National Research Council Canada

2016–17

Report on Plans and Priorities

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

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Ministers' Message

As Canada begins a new chapter in 2016–17, creating a culture of innovation is more important than ever in driving economic growth.

The recent name change of our Innovation, Science and Economic Development Portfolio recognizes this, placing a deliberate emphasis both on innovation and scientific discovery, and their equal importance for economic development nationally and throughout all of Canada's diverse regions.

We have promised Canadians a government that will bring real change — in both what we do and how we do it. We will invest in growing our economy, increase transparency and use the best evidence available to inform decision making.

Through the programs of the Innovation, Science and Economic Development Portfolio, we will work to develop and deliver an innovation agenda for Canada that will help improve our productivity performance, grow the economy and enhance our prosperity and well-being.

This 2016-17 Report on Plans and Priorities of the National Research Council of Canada provides information on how the Council will support the Government on achieving our agenda in the coming year and we are fully confident that the National Research Council of Canada is prepared to successfully support us and work with our partners inside and outside government to deliver for Canadians. However, given our commitment to more effective reporting, this year's report will be the final submission using the existing reporting framework.

The Prime Minister and the President of the Treasury Board are working to develop new, simplified and more effective reporting processes that will better allow Parliament and Canadians to monitor our Government's progress on delivering real change to Canadians. In the future, the National Research Council of Canada's reports to Parliament will focus more transparently on how we are using our resources to fulfill our commitments and achieve results for Canadians.

The Honourable Navdeep Bains

Minister of Innovation, Science and Economic Development

The Honourable Kirsty Duncan

Minister of Science

The Honourable Bardish Chagger

Minister of Small Business and Tourism

These new reporting mechanisms will allow Canadians to more easily follow our Council's progress towards delivering on our priorities, which were outlined in the Prime Minister's mandate letters to us.[i]

It is our pleasure to present the *Report on Plans and Priorities* for the National Research Council of Canada for 2016–17, which sets out how the Council's work will contribute to attaining these shared objectives.

The Honourable Navdeep Bains	The Honourable Kirsty Duncan	The Honourable Bardish Chagger
Minister of Innovation, Science and Economic Development	Minister of Science	Minister of Small Business and Tourism
Mandate Letter[ii]	Mandate Letter[iii]	Mandate Letter[iv]

President's Message

I am pleased to submit for tabling in Parliament, the 2016-17 Report on Plans and Priorities for the National Research Council of Canada (NRC). This year we will continue to focus on delivering the mission-oriented innovation support that Canadian companies need to grow, working in an open and collaborative manner to maximize our investments and deliver high returns for Canadians.

Recent client survey results indicate that NRC is indeed helping move the yardsticks when it comes to enabling Canadian businesses to invest more in research and development (R&D). This demonstrates we are on the right track and in 2016-17 we will continue to deliver the kinds of direct, hands-on support and services that Canadian businesses need to succeed in Canada and competitive international markets.

As NRC approaches its centennial in 2016, we will also put many new and inspiring initiatives into action. We recognize that in addition to meeting the immediate and near-term innovation needs of Canadian industry, we must look to the future and invest to build capabilities in areas where Canada must have a strong leadership position. This way, NRC will continue to meet our critical mandate for Canada over the coming decades.

John McDougall, P.Eng.
President, National Research Council Canada

Section I: Organizational Expenditure Overview

Organizational Profile

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

Institutional Head: John McDougall, President

Ministerial Portfolio: Innovation, Science and Economic Development

Enabling Instrument(s): *National Research Council Act* [v], 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. NRC works in partnership with members of the Innovation, Science and Economic Development Portfolio to leverage complementary resources to promote innovation, to exploit synergies in key areas of S&T, to promote the growth of small and medium-sized enterprises (SMEs) and to contribute to Canadian economic growth. NRC's Council provides independent strategic advice to the NRC President and reviews organizational performance. The President provides leadership and strategic management and is responsible for the achievement of NRC's long-range goals and plans. Each of NRC's seven Vice Presidents is responsible for a number of areas composed of research sub-programs, 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.

Organizational Context

Raison d'être

National Research Council of Canada (NRC) bridges the innovation gap between early stage research and development (R&D) and commercialization, focusing on socio-economic benefits for Canada and increasing national performance in business-led R&D and innovation. A federal leader in technology development, NRC supports Canadian industry to enhance their innovation capabilities and capacity and become more productive in the development and deployment of innovative products, processes and services for markets of national priority and importance. With a presence in every province, NRC combines its strong national foundation with international linkages to help Canada grow in productivity and remain globally competitive. NRC works in collaboration with industry, governments and academia to maximize Canada's overall R&D investment.

Responsibilities

Under the [i†] *National Research Council Act*, NRC is responsible for:

- Undertaking, assisting or promoting scientific and industrial research in fields of importance to Canada;
- Providing vital scientific and technological services to the research and industrial communities;
- Investigating standards and methods of measurement;
- Working on the standardization and certification of scientific and technical apparatus, instruments and materials used or usable by Canadian industry;
- Operating and administering any astronomical observatories established or maintained by the Government of Canada;
- Establishing, operating and maintaining a national science library; and
- Publishing and selling or otherwise distributing such scientific and technical information as the Council deems necessary.

Strategic Outcomes and Program Alignment Architecture

1. Strategic Outcome (SO1): Canadian businesses prosper from innovative technologies

- **1.1 Program:** Technology Development and Advancement (TD&A)
  - **1.1.1 Sub-Program:** Aerospace
  - **1.1.2 Sub-Program:** Automotive and Surface Transportation (AST)
  - **1.1.3 Sub-Program:** Ocean, Coastal and River Engineering (OCRE)
  - **1.1.4 Sub-Program:** Energy, Mining and Environment (EME)
  - **1.1.5 Sub-Program:** Construction
  - **1.1.6 Sub-Program:** Aquatic and Crop Resource Development (ACRD)
  - **1.1.7 Sub-Program:** Medical Devices (MD)
  - **1.1.8 Sub-Program:** Human Health Therapeutics (HHT)
  - **1.1.9 Sub-Program:** Information and Communications Technologies (ICT)
  - **1.1.10 Sub-Program:** Security and Disruptive Technologies (SDT)
- **1.2 Program:** Industrial Research Assistance Program (IRAP)

2. Strategic Outcome (SO2): R&D Infrastructure for an innovative and knowledge-based economy

- **2.1 Program:** Science Infrastructure and Measurement (SI&M)
  - **2.1.1 Sub-Program:** National Science Infrastructure (NSI)
  - **2.1.2 Sub-Program:** Measurement Science and Standards (MSS)

Program: Internal Services

Organizational Priorities

Priority 1: Generating results for clients

Description

- Generate demonstrable results for clients through market-driven research, technology development, innovation support services and access to scientific infrastructure, helping Canada thrive in today's globally competitive, innovation-based economy.

Priority Type[1]

Ongoing

[1] Type is defined as follows: **previously committed to**—committed to in the first or second fiscal year prior to the subject year of the report; **ongoing**—committed to at least three fiscal years prior to the subject year of the report; and **new**—newly committed to in the reporting year of the RPP or DPR.

Key Supporting Initiatives

Planned Initiatives	Start Date	End Date	Link to Department's Program Alignment Architecture
• Further strengthen strategic partnerships, engage key stakeholders and facilitate networks among industry and innovation players – to lower technology development risk and solve short and longer term technological challenges.	April 2014	Ongoing	SO1: Canadian businesses prosper from innovative technologies, and SO2: R&D infrastructure for an innovative and knowledge-based economy
• Advance emerging technologies of increasing importance nationally and globally, supported by foresight activities to remain ahead of the curve and anticipate the future needs of business and Canada.	April 2015	Ongoing	
• Support Canadian industry in accessing domestic and global markets by advancing the development of measurement standards that underlie domestic and international trade. Additionally, through its international framework, NRC will support Canadian industrial competitiveness by investing in key international networks (such as [vi†] EUREKA) that facilitate Canadian access to global value chains.	April 2014	Ongoing	
• Through NRC-IRAP, provide SME clients with access to technical and business advice, networking opportunities, and cost-shared merit-based contributions for their innovative projects.	April 2014	Ongoing	
• Facilitate access to national, large-scale science infrastructure for Canadian research communities, including the TRIUMF sub-atomic research facility, and astronomical observatories, as mandated by the National Research Council Act.	April 2014	Ongoing	

Priority 2: Effective and efficient resource management

Description

- Drive organizational growth to deliver on expected results and enable effective and efficient resource management for a sustainable and secure organization.

