the 2017 Budget funding for Youth Employment Strategy ($10.0M), the sunsetting of the Genomics R&D Initiative ($8.2M) and a reduction of the 2014 Federal Infrastructure Initiative ($3.3M).

Total spending in 2020-21 ($830.9M) is expected to decrease by $57.6M in comparison to 2019-20 ($888.5M). The decrease is due principally to the sunsetting of TRIUMF five-year additional funding ($35.9M) and a reduction of the 2014 Federal Infrastructure Initiative funding ($17.4M).

Budgetary planning summary for Core Responsibilities and Internal Services (dollars)

Core Responsibilities and Internal Services	2015–16 Expenditures	2016–17 Expenditures	2017–18 Forecast spending	2018–19 Main Estimates	2018–19 Planned spending	2019–20 Planned spending	2020–21 Planned spending
Science and Innovation	740,987,637	808,753,764	815,744,692	907,545,876	917,284,562	772,512,495	714,833,977
Internal Services	204,089,958	239,986,701	243,837,722	119,473,705	122,587,640	116,002,531	116,085,049
Total	**945,077,595**	**1,048,740,465**	**1,059,582,414**	**1,027,019,581**	**1,039,872,202**	**888,515,026**	**830,919,026**

Expenses and FTEs related to National Science Library, Research Information Technology Platforms and Special Purpose Real Property were not reallocated to the Science and Innovation Core Responsibility for 2015-16, 2016-17 and 2017-18 because the reporting structure was not in place to allow NRC to report on the Departmental Results Framework and Program Inventory of record for 2018-19.

Planned human resources

Human resources planning summary for Core Responsibilities and Internal Services (full-time equivalents)[6]

Core Responsibilities and Internal Services	2015–16 Full-time equivalents	2016–17 Full-time equivalents	2017–18 Forecast full-time equivalents	2018–19 Planned full-time equivalents	2019–20 Planned full-time equivalents	2020–21 Planned full-time equivalents
Science and Innovation	2,764	2,925	2,862	2,560	2,535	2,535
Internal Services	904	946	969	884	884	884
Total	**3,668**	**3,871**	**3,831**	**3,444**	**3,419**	**3,419**

Note: Main Estimates, Planned spending and Full-time equivalents figures do not include Budget 2018 announcements. More information will be provided in the 2018–19 Supplementary Estimates and Departmental Results Report, as applicable.

Estimates by vote

For information on NRC's organizational appropriations, consult the 2018–19 Main Estimates.[xxiii]

Consolidated Future-Oriented Condensed Statement of Operations

The Consolidated Future-Oriented Condensed Statement of Operations provides a general overview of NRC's operations. The forecast of financial information on expenses and revenues is prepared on an accrual accounting basis to strengthen accountability and to improve transparency and financial management.

Because the Consolidated Future-Oriented Condensed Statement of Operations is prepared on an accrual accounting basis, and the forecast and planned spending amounts presented in other sections of the Departmental Plan are prepared on an expenditure basis, amounts may differ.

A more detailed Consolidated Future-Oriented Statement of Operations and associated notes, including a reconciliation of the net cost of operations to the requested authorities, are available on NRC's website[xxiv].

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[6] Decimals have been removed, and totals might not agree exactly with previous reports as a result. Full-time equivalents are defined in Appendix A. At the time of publication, NRC's head count was 3,700.

Consolidated Future-Oriented Condensed Statement of Operations
for the year ended March 31, 2019 (dollars)

Financial information	2017–18 Forecast results	2018–19 Planned results	Difference (2018–19 Planned results minus 2017–18 Forecast results)
Total expenses	1,037,364,000	986,870,000	(50,494,000)
Total revenues	221,858,000	202,100,000	(19,758,000)
Net cost of operations before government funding and transfers	815,506,000	784,770,000	(30,736,000)

NRC's 2018-19 planned expenses and revenues are based on the Annual Reference Level Update (ARLU). They include NRC's portion of the expenses accounts of the Canada-France-Hawaii Telescope Corporation (CFHT) ($2.4M) and TMT International Observatory LLC (TIO) ($4.8M). Revenues include $20.1M of accrued adjustments mainly from the consolidation of the revenue accounts of CFHT ($2.2M) and TIO ($15.1M) with NRC operations. Further details on the consolidation are provided in the Consolidated Future-Oriented Statement of Operations and associated notes.