Priority Type[2]

Ongoing

Key Supporting Initiatives

Planned Initiatives	Start Date	End Date	Link to Department's Program Alignment Architecture
• Increase external visibility of NRC R&D initiatives and opportunities, including international market/outreach strategies and relationship opportunities with Regional Development Agencies, provincial governments and Research and Technology Organizations (RTOs), and academia.	April 2015	Ongoing	SO1: Canadian businesses prosper from innovative technologies, and SO2: R&D infrastructure for an innovative and knowledge-based economy:
• Partner with other science-based departments to further develop a single, shared online discovery and access platform for federal science library services and collections.	April 2015	Ongoing	
• Maintain a security framework, operations and mindset that ensure the security of infrastructure, information and people.	April 2015	Ongoing	
• Continue regular corporate and R&D performance reporting to track delivery against objectives and make timely course corrections.	April 2015	Ongoing	
• Use three-year reviews of R&D performance to support management and investment decisions on continuance, adjustments or termination.	April 2014	Ongoing	
• Continue to implement succession planning, workforce planning and talent acquisition initiatives that ensure an agile and sustainable workforce to support the continued implementation of NRC's strategy.			

For more information on organizational priorities, see the Ministers' mandate letters on the Prime Minister of Canada's website.[vii]

[2] Type is defined as follows: **previously committed to**—committed to in the first or second fiscal year prior to the subject year of the report; **ongoing**—committed to at least three fiscal years prior to the subject year of the report; and **new**—newly committed to in the reporting year of the RPP or DPR.

Risk Analysis

Key Risks

Risk[1]	Risk Response Strategy	Link to PAA
Delivery of Results for Clients & Canada: Risk Statement: Inability to deliver results at a level and in a manner that sustains stakeholder confidence.	**Key actions to respond to risk include:** Throughout the fiscal year: 1. Clarify performance commitments during reviews of personnel performance; 2. Use external challenge function of R&D market needs; 3. Leverage IRAP and corporate capabilities and knowledge to develop marketing plans; 4. Share R&D success stories internally and externally; 5. Manage facility and staff utilization across all portfolios; 6. Proactively manage value propositions and milestones for all R&D initiatives; 7. Further define and use project management standards (These actions complement others defined in response to the risk related to Operational Efficiency). **Indicators:** • Performance data and 3-year reviews of R&D initiatives; • Client/stakeholder feedback.	SO1 and SO2
Balanced NRC Security: NRC dependencies on others for implementing security affect NRC's ability to operate, ultimately impacting NRC's credibility and competitiveness.	**Key actions to respond to risk include:** 1. Continue Risk Assessment Committee to determine risks and approach/mitigation (Ongoing); 2. Complete implementation of enterprise security initiative including employee engagement and training (Sept. 2016); 3. Define security roles and responsibilities between Shared Services Canada (SSC) and NRC, and establish resolution mechanisms (June 2016). **Indicators:** • Feedback from clients, collaborators, and stakeholders; • Reported security incidents and trends (IT and physical intrusions).	
Global Disruption: Significant instability and economic downturn created by global disruptions impact client ability and/or willingness to invest in R&D.	**Key actions to respond to risk include:** 1. Rejuvenate NRC Foresight Office; 2. Implement a strategic intelligence initiative of around 4 to 5 scenarios of potential major global disruptions for NRC, including identification of critical NRC assets for protection and a framework for adjustments to NRC business to make timely responses should disruptions occur (by Q1 2016-17). **Indicators:** • Feedback from clients, collaborators, and stakeholders; • Insights from NRC intelligence network (Advisory Boards, NRC Council, etc.) and scanning of economic and geopolitical environment.	

[1] The above risks represent a subset of NRC's highest corporate risks, and are more externally-oriented.

The highest risks identified in 2015-16 have been carried over for continued attention in 2016-17 - operational efficiency, and sourcing and management of technical and business expertise. Some key factors driving these risks include: transitioning of NRC's corporate IT infrastructure to a

secure environment; concurrent government email transformation initiative; impact of centralized service model through SSC on operations; and lengthy time to hire in the current federal process. At the same time, Canada is facing increased competition globally for specialized R&D talent, growing investments in science, technology and innovation abroad, declining Canadian industry investment in R&D, and escalating levels of global disruptions that could impact NRC and its clients.

Moving forward it will be key to ensure a balance between security requirements and operational capability. The creation of a new Security Branch and a dedicated Business Continuity function are expected to support NRC preparedness and resilience in response to potential disruptions. Development of potential global disruption scenarios (e.g., geopolitical disturbances, major commodity price downturns) leveraging NRC's foresight capabilities is also expected to support greater preparedness should such an event materialize.

In the coming year, NRC will be working on creating future research opportunities designed to balance shorter term revenue generation with longer term capability development. This will be important to create a balanced portfolio taking into account, decisions from recent mid-term program reviews and reassessments of R&D initiatives. To support leading-edge concepts for higher risk, higher impact R&D projects, a new ideation fund has also been launched.Moving forward, effective marketing and collaboration with partners through vehicles such as [viii†] Innoventures Canada (ICAN), and [vi†] EUREKA, will be key to raising visibility of NRC capabilities, both nationally and internationally, as a leading RTO.

Planned Expenditures

Budgetary Financial Resources[3] (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
1,053,658,576	1,066,421,431	975,760,135	976,161,390

Human Resources[3] (Full-Time Equivalents [FTEs])

2016-17	2017-18	2018-19
3,749.0	3,417.7	3,457.2

Budgetary Planning Summary for Strategic Outcome(s) and Program(s) (dollars)

Strategic Outcome(s), Program(s) and Internal Services	2013-14 Expenditures	2014-15 Expenditures	2015-16 Forecast Spending	2016-17 Main Estimates	2016–17 Planned Spending [3]	2017–18 Planned Spending [3]	2018–19 Planned Spending [3]
Strategic Outcome 1: Canadian businesses prosper from innovative technologies							
Program 1.1: TD&A	317,721,198	344,930,416	366,363,504	382,178,045	394,009,694	343,100,905	349,442,863
Program 1.2: IRAP	278,130,653	271,824,267	294,223,561	269,541,644	269,541,644	269,658,433	262,558,251
Subtotal	595,851,851	616,754,683	660,587,065	651,719,689	663,551,338	612,759,338	612,001,114
Strategic Outcome 2: R&D infrastructure for an innovative and knowledge-based economy							
Program 2.1: SI&M	99,678,744	106,451,583	120,676,658	167,739,242	168,670,448	156,197,901	161,855,615
Subtotal	99,678,744	106,451,583	120,676,658	167,739,242	168,670,448	156,197,901	161,855,615
Internal Services Subtotal	198,887,611	232,498,650	248,588,794	234,199,645	234,199,645	206,802,896	202,304,661
Total	894,418,206	955,704,916	1,029,852,517	1,053,658,576	1,066,421,431	975,760,135	976,161,390

NRC's expenditure profile has increased since 2012-13 primarily as a result of investments and initiatives announced in Economic Action Plan 2012, Economic Action Plan 2013, Economic Action Plan 2014 and Economic Action Plan 2015. NRC's future expenditures and human resources profiles do not reflect future budget decisions.

[3] Planned figures do not reflect future budget decisions.

Alignment of Spending With the Whole-of-Government Framework

Alignment of 2016–17 Planned Spending With the [ix†] Whole-of-Government Framework (dollars)

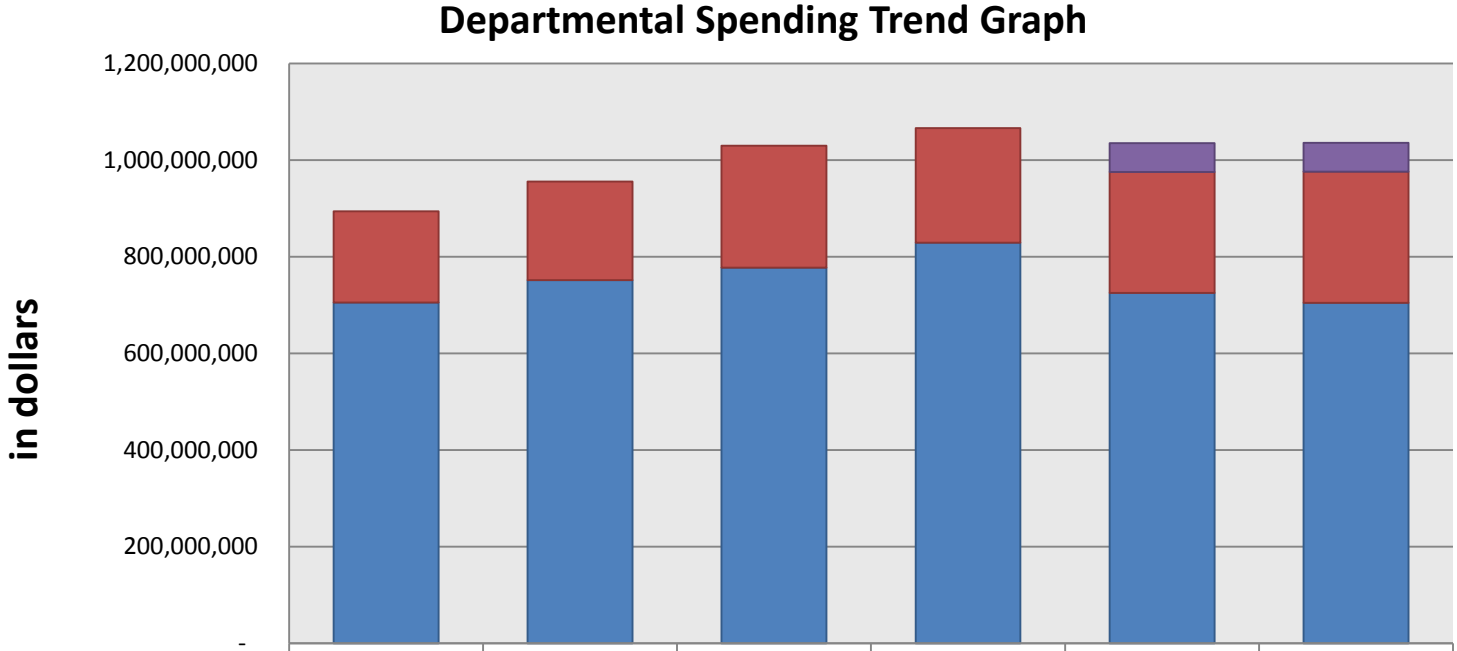
Strategic Outcome	Program	Spending Area	Government of Canada Outcome	2016–17 Planned Spending [4]
SO1: Canadian businesses prosper from innovative technologies	1.1 Technology Development and Advancement	Economic Affairs	Strong Economic Growth	394,009,694
	1.2 Industrial Research Assistance Program (IRAP)			269,541,644
SO2: R&D infrastructure for an innovative and knowledge-based economy	2.1 Science Infrastructure and Measurement		Innovative and Knowledge-based Economy	168,670,448

Total Planned Spending by Spending Area (dollars)

Spending Area	Total Planned Spending [4]
Economic affairs	832,221,786
Social affairs	N/A
International affairs	N/A
Government affairs	N/A

[4] Planned spending in this table excludes the cost of Internal Services.

Departmental Spending Trend



	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19
Sunset Programs - Anticipated	0	0	0	0	59,600,000	59,600,000
Statutory	189,031,093	204,133,916	252,390,727	237,065,393	250,728,047	271,593,282
Voted	705,387,113	751,571,000	777,461,790	829,356,038	725,032,088	704,568,108
Total	894,418,206	955,704,916	1,029,852,517	1,066,421,431	1,035,360,135	1,035,761,390

Planned spending for future years does not reflect future budget decisions. Anticipated Sunset Programs include funding to sustain operations of the refocused National Research Council of Canada to develop and deploy industry-relevant research and technology solutions that will help grow innovative businesses in Canada. The anticipated sunsetting renewal of Refocus NRC will sustain a portion of salary and operating costs of its Technology Development and Advancement Program that supports the research and innovation needs of Canadian industry. As well, this funding will sustain NRC in continuing to provide, in every province across Canada, the technical services, scientific expertise and unique infrastructure that Canadian businesses need to successfully bring their innovations to market.

Estimates by Vote

For information on NRC's organizational appropriations, consult the [[x]†] *2016–17 Main Estimates* on the Treasury Board of Canada Secretariat website

Section II: Analysis of Program(s) by Strategic Outcome

Strategic Outcome 1: Canadian businesses prosper from innovative technologies

Program 1.1: Technology Development and Advancement

Description

This program develops and advances technologies to enhance the prosperity of Canadian industries in support of federal priorities such as the federal Science, Technology, and Innovation Strategy. This includes national-scale flagship technology-development initiatives having sufficient critical mass to contribute demonstrably to national prosperity. To bring new and innovative products and processes to the marketplace, companies must advance the emerging and maturing technologies embodied in applied developments and prototypes to a level where the risk is sufficiently reduced to be acceptable from business, investment, and regulatory perspectives. The program bridges this critical technology gap through mission-oriented research and development services, and specialized technical services such as custom design and fabrication, testing, prototyping, up-scaling, and demonstration in specialized facilities.

Budgetary Financial Resources (dollars)[5]

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
382,178,045	394,009,694	343,100,905	349,442,863

Human Resources (Full-Time Equivalents [FTEs])[4]

2016–17	2017–18	2018–19
2,088.3	1,753.5	1,799.5

[5] Spending and FTEs for the Vice President Offices (Engineering & Life Sciences) and Design Fabrication Services in support of sub-programs were excluded from sub-program totals.

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Canadian industries commercialize advanced technologies	Technology deployment[6] (client commitments to exploit NRC innovations)	20	March 2017
	Client/stakeholder feedback[7] on benefits: jobs, sales, R&D	85%	March 2017

Planning Highlights

The Canadian economy has seen a significant change in commodity prices, particularly in petroleum-based fuels. This has opened new opportunities but has also led to direct and indirect impacts in many Canadian industry sectors. It has also left its mark on some of the Program's industry-targeted research initiatives where there has been a shift by industry partners, particularly in the oil and gas sector, to reduce their engagement in mid-to long-term strategic research towards more short-term, applied technical services. This trend required the Program to re-calibrate its research initiatives to bring the highest possible value to its partners.

In 2016-17, all R&D initiatives will operate with the necessary adjustments in place. They will build on earlier successes in delivering targeted research, technology development and demonstration, and direct technology support to Canadian industry – elements that are crucial for Canadian companies to thrive in a highly competitive global market.

To further remain relevant to industry, the Program will explore opportunities for new research initiatives addressing challenges faced by Canadian industries in the evolving global and national landscape.

To remain sensitive and agile to respond to changes in industry and other partner's needs, NRC will maintain a disciplined quarterly reporting mechanism for all R&D initiatives under the Program.

To protect commercial interests, the present report respects constraints on disclosure of on-going proprietary work.

[6] This is a measure of NRC's success in advancing technologies to the point of client and stakeholder readiness and commitment to exploit technologies commercially. It is counted in terms of the number of unique press releases, company public reports, and NRC Key Accounts in which an NRC client or stakeholder expresses, during the reporting period, a commitment to exploit innovations that have already been successfully developed or advanced by or with NRC.

[7] The proportion of surveyed clients and stakeholders who report an increase in jobs, sales, R&D expenditures or other positive benefits as result of services received from NRC.

Sub-Program 1.1.1: Aerospace

Description

This sub-program advances product and process technologies to enhance the prosperity of the aerospace industry sector in Canada that is striving to remain competitive in the face of razor-thin margins and increasing regulatory demands. The sector is important to the Canadian economy as a major contributor to manufacturing trade and for hundreds of thousands of skilled jobs at all levels of the supply chain. It is also important for its impacts on the transportation costs of materials and products that drive the economy. Results are achieved through multi-disciplinary collaborative research and development services in addition to custom technical services in specialized facilities, such as testing and prototyping, for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
74,178,547	74,640,081	77,113,625

Human Resources (FTEs)

2016–17	2017–18	2018–19
391.8	371.0	383.8

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancements of aerospace process and product technologies	Client/stakeholder financial investment in technology development	$32.0M	March 2017
	Licensing and royalty revenue from NRC clients	$0.03M	March 2017

Planning Highlights

The sub-program will continue to enhance the competiveness of Canada’s aerospace sector by helping NRC-Aerospace original equipment manufacturers and related SMEs advance their innovative technologies into products.