NRC's 2018-19 planned expenses decreased primarily due to TIO ($46.8M) being recorded as capital assets as opposed to contributions during the construction phase, and other NRC expenses due to the decrease of ARLU confirmed as of January 2018.

Supplementary information

Corporate information

Organizational profile

Appropriate ministers:

The Honourable Navdeep Bains, P.C., M.P., Minister of Innovation, Science and Economic Development; and

The Honourable Kirsty Duncan, P.C., M.P., Minister of Science and Minister of Sport and Persons with Disabilities

Institutional head: Mr. Iain Stewart, President

Ministerial portfolio: Innovation, Science and Economic Development

Enabling instrument: National Research Council Act [xxv], R.S.C. 1985, c. N-15

Year of incorporation / commencement: 1916

Other: NRC is a departmental corporation of the Government of Canada, reporting to Parliament through the Minister of Innovation, Science and Economic Development in collaboration with the Minister of Science and Minister of Small Business and Tourism. NRC works in partnership with members of the Innovation, Science and Economic Development Portfolio to leverage complementary resources to promote science and integrated innovation, to exploit synergies in key areas of science and technology, to promote the growth of small and medium-sized enterprises and to contribute to Canadian economic growth. NRC's Council provides independent strategic advice to the NRC President and it reviews organizational performance. The President provides leadership and strategic management and is responsible for the achievement of NRC's long-range goals and plans in alignment with government priorities as reflected in his mandate letter. Each of NRC's Vice Presidents is responsible for a number of areas composed of Programs and research initiatives, centres, the Industrial Research Assistance Program, and/or a corporate branch. Vice Presidents and NRC managers are responsible for executing plans and priorities to ensure successful achievement of objectives.

Raison d'être, mandate and role

"Raison d'être, mandate and role: who we are and what we do" is available on NRC's website[xxiv].

Operating context and key risks

Information on operating context and key risks is available on NRC's website[xxiv].

Reporting framework

NRC's Departmental Results Framework and Program Inventory of record for 2018–19 are shown below.[7]

Core Responsibility: Science and Innovation		
Departmental Results Framework	Departmental Result: Scientific and technological knowledge advances	I1. Citation score of NRC-generated publications relative to world average
		I2. Number of unique intellectual assets (e.g., patents, disclosures, publications) generated by NRC research leaders
		I3. Percentage of the NRC workforce made up of underrepresented groups relative to Canadian average labour market availability in Science, Technology, Engineering and Mathematics
	Departmental Result: Innovative businesses grow	I4. Percentage revenue growth of firms engaged with NRC (research and development-engaged firms)
		I5. Percentage revenue growth of firms engaged with NRC (IRAP-engaged firms)
		I6. Percentage growth in Canada's science and technology related jobs through NRC supported firms (research and development-engaged firms)
		I7. Percentage growth in Canada's science and technology related jobs through NRC supported firms (IRAP-engaged firms)
		I8. Firm investment in NRC research and development services and scientific and technological infrastructure
	Departmental Result: Evidence-based solutions inform decisions in Government priority areas	I9. NRC investment in collaborative work with other federal government departments in Government priority areas
		I10. Number of scientific and other publications (e.g., technical papers, committee proceedings, reports) generated by NRC research leaders in Government priority areas

Program Inventory / **Internal Services**

- Aerospace
- Aquatic and Crop Resource Development
- Automotive and Surface Transportation
- Business Management Support (Enabling)
- Construction
- Design & Fabrication Services (Enabling)
- Energy, Mining and Environment
- Herzberg Astronomy & Astrophysics
- Human Health Therapeutics
- Industrial Research Assistance Program
- Information and Communications Technologies
- International Affiliations
- Measurement Science and Standards
- Medical Devices
- National Institute for Nanotechnology
- National Science Library
- Ocean, Coastal and River Engineering
- Security and Disruptive Technologies
- Special Purpose Real Property (Enabling)
- Research Information Technology Platforms (Enabling)
- TRIUMF

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[7] See GC InfoBase[xix] for the full names and descriptions of the Departmental Results Indicators in NRC's newly-approved Departmental Results Framework. Revisions to the Information and Communications Technologies Program are anticipated in 2018-19.