For example, the sub-program will design and conduct complex tests in its wind tunnel facilities using high-fidelity models to demonstrate the feasibility and economic benefits of innovative aircraft configurations. The results will support advancing a new product line for the Canadian aerospace industry in the longer term.

The costs of workplace-related disability claims have increased in the aerospace industry. For example, noise-induced hearing loss in the aerospace sector has risen to well over $33M

annually for the Department of National Defence (DND) alone. The sub-program will explore innovative means of optimizing ergonomics in aerospace workplaces with the goal of ultimately reducing the number of disability claims while increasing productivity and reducing the burden on the healthcare system. Commercial opportunities for the resulting technologies will be explored and exploited through Canadian SMEs.

In addition, the sub-program will provide engineering research and development support to extend the life of existing fleets, decreasing related costs to Canadian industries and taxpayers. For the same purpose, the sub-program will also demonstrate and validate new technologies to enhance aircraft life-prediction capabilities.

Sub-Program 1.1.2: Automotive and Surface Transportation

Description

This sub-program provides technical knowledge and advances product and process technologies for producing more fuel-efficient, affordable, and environmentally-responsible ground vehicles and for delivering engineering solutions to complex technology challenges facing surface transport industries including heavy vehicle and rail. This is important for reducing transportation infrastructure and costs and for enhancing Canada's share of ground vehicle supply chains and for enhancing the prosperity of the ground vehicle industry sector in Canada as it is faced with growing environmental concerns, competitive pressures, and stringent regulations. The Canadian economy relies on advanced manufacturing sectors such as the ground vehicle industries as major economic drivers, accounting for a significant portion of manufacturing trade, and therefore must remain competitive. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services, such as testing, prototyping and system integration, for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
55,521,673	55,375,524	56,900,755

Human Resources (FTEs)

2016–17	2017–18	2018–19
260.4	244.7	254.0

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancements in ground vehicle process and product technologies	Client/stakeholder financial investment in technology development	$27.2M	March 2017
	Licensing and royalty revenue from NRC clients	$0.40M	March 2017

Planning Highlights

Automotive and Surface Transportation (AST) will build on its reputation as a leader in improving the competitiveness and safety of Canada’s transportation system by advancing value-added technologies. Due to the size and the importance of the transportation sector to the Canadian economy, including the vehicle manufacturing sector, every step of advancement can entail a fairly large impact.

In 2016-17, AST will focus on the major priorities of the automotive and ground vehicle industry, namely technologies for cost reduction, safety, and energy efficiency. This will include updating and developing custom software aimed at improving product safety as well as increasing design options and efficiencies in manufacturing.

Additionally, AST will work closely with industry clients to develop and validate new products and manufacturing techniques for lighter, more efficient vehicles while expanding markets for Canada's aluminum and "green" bio-composite industries.

Moreover, AST will continue working with industry clients to advance novel energy storage systems for electric vehicles. Once the research has progressed to the stage that key manufacturing technologies can be transferred to industry, it is expected to reduce the costs of electric motor manufacturing to Canadian companies across the supply chain.

To leverage expertise and industry engagement, the sub-program will continue to provide leadership in extending industry consortiums that are cooperating to solve common challenges in vehicle manufacturing.

For Canada's ground transportation industry, AST will continue to deliver innovative technologies to reduce the fuel, maintenance, and repair costs of ground fleets. This is important to the competitive advantage of Canada's transportation industry, and also for advancing Canada's priority for a cleaner economy.

For Canada's rail industry, AST will work collaboratively with industry and regulators in advancing technologies for monitoring track infrastructure. This will include predictive monitoring technologies needed to increase significantly the operational efficiencies and to enhance the safety of the Canadian freight railway system over the next 6 to 8 years.

Sub-Program 1.1.3: Ocean, Coastal, and River Engineering

Description

This sub-program develops and advances technologies and standards for safe and effective operations in Canada's vast ocean, coastal and river environments, including the Arctic. This is important for lowering barriers for natural resource development and for enhancing the prosperity of the Canadian marine transportation and water resource sectors facing costly challenges of harsh environments (ice, wind, waves, currents), extreme weather events (floods, "100 year wave"), and coastal erosion. Results are achieved by working with Canadian industry through multi-disciplinary collaborative research and development services in addition to custom technical services, such as testing, prototyping, numerical modeling, and system integration in specialized facilities, for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
15,651,402	16,748,383	18,207,261

Human Resources (FTEs)

2016–17	2017–18	2018–19
104.8	103.5	107.1

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancements of process and product technologies for ocean, coastal and inland water engineering	Client/stakeholder financial investment in technology development	$12.1M	March 2017
	Licensing and royalty revenue from NRC clients	$0.1M	March 2017

Planning Highlights

Ocean, Coastal, and River Engineering (OCRE) will continue working with Canadian industry to deliver innovative technologies and practical support to improve Canada’s competitiveness in the ocean technology and marine industry. This will include reducing risks and costs of marine operations while supporting the safe and responsible development of marine-based resources within Canada’s three oceans. It will further continue to address some of the pressing needs in Canada’s Arctic with research, technology development and technology demonstration specific to the high North.

For example, in 2016-17, within its Arctic research initiative, OCRE expects to deliver enhancements to NRC’s predictive ice forecasting model in order to assist in the training of

mariners operating in Canadian Arctic and sub-Arctic waters. It further supports ship operators in making more informed decisions when navigating ice-prone waters – areas where the costs and the risks to industry are relatively high.

In addition, also within the Arctic research initiative, this sub-program will continue its significant role in developing technologies, such as dynamic positioning systems, for more efficient operation in ice. Other research activities aim at the development of a prototype system for risk assessment, optimal route planning and optimal vessel class for marine operations in harsh climates.

Through technical services and collaborative arrangements, OCRE will support the continued efforts of Canada's National Shipbuilding and Procurement Strategy. It will also support the Royal Canadian Navy (RCN) in improving submarine operations. OCRE will explore with industry partners to find out if and where opportunities exist to commercialise the findings.

Sub-Program 1.1.4: Energy, Mining and Environment

Description

This sub-program develops and advances technologies and techniques for enhancing the innovation capacity and growth of Canada's natural resources and utility sectors. These sectors are important contributors to Canada's GDP that are challenged by volatile global markets and growing environmental pressures. To remain sustainable, industries in these sectors require technologies to reduce production costs. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized advisory and technical services for transferring or advancing technologies into industrial solutions for the marketplace.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
29,547,454	25,089,509	26,037,479

Human Resources (FTEs)

2016–17	2017–18	2018–19
192.5	155.0	157.2

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancements of process and product technologies for the natural resources and utility sectors	Client/stakeholder financial investment in technology development	$6.9M	March 2017
	Licensing and royalty revenue from NRC clients	$0.3M	March 2017

Planning Highlights

Energy, Mining and Environment (EME) will remain committed to providing practical solutions to complex technology challenges for increasing the competitive advantage of Canadian industries in the sectors of renewable energy, hard rock mining, and environmental management.

A particular focus will be technologies for supporting the Government of Canada's priority for clean, sustainable sources of energy. For example, EME will advance biotechnology solutions for waste management and alternative sources of energy. It will also work with utilities, regulators, standards bodies, and industries towards advancing energy storage solutions that will accelerate the integration of renewable technologies in the electrical grid, gaining fuller benefits of smart-grid technology while enhancing a clean economy in which the Canadian renewable energy sector can thrive.

In further contribution to a cleaner economy, EME will apply its technical expertise with mining companies and environmental service providers to address water and waste treatment and to support improvements in mine tailing management and remediation while supporting the growth of the Canadian environmental management sector.

EME will also continue to respond to the needs of the mining industry to improve their operational efficiencies in order to increase their competitive advantage in the world market.

Sub-Program 1.1.5: Construction

Description

This sub-program provides technical knowledge and it advances product and process technologies to enhance the prosperity of the Canadian construction industry sector as it faces critical challenges in responding to expectations for better performing and more affordable buildings and infrastructure while striving to remain competitive in the global marketplace. The success of this sector is critical as a major contributor to Canada's GDP, employing millions of individuals, and managing assets valued in the trillions of dollars. Results are achieved through multi-disciplinary collaborative research and development and standardization services in addition to custom technical services -- such as testing, product and process validation, prototyping, and system integration in field and in specialized facilities -- for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
28,538,634	25,759,614	28,008,990

Human Resources (FTEs)

2016–17	2017–18	2018–19
178.3	156.4	161.7

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancements of process and product technologies for the construction industry sector	Client/stakeholder financial investment in technology development	$15.0M	March 2017
	Licensing and royalty revenue from NRC clients	$0.84M	March 2017

Planning Highlights

To facilitate commercialization of innovative building products, the sub-program will maintain responsibility for expert review of model building regulations and for providing technical evaluation services.

The sub-program will publish and deploy updated model building regulations, incorporating NRC-developed performance targets and benchmarks for innovative products and building components. Provinces and territories will be supported in their efforts to adopt and enforce these regulations. Builders and building product manufacturers will be supported in bringing increased energy efficiency and cost savings to the built environment. R&D activities planned for 2016-17 will respond to short-term industry demands for tools to address specific

opportunities including healthy indoor environments and the needs of Canada's aging population.

The sub-program will advance technologies that provide a competitive advantage across all segments of the Canadian construction industry. For example, work will continue with industry in validating the commercial feasibility of Canadian energy-saving technologies for buildings. Together, the targeted technologies are expected to ultimately permit buildings to produce more energy than consumed while opening global marketing opportunities for Canadian firms.

In contribution towards the Government of Canada's goal of rebuilding Canada for the 21st Century, the sub-program will provide leadership in developing and validating high-performance materials and structural systems that extend the service-life and performance of Canada's infrastructure while growing the supply chain of Canada's construction industry. These technologies will be complemented by assessment tools that determine remaining service-life and necessary maintenance of infrastructure.

Work will continue with industry and governments in realizing the benefits of recent changes to the National Building Code of Canada that permit wood construction in buildings of 5 or 6 stories, providing a new option for safe, affordable housing. The sub-program's leadership will help industry reduce the construction times and the environmental impacts of tall buildings while further increasing exports of Canadian forest products.

Sub-Program 1.1.6: Aquatic and Crop Resource Development

Description

In collaboration with industry, this sub-program develops improved varieties of crops and develops technologies for maximizing crop value and converting biomass to enhance the prosperity and global market share of the Canadian agriculture, bio-product, and natural health product industry sectors. This includes development and validation of value-added goods – from natural ingredients and health products through to chemicals and industrial oils and other products – for leveraging Canada's abundant aquatic and crop resources. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
41,574,725	28,732,432	29,500,685

Human Resources (FTEs)

2016–17	2017–18	2018–19
217.7	155.8	157.4

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancements in agricultural crops and related value-added products	Client/stakeholder financial investment in technology development	$5.5M	March 2017
	Licensing and royalty revenue from NRC clients	$0.40M	March 2017

Planning Highlights

Aquatic and Crop Resource Development (ACRD) will provide specialized technical services and equipment for Canada's agri-food, as well as food and consumer packaged goods sectors. ACRD will "bundle" high value platform technologies and facilities to create greater overall impact and benefit to clients.

ACRD will provide collaborative research expertise, technical services and infrastructure to develop new products and processes that create commercial opportunities for the Canadian bio-based specialty chemical industry. This will include producing alternatives to traditional chemical feedstock for products ranging from specialty personal care and cosmetics to food and nutritional ingredients, and household goods.

In support of the government's priority for clean sustainable technologies, ACRD will continue advancing the management of carbon dioxide emissions through algal carbon conversion. In 2016-17, it will collaborate with key partners, including industry, to deploy an Algal Carbon Conversion demonstration plant. The facility will use marine algae to convert carbon dioxide emissions into biomass that can in turn be converted to biofuel and other valuable end products. Successful deployment will propel Canada to a world-leading position in managing carbon emissions and resources, and help create and expand markets for Canadian photobioreactor producers. An increased focus will be directed to valorizing the algal biomass, including in the food and consumer packaged goods sector.

ACRD will continue to contribute to the Canadian Wheat Alliance (CWA) between NRC, Agriculture and Agri-Food Canada, the University of Saskatchewan and the Province of Saskatchewan with support from the Genomics R&D Initiative (GRDI). Together, the Alliance will improve the profitability of wheat to help bolster the Canadian economy and to improve the profitability of Canadian farmers. Fusarium head blight is a widespread fungal disease that significantly affects the quality of durum wheat and other grain crops, causing lower exports and revenues. The CWA will continue research to reduce wheat losses due to Fusarium as well as rust diseases, heat, drought and cold. Efforts will be made in 2016-17 to build further engagement with, and support from, the private sector for these research activities.

Sub-Program 1.1.7: Medical Devices

Description

This sub-program applies expertise in biochips, nano-materials, micro-devices, *in vitro* diagnostics, imaging, optical bio-photonics, medical simulation, and radio-frequency engineering and electronics to develop and advance technologies for enhancing the prosperity of the medical device industry as it strives to respond to increasing demands for equipment and supplies that are faster, more accurate, more informative, more affordable and less invasive. The industry is important for its growing contribution to Canada's GDP and its contribution to effective and efficient health care. Results are achieved through provision of industry-driven technical services and multi-disciplinary collaborative research.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
11,803,400	10,134,091	10,513,237

Human Resources (FTEs)

2016–17	2017–18	2018–19
67.0	53.7	54.6

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancements in medical devices for the marketplace	Client/stakeholder financial investment in technology development	$3.2M	March 2017
	Licensing and royalty revenue from NRC clients	$0.26M	March 2017

Planning Highlights

Health care cost, efficiency and effectiveness remain Canadian priorities as the needs and the longevity of the population increase. These priorities are driving the development of innovative technologies to ensure patient safety, shorten recovery time, and reduce costs while improving patient care both in health care facilities and at home.

In addition, rapid advances in instrumentation and communication technology and bio-combination, as well as competitive pressures to reduce time-to-market impact the Canadian industry, creating both opportunities and challenges. In response, the sub-program will provide technical services to support client-driven product developments that target reduced time-to-market and development costs, and mitigate technological risk. Medical Devices' (MDs) core offering will be further augmented by including certification and compliance support services;

thereby permitting NRC to provide industry comprehensive product development services currently not present in the Canadian landscape.

In 2016-17, the MD sub-program will continue to work with Canadian-based companies in the highly R&D intensive medical devices sector to develop cost-effective technologies that provide rapid, sensitive, accurate and globally competitive high-technology solutions in the fields of *in vitro* diagnostics, *in vivo* imaging, implantables for orthopedics, detection of pathogens, cardiac and dental markets as well as digital health and simulation.

With the assistance of the sub-program, several innovations in these areas are approaching market-readiness. Experts from MD will continue working with their industry clients towards this end. Resulting technologies are expected to be commercialized globally through Canadian companies, contributing to the growth of Canada’s medical device sector. The sub-program will work to attract multinational enterprises and investors to support Canadian innovation in the sector.

Sub-Program 1.1.8: Human Health Therapeutics

Description

In collaboration with industry, this sub-program develops vaccines and biologics for enhancing the prosperity of the Canadian bio-therapeutics industry, and to provide more effective treatments to Canadians. Activities include developing biologic materials for treating and preventing infectious and chronic diseases, and technologies to deliver therapeutics from circulation in the blood to the central nervous system. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
52,094,948	42,737,038	44,673,121

Human Resources (FTEs)

2016–17	2017–18	2018–19
299.4	228.9	233.5

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Improved and more affordable vaccines and biologics for the marketplace	Client/stakeholder financial investment in technology development	$15.7M	March 2017
	Licensing and royalty revenue from NRC clients	$2.9M	March 2017

Planning Highlights

New medicines and vaccines help advance Canada’s technology-driven economy while also helping people recover faster, avoid illness, and stay healthy. This ultimately generates measurable healthcare savings by keeping people out of hospitals and avoiding costly, often invasive procedures. Developing new drugs is a long, complex and expensive process, involving a series of research stages and regulatory approvals, which on average takes 10 - 15 years from discovery to approval for marketing. Canada’s pharmaceutical industry, which supports 34,000 high-quality well-paying jobs in Canada, has an economic impact of more than $3B a year on our economy. Human Health Therapeutics (HHT) supports this process at various levels. HHT has a proven track record of enabling its industry clients and collaborators to advance their innovative therapeutic candidates along the arduous path to regulatory approval and, ultimately, to market.