Concordance between the Departmental Results Framework and the Program Inventory, 2018–19, and the Program Alignment Architecture (PAA), 2017–18

2018–19 Core Responsibilities and Program Inventory	2017–18 Lowest-level program of the PAA	Percentage[8]
Core Responsibility: Science and Innovation		
Aerospace	Aerospace	89.3
Aquatic and Crop Resource Development	Aquatic and Crop Resource Development	100.0
Automotive and Surface Transportation	Automotive and Surface Transportation	96.9
Business Management Support (Enabling)	Internal Services – Management and Oversight	100.0
Construction	Construction	98.3
Design & Fabrication Services (Enabling)	Aerospace Automotive and Surface Transportation Ocean, Coastal and River Engineering Energy, Mining and Environment Construction Security and Disruptive Technologies	10.7 3.1 7.1 6.4 1.7 2.4
Energy, Mining and Environment	Energy, Mining and Environment	93.6
Herzberg Astronomy & Astrophysics	National Science Infrastructure	68.9
Human Health Therapeutics	Human Health Therapeutics	100.0
Industrial Research Assistance Program	Industrial Research Assistance Program	100.0
Information and Communications Technologies[9]	Information and Communications Technologies	100.0
International Affiliations	Internal Services – Management and Oversight	100.0
Measurement Science and Standards	Measurement Science and Standards	100.0
Medical Devices	Medical Devices	100.0
National Institute for Nanotechnology	Security and Disruptive Technologies	43.0
National Science Library	Internal Services – Information Management	100.0
Ocean, Coastal and River Engineering	Ocean, Coastal and River Engineering	92.9
Security and Disruptive Technologies	Security and Disruptive Technologies	54.6
Special Purpose Real Property (Enabling)	Internal Services – Real Property	100.0
Research Information Technology Platforms (Enabling)	Internal Services – Information Technology	100.0
TRIUMF	Science Infrastructure and Measurement	31.1

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[8] Percentage of lowest-level PAA program (dollars) corresponding to the program in the Program Inventory

[9] Revisions anticipated in 2018-19

Supporting information on the Program Inventory

Supporting information on planned expenditures, human resources, and results related to NRC's Program Inventory is available in the GC InfoBase[xix].

Supplementary information tables

The following supplementary information tables are available on NRC's website[xxiv].

▸ 2018–19 Departmental Sustainable Development Strategy

▸ Details on transfer payment programs of $5 million or more

▸ Disclosure of transfer payment programs under $5 million

▸ Gender-Based Analysis Plus

▸ Horizontal initiatives

▸ Planned evaluation coverage over the next five fiscal years

▸ Upcoming internal audits for the coming fiscal year

Federal tax expenditures

The tax system can be used to achieve public policy objectives through the application of special measures such as low tax rates, exemptions, deductions, deferrals and credits. The Department of Finance Canada publishes cost estimates and projections for these measures each year in the Report on Federal Tax Expenditures[xxvi]. This report also provides detailed background information on tax expenditures, including descriptions, objectives, historical information and references to related federal spending programs. The tax measures presented in this report are the responsibility of the Minister of Finance.

Organizational contact information

National Research Council Canada
NRC Communications
1200 Montreal Road, Bldg. M-58
Ottawa, Ontario, Canada K1A 0R6
Phone: (613) 993-9101 or toll-free 1-877-NRC-CNRC (1-877-672-2672)
Fax: (613) 952-9907
TTY number: (613) 949-3042
E-mail: info@nrc-cnrc.gc.ca

Appendix A: Definitions

appropriation (crédit)

Any authority of Parliament to pay money out of the Consolidated Revenue Fund.

budgetary expenditures (dépenses budgétaires)

Operating and capital expenditures; transfer payments to other levels of government, organizations or individuals; and payments to Crown corporations.