With expertise and infrastructure in antibody generation, molecular modeling, cell culture optimization, *in vitro* and *in vivo* activity assays and bioprocessing, HHT will continue advancing a rich pipeline of prospective drug candidates of its industry clients, particularly in the areas of biologics (which increasingly dominate market share). Current candidates include therapeutics for diseases of the central nervous system, and vaccines against cancer where modern medicines have yet to penetrate.

By transferring know-how and novel vaccine technologies to Canadian industry, HHT will help foster a strong manufacturing sector in Canada that is recognized for its high-quality manufacturing practices.

Sub-Program 1.1.9: Information and Communication Technologies

Description

In support of Canada's digital economy, this sub-program applies leading-edge expertise in software development, semiconducting materials and photonic device design and fabrication to design, validate, demonstrate and deliver both physical and software solutions that lead to new market opportunities for industries in Canada's Information and Communication Technology (ICT) sector that seek to profit from an explosive growth of data and from escalating needs for greater connectivity and for revolutionary ways to use computers to make decisions, synthesize information, and discover new knowledge. This is important for increasing Canada's global share of the growing ICT market. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services in state-of-the-art facilities for transferring or advancing technologies into deployed solutions and improved practices for the marketplace. This includes custom manufacturing of novel components for innovative photonic, electronic, and opto-electronic devices.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
42,133,168	34,712,454	36,749,944

Human Resources (FTEs)

2016–17	2017–18	2018–19
217.2	162.7	167.0

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancements of process and product technologies for the information and communications technology sectors	Client/stakeholder financial investment in technology development	$11.0M	March 2017
	Licensing and royalty revenue from NRC clients	$0.40M	March 2017

Planning Highlights

In 2016-17, the sub-program will continue to apply its expertise and advanced laboratory and fabricating capabilities to advance technologies for the prosperity of Canada’s ICT sector.

The sub-program will conduct leading-edge R&D with commercial partners on advanced optical communications. This will include, for example, next generation optical communication components to enable the Canadian photonics sector to increase fibre optic communication network capacity, advancing the sector’s product offerings in the global economy. To further

leverage its reach and expertise, the sub-program will work to increase existing client engagement in advanced photonics development and to develop partnerships with other global leaders in photonics R&D.

The sub-program will also perform leading R&D in collaboration with commercial partners in next-generation machine vision for a wide range of applications; e.g., imaging systems and software.

Ground-breaking R&D with commercial partners will continue in Printable Electronics (PE) to advance NRC's long-term goal of positioning the packaging, commercial and security printing industries to be early adopters of innovative PE solutions. An emerging field, PE involves several industries (e.g. ICT, materials, digital manufacturing, and printing) presenting a transformative opportunity to add intelligence to everyday objects, powering the "Internet of Things." In 2016-17, the focus will be on further developing conductive inks with the industry leaders comprising the PE Consortium while licensing technologies to companies in the ecosystem.

The sub-program will collaborate with the security industry to develop software-based, multimedia analytic tools that will enable users to find information quickly and more efficiently. It will participate in projects to develop advanced tools allowing end-users in the security sector to analyze multilingual texts to monitor risks to Canada and public perceptions of those risks. Opportunities for commercializing the developed technologies will be exploited.

The sub-program will support skills development and the reduction of labour shortages through personalized training and enhanced access to learning resources. It will engage with commercial partners in e-learning and with end-users in industry (e.g. oil and gas and defence) to develop prototypes and to increase access to training and professional development.

Sub-Program 1.1.10: Security and Disruptive Technologies

Description

This sub-program builds and validates emerging technology platforms (such as nanotechnology, quantum technologies and the convergence of nano-, bio- and information technologies) that can be applied in a range of industries to sustain Canada's industrial competitiveness by opening new markets and value networks for Canadian industries in tomorrow's economy. Efforts focus on applications for addressing national security challenges because security and defence innovation players are amongst the earliest adopters of such technologies from which broader commercial adaptations ultimately evolve, replacing existing technologies. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services in state-of-the-art facilities for ultimately introducing disruptive and transformational technology solutions into practice and the marketplace.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
42,965,743	29,171,779	21,737,766

Human Resources (FTEs)

2016–17	2017–18	2018–19
159.2	121.8	123.2

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Advancement of process and product technologies in security and other industry sectors	Client/stakeholder financial investment in technology development	$2.9M	March 2017
	Licensing and royalty revenue from NRC clients	$0.16M	March 2017

Planning Highlights

Security and Disruptive Technologies (SDT) will remain committed to engaging players across the innovation system to build emerging technology platforms by validating and de-risking technologies through leading edge, use-inspired R&D.

In 2016-17, SDT will collaborate with industry, Other Government Departments (OGDs), universities and research centres to develop and advance technology for critical components required for next-generation quantum technologies. It will leverage its unique position in the Canadian photonics value chain and provide Canadian industry access to the major research infrastructure and expertise needed to effectively de-risk new quantum technologies for advanced sensing and ultra-secure communications. This work will increase long-term

competitiveness in the Canadian photonics industry and lead to novel communication and measurement solutions for a numbers of sectors, including ICT, energy and environment, and security and defense. SDT will continue to develop photonic sensors for extreme environments.

SDT will work to serve innovators as a "one-stop-shop" for nano-materials solutions for security materials technology. It will contribute to developing and delivering cost-effective, highly efficient, next-generation, nano-materials and armour systems, including testing and performance evaluation. In 2016-17, SDT will collaborate with Defence Research and Development Canada and industry partners to develop targeted applications focused on improving the performance-to-weight ratio for armoured vehicles and personal protective equipment. Opportunities for exploiting the resulting technologies on the global market will be explored with Canadian companies.

The sub-program will engage researchers and entrepreneurs on nano-enabled technologies to understand evolving industry needs and support the scaling up of manufacturing processes. It will work with industry, academic and provincial organizations to enhance insights and facilitate access to global market opportunities for nanotechnologies, understand evolving industry needs and support multidisciplinary collaboration. In 2016-17, the focus will be on developing new approaches for industry-university-federal laboratory partnerships for nanotechnologies.

Program 1.2: Industrial Research Assistance Program

Description

The program contributes to the growth and prosperity of Canadian small and medium sized enterprises (SMEs) by stimulating innovation, adoption and/or commercialization of technology-based products, services, or processes in Canada. This is done through: 1) technical and related business advice and networking facilitated by a cross-Canada network of field professional staff; 2) cost-shared merit-based contributions; and 3) contributions supporting employment of post-secondary graduates. This program uses funding from the following transfer payments: Contributions to Firms; Contributions to Organizations; Youth Employment Program (YEP); and Contributions to Canadian HIV Technology Program (CHTD), Business Innovation Access Program (BIAP) and Canada Accelerator and Incubator Program (CAIP).

Budgetary Financial Resources (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
269,541,644	269,541,644	269,658,433	262,558,251

Human Resources (Full-Time Equivalents [FTEs])

2016–17	2017–18	2018–19
410.0	410.0	400.0

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Innovative businesses grow in Canada	SME jobs supported	7,300	March 2017
	SME served	1,500	March 2017
	SME client feedback[8] on growth	In development	March 2017

Planning Highlights

In 2016-17, NRC will assist SMEs through contributions of non-repayable funding for cost-shared innovative projects based on merit. Experts at Industrial Research Assistance Program (IRAP) will continue to provide SMEs with technology and business advice without charge and will connect them with partner organizations that can provide further assistance such as financing, research and development, intellectual property, and technology transfer.

[8] This is the percentage of surveyed IRAP clients funded through Contribution to Firms transfer payment program and who reported having experienced growth in terms of: 1) employees or; 2) revenue from goods and services or; 3) net operating profit. Data is compiled from an on-line survey completed by firms 6 months following their fiscal year end. The survey is administered for 5 years following project completion, therefore some time is required to develop a baseline against which a target can be based. Pending development of the performance target, IRAP will be aiming for client growth (revenue, jobs) exceeding that of a comparable non-client control group.

IRAP will further support job creation in Canadian SMEs by supporting the placement of graduates in SMEs through Employment and Social Development Canada's Youth Employment Strategy (YES).

It will pursue the delivery of the Canadian International Innovation Program (CIIP) in partnership with Global Affairs Canada (GAC) to foster and support collaborative industrial research and development projects with high potential for commercialization between Canada and partner countries.