Core Responsibility (responsabilité essentielle)

An enduring function or role performed by a department. The intentions of the department with respect to a Core Responsibility are reflected in one or more related Departmental Results that the department seeks to contribute to or influence.

Departmental Plan (plan ministériel)

A report on the plans and expected performance of appropriated departments over a three-year period. Departmental Plans are tabled in Parliament each spring.

Departmental Result (résultat ministériel)

Any change or changes that the department seeks to influence. A Departmental Result is often outside departments' immediate control, but it should be influenced by Program-level outcomes.

Departmental Result Indicator (indicateur de résultat ministériel)

A factor or variable that provides a valid and reliable means to measure or describe progress on a Departmental Result.

Departmental Results Framework (cadre ministériel des résultats)

The department's Core Responsibilities, Departmental Results and Departmental Result Indicators.

Departmental Results Report (rapport sur les résultats ministériels)

A report on the actual accomplishments against the plans, priorities and expected results set out in the corresponding Departmental Plan.

experimentation (expérimentation)

Activities that seek to explore, test and compare the effects and impacts of policies, interventions and approaches, to inform evidence-based decision-making, by learning what works and what does not.

full-time equivalent (équivalent temps plein)

A measure of the extent to which an employee represents a full person-year charge against a departmental budget. Full-time equivalents are calculated as a ratio of assigned hours of work to scheduled hours of work. Scheduled hours of work are set out in collective agreements.

gender-based analysis plus (GBA+) (analyse comparative entre les sexes plus [ACS+])

An analytical process used to help identify the potential impacts of policies, Programs and services on diverse groups of women, men and gender-diverse people. The "plus" acknowledges that GBA goes beyond sex and gender differences. We all have multiple identity factors that intersect to make us who we are; GBA+ considers many other identity factors, such as race, ethnicity, religion, age, and mental or physical disability.

government-wide priorities (priorités pangouvernementales)

For the purpose of the 2018–19 Departmental Plan, government-wide priorities refers to those high-level themes outlining the government's agenda in the 2015 Speech from the Throne, namely: Growth for the Middle Class; Open and Transparent Government; A Clean Environment and a Strong Economy; Diversity is Canada's Strength; and Security and Opportunity.

horizontal initiative (initiative horizontale)

An initiative in which two or more federal organizations, through an approved funding agreement, work toward achieving clearly defined shared outcomes, and which has been designated (by Cabinet, a central agency, etc.) as a horizontal initiative for managing and reporting purposes.

non-budgetary expenditures (dépenses non budgétaires)

Net outlays and receipts related to loans, investments and advances, which change the composition of the financial assets of the Government of Canada.

performance (rendement)

What an organization did with its resources to achieve its results, how well those results compare to what the organization intended to achieve, and how well lessons learned have been identified.

performance indicator (indicateur de rendement)

A qualitative or quantitative means of measuring an output or outcome, with the intention of gauging the performance of an organization, Program, policy or initiative respecting expected results.

performance reporting (production de rapports sur le rendement)

The process of communicating evidence-based performance information. Performance reporting supports decision making, accountability and transparency.

planned spending (dépenses prévues)

For Departmental Plans and Departmental Results Reports, planned spending refers to those amounts presented in the Main Estimates.

A department is expected to be aware of the authorities that it has sought and received. The determination of planned spending is a departmental responsibility, and departments must be able to defend the expenditure and accrual numbers presented in their Departmental Plans and Departmental Results Reports.

plan (plan)

The articulation of strategic choices, which provides information on how an organization intends to achieve its priorities and associated results. Generally a plan will explain the logic behind the strategies chosen and tend to focus on actions that lead up to the expected result.

priority (priorité)

A plan or project that an organization has chosen to focus and report on during the planning period. Priorities represent the things that are most important or what must be done first to support the achievement of the desired Departmental Results.

Program (programme)

Individual or groups of services, activities or combinations thereof that are managed together within the department and focus on a specific set of outputs, outcomes or service levels.

Program Alignment Architecture (architecture d'alignement des programmes)

A structured inventory of an organization's programs depicting the hierarchical relationship between programs and the Strategic Outcome(s) to which they contribute.[10]

result (résultat)

An external consequence attributed, in part, to an organization, policy, Program or initiative. Results are not within the control of a single organization, policy, Program or initiative; instead they are within the area of the organization's influence.

statutory expenditures (dépenses législatives)

Expenditures that Parliament has approved through legislation other than appropriation acts. The legislation sets out the purpose of the expenditures and the terms and conditions under which they may be made.

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[10]. Under the Policy on Results, the Program Alignment Architecture has been replaced by the Program Inventory.

Endnotes

i Minister of Innovation, Science and Economic Development Mandate Letter, http://pm.gc.ca/eng/minister-innovation-science-and-economic-development-mandate-letter

ii Minister of Science Mandate Letter, http://pm.gc.ca/eng/minister-science-mandate-letter

iii NRC Dialogue, https://www.nrc-cnrc.gc.ca/eng/achievements/employees/2017/employees_working_together.html

iv NRC President's Mandate Letter, http://www.nrc-cnrc.gc.ca/eng/about/corporate_overview/mandate.html

v Innovation and Skills Plan, https://www.ic.gc.ca/eic/site/062.nsf/eng/home

vi Superclusters, https://www.canada.ca/en/innovation-science-economic-development/programs/small-business-financing-growth/innovation-superclusters.html

vii GBA+, http://www.swc-cfc.gc.ca/gba-acs/index-en.html

viii EUREKA, https://www.nrc-cnrc.gc.ca/eng/about/global/eureka.html

ix NRC Construction Program, https://www.nrc-cnrc.gc.ca/eng/rd/construction/index.html

x Infrastructure Canada, https://www.canada.ca/en/office-infrastructure.html

xi Canada's New IP Strategy, https://www.ic.gc.ca/eic/site/693.nsf/eng/00157.html

xii NRC EME Program, https://www.nrc-cnrc.gc.ca/eng/rd/eme/index.html

xiii Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy, https://unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf

xiv TRIUMF, http://www.triumf.ca/

xv NRC OCRE Program, https://www.nrc-cnrc.gc.ca/eng/rd/ocre/index.html

xvi Federal Arctic Policy Framework, http://www.aadnc-aandc.gc.ca/eng/1503687877293/1503687975269

xvii NRC Building Codes, https://www.nrc-cnrc.gc.ca/eng/solutions/collaborative/brma.html

xviii Canada's Youth Employment Strategy, https://www.canada.ca/en/employment-social-development/services/funding/youth-employment-strategy.html

xix GC InfoBase, https://www.tbs-sct.gc.ca/ems-sgd/edb-bdd/index-eng.html

iii NRC Dialogue, https://www.nrc-cnrc.gc.ca/eng/achievements/employees/2017/employees_working_together.html

xx New Vision for Science and Research in Canada, https://www.canada.ca/en/innovation-science-economic-development/news/2017/11/government_unveilsplanstostrengthenfundamentalresearchincanada.html

xxi Budget 2017, https://www.budget.gc.ca/2017/home-accueil-en.html

xxii Federal Approach to Contaminated Sites, http://www.federalcontaminatedsites.gc.ca/8DF3AC07-5A7D-483F-B263-6DE03104319A/fa-af-eng.pdf

xxiii Main Estimates, http://www.tbs-sct.gc.ca/hgw-cgf/finances/pgs-pdg/gepme-pdgbpd/index-eng.asp

xxiv NRC Reports, https://www.nrc-cnrc.gc.ca/eng/reports/index.html

xxv National Research Council Act, http://laws.justice.gc.ca/eng/N-15/index.html

xxvi Report on Federal Tax Expenditures, http://www.fin.gc.ca/purl/taxexp-eng.asp