IRAP's Concierge Service will continue to provide a single access point where innovative Canadian SMEs can access information on funding, expertise, facilities and equipment to help them grow through innovation.

IRAP's Canada Accelerator and Incubator Program (CAIP) will advance efforts to establish a critical mass of outstanding business incubators and accelerators that can develop innovative, high-growth firms representing superior early-stage investment opportunities.

IRAP's performance targets reflect the sun-setting of BIAP and of CHTD in 2015-16. IRAP will continue to provide support to innovative SMEs in the development of technologies up to their commercialization. For example, it will increase its activities with other government departments and agencies to support the delivery of grants and contributions (i.e., Public Works and Government Services Canada-Office of Small and Medium Enterprise-Build in Canada Innovation Program, Global Affairs Canada-Canadian International Innovation Program, Western Diversification-Western Innovation Initiative, and Atlantic Canada Opportunities Agency).

Strategic Outcome 2: R&D infrastructure for an innovative and knowledge-based economy

Program 2.1: Science Infrastructure and Measurement

Description

This program manages national science facilities and infrastructure critical to research, development and innovation by Canadian scientific and technological communities. This includes operating and administering Canada's astronomical observatories. It also fosters development and maintenance of Canada's metrological infrastructure system that provides industries and researchers access to reliable measurements that are traceable to recognized national standards maintained by the program. The program helps clients make the most of this infrastructure by facilitating access to a wide range of Canadian and international user communities and by participating in networks. In addition, the program provides stewardship of the TRIUMF sub-atomic research facility. This program uses funding from the following transfer payment: TRIUMF (Canada's National Laboratory for Particle and Nuclear Physics).

Budgetary Financial Resources[9] (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
167,739,242	168,670,448	156,197,901	161,855,615

Human Resources[8] (Full-Time Equivalents [FTEs])

2016–17	2017–18	2018–19
278.4	281.9	285.4

Performance Measurement[10]

Expected Results	Performance Indicator	Targets	Date to Be Achieved
National science infrastructure and measurement standards services are valued by user communities	Client/user satisfaction	85%	March 2017

Planning Highlights

Science Infrastructure and Measurement (SI&M) will manage national science infrastructure and scientific services to support Canadian excellence in R&D. The Program will manage infrastructure underpinning measurements that are critical to enabling trade in the global economy. It will continue working with academic, industrial and government partners to ensure

[9] Spending and FTEs for the Vice President Office (Emerging Technologies) were excluded from sub-program totals.

[10] Does not include TRIUMF.

that national S&T facilities are managed effectively and efficiently, and remain accessible to Canadians in accordance with NRC's assigned mandate and evolving national needs. In addition, the Program will leverage its infrastructure to provide Canadians access to critical international R&D facilities, user communities, and networks including leading-edge observatories and one of the world's largest accessible collections of astronomical data.

SI&M will provide comprehensive support to the users of Canada's astronomical observatories and will participate in designing and building instruments that enable the astronomers to perform research at the highest level of international science.

Sub-Program 2.1.1: National Science Infrastructure

Description

This sub-program manages Canada's astronomical observatories as mandated in the National Research Council Act, and it compiles and disseminates astronomical data while leveraging access to international observatories for Canadian researchers in astrophysics. This sub-program uses funding from the following transfer payment: Contributions to the International Astronomical Observatories Program.

Budgetary Financial Resources (dollars)[11]

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
143,225,497	129,717,593	134,374,520

Human Resources (FTEs)

2016–17	2017–18	2018–19
114.3	115.6	116.8

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Canadian scientists have access to astronomical observatories and data	User access and downloads of astronomy data	4000	March 2017
	Scientific publications by telescope users	490	March 2017

Planning Highlights

In 2016-17, the National Science Infrastructure (NSI) sub-program will remain committed to maintaining access to world-class observatories for Canadian astronomers. NSI will apply its expertise to developing innovative scientific instruments useful for such telescopes as the Gemini Observatory and the Canada-France-Hawaii-Telescope. Through active contribution to these internationally-operated telescopes, NSI will continue to secure access for Canadian astronomers.

In 2016-17, NSI will continue to collaborate with industry in designing and fabricating innovative instruments and related observatory infrastructure for operating telescopes. This will include investigating new adaptive optics components, algorithms and system concepts for next-generation instruments that will provide clearer and more distant images.

[11] Includes planned spending for TRIUMF. The planning highlights associated with TRIUMF can be found in the Supplementary information tables listed in the 2016–17 Report on Plans and Priorities on [xii†] NRC's website.

NSI will continue to further Canada's interests in the Thirty Metre Telescope (TMT), an international partnership joined by Canada in 2015. In addition, NSI will continue to operate the Canadian Astronomy Data Centre (CADC), which enables advanced data processing and data mining capabilities as the astronomy community deals with increasingly large data sets.

NSI will also continue to provide radio astronomers access to and support for NRC's Dominion Radio Astrophysical Observatory as well as to the Atacama Large Millimetre/submillimetre Array (ALMA) observatory. NRC will also continue to participate in the pre-construction detailed design phase of the Square Kilometer Array (SKA) telescope, a global project planned for construction after 2018. This will help gain access for Canadian astronomers to what promises to become the most powerful telescope in the world.

Sub-Program 2.1.2: Measurement Science and Standards

Description

As mandated under the National Research Council Act and also the Weights and Measures Act, this sub-program investigates and determines standards and methods of measurement for Canada's national measurement system. This national metrological system is critical for underpinning trade and commerce in the global economy. The sub-program supports international metrological treaties and arrangements to establish and maintain foreign recognition and acceptance of Canada's standards and measures that are critical for participation in multi-lateral and free-trade agreements. The sub-program provides a wide variety of calibration and measurement services that underpin the accuracy of millions of measurements conducted annually in public and private sector testing and calibration laboratories. In addition, the sub-program provides expert assessments and formal recognition of the measurement capabilities of industrial calibration laboratories. This is important for providing Canada's trading partners confidence in the reliability of Canadian industries' measurements and test certifications of compliance to regulatory and product standards that govern trade. The sub-program also develops measurement standards for emerging technologies that open new global market opportunities for Canadian industries.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
25,444,951	26,480,308	27,481,095

Human Resources (FTEs)

2016–17	2017–18	2018–19
164.1	166.3	168.6

Performance Measurement

Expected Results	Performance Indicators	Targets	Date to Be Achieved
Internationally-recognized national system of measurement that meets Canada's evolving needs.	MSS clients served	725	March 2017
	Calibration and measurement capabilities recognized internationally[12]	600	March 2017
	Scientific and other publications in metrology	1500	March 2017

[12] The number of calibration and measurement capabilities recognized internationally during the reporting period, measured by the number of approved calibration and measurement capabilities of this Sub-Program as published in the Key Comparisons Database of the Bureau international des poids et mesures.

Planning Highlights

In 2016-17, Measurement Science and Standards (MSS) will focus on areas of national metrological infrastructure that provide the evidentiary basis for standardization, reliable testing and production methodologies, as well as internationally recognized certification and accreditation schemes.

To support the productivity (particularly efficiency, quality, safety) of clients in target sectors (e.g. energy, health, and industrial processing), MSS will continue to provide metrology services that aim to ensure Canadian companies better meet supply chain requirements and are well-positioned to meet global market access requirements. This will include developing standards and calibration services that better meet the needs of low dose radiation therapy end-users.

To respond to food safety needs, MSS will begin developing novel biotoxin certified reference materials for use in improved food safety tests.

To facilitate Canada's entry into global markets for new technologies, MSS will develop measurement standards for emerging areas such as environmental and nano-technologies. It will continue work with international peers to evaluate methods to assess the purity and other key measurements of nanomaterials including the characterization of their surface properties.

MSS will provide scientific advice to inform national decision-making for commerce, standards development, regulations and trade agreements. It will also strengthen relationships with Canadian stakeholders, assimilate market insights and policy intelligence and participate in domestic and international fora.

Internal Services

Description

Internal Services are groups of related activities and resources that are administered to support the needs of programs and other corporate obligations of an organization. Internal services include only those activities and resources that apply across an organization, and not those provided to a specific program. The groups of activities 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; Material Services; and Acquisition Services.

Budgetary Financial Resources (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
234,199,645	234,199,645	206,802,896	202,304,661

Human Resources (FTEs)

2016–17	2017–18	2018–19
972.3	972.3	972.3

Planning Highlights

NRC will remain committed to improving the client-focus of its internal services, decreasing administrative burden and costs. Toward this objective, NRC will continue building a **new service delivery model** for financial operations and reporting, procurement, information management and technology, building operations, real property, security, and design and fabrication. The new model will facilitate client self-service, supported by simplified, optimized and integrated end-to-end processes leveraged by technology and automation.

Complementing these advancements, NRC will continue migrating its corporate and R&D applications and services into the **information technology** environment managed by Shared Services Canada, ensuring a robust and secure foundation for NRC business. NRC will continue to structure its information management practices and activities to optimize the balance between access and protection of proprietary information, all within the broader context of federal access and privacy laws, and the Government of Canada information management framework.

Supported by these systems, NRC will remain committed to **strong management and oversight** to ensure the on-going market-relevance, performance, and impact of its research and technical initiatives. For example, in-depth reviews of each research and technical initiative will continue on a rolling 3-year cycle in addition to ongoing management oversight and regular quarterly management reviews. The resulting information from these formal reviews will continue to inform executive decisions on future R&D investments and direction.

To remain responsive and relevant to its industry clients, NRC will continue to enhance its **Client Relationship Management** system as its centralized tool for managing the sales pipeline,

opportunities in various phases, customer and account information, sales cycle and signed agreements. As the system continues to evolve and mature, it will become important for extracting business intelligence, which will be vital in devising sales, account and go-to-market strategies.

NRC will celebrate its centennial in 2016. Internal and external **communications** will showcase the technology solutions that NRC has delivered over the last century, linking them with the organization's ability to anticipate national needs and to renew itself continually to serve Canada within an evolving science and technology landscape. These celebrations will support on-going communications that increase awareness of NRC and its business offerings in the marketplace. Internal communications efforts will inform and enhance the employee experience within a supportive and engaging workplace.

Likewise, in **human resource (HR) management**, NRC will continue to implement its new Talent Attraction and Acquisition strategy, for which the ground work was laid in 2015-16. As a result, NRC will benefit from a modern hiring function using new technologies, relevant and proactive sourcing approaches, efficient and flexible hiring practices, enhanced candidate care and enriched hiring manager and HR roles for excellence in recruiting. To further equip current staff to meet business goals and to attract and retain top talent, NRC will develop a framework for learning and development (L&D). This will include a clear learning governance model, plans for delivering effective enterprise-wide L&D solutions, supportive technology solutions, and a focused approach to leadership development.

Section III: Supplementary Information

Future-Oriented Condensed Statement of Operations

The future-oriented condensed statement of operations provides a general overview of the 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 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 Report on Plans and Priorities are prepared on an expenditure basis, amounts differ.

A more detailed future-oriented statement of operations and associated notes, including a reconciliation of the net cost of operations to the requested authorities, can be found on [xi†] NRC's website.

Future-Oriented Condensed Statement of Operations
For the Year Ended March 31, 2016
(dollars)

Financial Information	2015-16 Forecast Results	2016-17 Planned Results	Difference (2016-17 Planned Results minus 2015-16 Forecast Results)
Total expenses	1,018,352,000	1,023,517,000	5,165,000
Total revenues	158,098,000	177,725,000	19,627,000
Net cost of operations	860,254,000	845,792,000	(14,462,000)

NRC's 2016-17 planned expenses reflect changes in planned grants and contribution expenses, salaries and benefits, an increased spending of externally generated revenue. NRC's 2015-16 estimated expenses include one-time project expenditures of $10M relating to the implementation of the Business Continuity and Secure NRC project. NRC's focus on increasing its external revenue generating activities to strengthen its future financial sustainability has resulted in an increase in planned revenue spending of $177.7M in 2016-17 from $158.1M in 2015-16.

Supplementary Information Tables

The supplementary information tables listed in the *2016–17 Report on Plans and Priorities* can be found on [xii†] NRC's website.

- Departmental Sustainable Development Strategy;
- Details on Transfer Payment Programs of $5 Million or more;
- Disclosure of Transfer Payment Programs under $5 Million;
- Horizontal Initiatives;
- Upcoming Internal Audits and Evaluations over the Next Three Fiscal Years.

Tax Expenditures and Evaluations

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 annually in the [xiii†] *Tax Expenditures and Evaluations* publication. The tax measures presented in the *Tax Expenditures and Evaluations* publication are the responsibility of the Minister of Finance.

Section IV: Organizational Contact Information

National Research Council of 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)
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Appendix: Definitions

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

budgetary expenditures: Include operating and capital expenditures; transfer payments to other levels of government, organizations or individuals; and payments to Crown corporations.

Departmental Performance Report: Reports on an appropriated organization's actual accomplishments against the plans, priorities and expected results set out in the corresponding Reports on Plans and Priorities. These reports are tabled in Parliament in the fall.

full-time equivalent: Is 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.

Government of Canada outcomes: A set of 16 high-level objectives defined for the government as a whole, grouped in four spending areas: economic affairs, social affairs, international affairs and government affairs.

Management, Resources and Results Structure: A comprehensive framework that consists of an organization's inventory of programs, resources, results, performance indicators and governance information. Programs and results are depicted in their hierarchical relationship to each other and to the Strategic Outcome(s) to which they contribute. The Management, Resources and Results Structure is developed from the Program Alignment Architecture.

non-budgetary expenditures: Include net outlays and receipts related to loans, investments and advances, which change the composition of the financial assets of the Government of Canada.

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

planned spending: For Reports on Plans and Priorities (RPPs) and Departmental Performance Reports (DPRs), planned spending refers to those amounts that receive Treasury Board approval by February 1. Therefore, planned spending may include amounts incremental to planned expenditures 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 RPPs and DPRs.

plans: 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.

priorities: Plans or projects 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 Strategic Outcome(s).

program: A group of related resource inputs and activities that are managed to meet specific needs and to achieve intended results and that are treated as a budgetary unit.

Program Alignment Architecture: A structured inventory of an organization's programs depicting the hierarchical relationship between programs and the Strategic Outcome(s) to which they contribute.

Report on Plans and Priorities: Provides information on the plans and expected performance of appropriated organizations over a three-year period. These reports are tabled in Parliament each spring.

results: 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: 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.

Strategic Outcome: A long-term and enduring benefit to Canadians that is linked to the organization's mandate, vision and core functions.

sunset program: A time-limited program that does not have an ongoing funding and policy authority. When the program is set to expire, a decision must be made whether to continue the program. In the case of a renewal, the decision specifies the scope, funding level and duration.

target: A measurable performance or success level that an organization, program or initiative plans to achieve within a specified time period. Targets can be either quantitative or qualitative.

voted Expenditures: Expenditures that Parliament approves annually through an Appropriation Act. The Vote wording becomes the governing conditions under which these expenditures may be made.

whole-of-government framework: Maps the financial contributions of federal organizations receiving appropriations by aligning their Programs to a set of 16 government-wide, high-level outcome areas, grouped under four spending areas.

Endnotes

i Ministerial Mandate Letters, http://pm.gc.ca/eng/ministerial-mandate-letters

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

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

iv Minister of Small Business and Tourism Mandate Letter, http://pm.gc.ca/eng/minister-small-business-and-tourism-mandate-letter

v Justice Laws, http://laws.justice.gc.ca/eng/N-15/index.html

vi. EUREKA network, http://www.eurekanetwork.org

vii. Prime Minister of Canada's website, http://pm.gc.ca/eng/ministerial-mandate-letters

viii. Innoventures Canada, http://www.i-can.ca/eng/index.html

ix. Whole-of-Government Framework, http://www.tbs-sct.gc.ca/ppg-cpr/frame-cadre-eng.aspx

x. 2015–16 Main Estimates, http://www.tbs-sct.gc.ca/ems-sgd/esp-pbc/me-bpd-eng.asp

xi National Research Council Canada, http://nrc-cnrc-dev.proteus.cisti.nrc.ca/eng/reports/2016_2017/rpp_2016_2017/supplementary.html

xii National Research Council Canada, http://nrc-cnrc-dev.proteus.cisti.nrc.ca/eng/reports/2016_2017/rpp_2016_2017/rpp_table_index.html

xiii. Tax Expenditures and Evaluations publication, http://www.fin.gc.ca/purl/taxexp-eng.asp