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# National Research Council Canada

## 2012-13

### Report on Plans and Priorities (RPP)

The Honourable Christian Paradis
Minister of Industry and Minister of State (Agriculture)

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# Minister of Industry's Message

Over the past year, the Canadian economy has proven to be resilient despite continued fiscal uncertainty in other parts of the world. Since our government introduced Canada's Economic Action Plan in 2009 to respond to the global recession, Canada has recovered not only all of the jobs lost during the recession but also all of our economic output.

As Minister of Industry, I am confident that the Industry Portfolio will play a key role in our government's plan to strengthen Canada's knowledge-based economy. Our efforts will focus on promoting innovation and modernizing Canada's marketplace policies, among other areas.

In 2012–13, the mandate and work of National Research Council Canada (NRC) will undergo a transformation. As a result, NRC will focus on business-led, industry-relevant research, driving increased productivity as well as sustainable economic growth and job creation. NRC will maintain its critical role in stimulating Canadian innovation and promoting the development of small and medium-sized businesses. It will achieve this by supporting clients and industry partners in commercializing technologies in areas of national importance, such as health care, climate change and natural resources.

A significant part of the Industry Portfolio's activities will involve developing Canada's digital economy by updating copyright and privacy laws and building a world-class digital infrastructure for next-generation wireless technologies and services. We will also put in place conditions that allow small businesses to grow and create jobs. This will mean reducing red tape, improving access to credit and focusing programs to promote more effective research and development.

Since coming to office, our government has made science and innovation a priority. We will leverage our past investments and continue to develop and recruit world-leading research talent. We will also take measures to encourage the private sector to increase research and development investments and improve commercialization outcomes.

In our government's pursuit to improve the well-being of Canadians, we will continue to work to secure the recovery, eliminate the deficit and invest in the drivers of long-term economic growth. We will also implement our plan to find savings in government expenditures to return to fiscal balance in the medium term.

This year's Report on Plans and Priorities for NRC delivers a comprehensive approach to promote and maintain Canada's strong and competitive economy. I look forward to working with my Cabinet and departmental colleagues, as well as with the private sector and other levels of government, to achieve our common goal of creating jobs and growth for all Canadians.

Christian Paradis
Minister of Industry and Minister of State (Agriculture)

# Minister of State's Message

As the Minister of State for Science and Technology, I am pleased to present the 2012–13 Report on Plans and Priorities for National Research Council Canada (NRC).

This year promises to be noteworthy, not only for Canada but also for the world. As economies across the globe begin to emerge from challenging economic times, Canada continues to thrive. Our financial system is strong, our economy has recovered all of the jobs and economic output lost during the recession, and our government has a low-tax plan that will continue to create jobs, economic growth and long-term prosperity across the country.

Our government recognizes the vital role that science and technology play in Canada's continued economic leadership. In this globalized and connected digital world, innovation will be the driver of economic growth. We understand this, and we are committed to supporting Canadian research and development (R&D) in both public and private sectors.

This year will see our government take specific actions to improve Canada's performance with respect to private sector R&D, following last year's report from the expert panel charged with the review of federal support for R&D. These actions will build on our investments to date and will seek to promote commercialization and the development of new products and services for Canadians.

Throughout its almost 100-year history, NRC has made significant contributions to the advancement of scientific knowledge and has been a key driver of Canada's leadership in research and innovation. In 2012–13, NRC will work to build on its past successes by increasing its focus on connecting ideas to the needs and opportunities present in the Canadian economy. With a more customer-focused business model and more business-like operations, NRC will be in a better position to help industry create the high-value jobs that Canadians want and that the economy needs. This will drive innovation, improve Canadian productivity and create economic growth for many years.

Canadians can and should be proud. Our government recognizes that we cannot take our success for granted. We must build on our past accomplishments in order to continue to grow, create jobs and lead the world for years to come. We are committed to achieving this, and it will be driven in no small part by science, research and innovation.

As we move into 2012–13, I will continue to work with our academic partners, the private sector and all Canadians to achieve the priorities laid out in this report.

Gary Goodyear
Minister of State (Science and Technology) (Federal Economic Development Agency for Southern Ontario)

# President's Message

The federal government is committed to optimizing results from its investments in science and technology to build a competitive, productive and growing economy for Canada. As Canada's national research and technology organization, the National Research Council is aligned with this commitment, having plans and priorities that focus on generating impacts for industry by increasing business enterprise expenditures on R&D, enhancing business productivity, and technology commercialization and job creation.

Mr. John McDougall, President

In 2012-13, we will focus our attention on changing our business model to be more market-driven, strengthen our approach to client relationship management and develop stronger collaborations with industry. Coupled with our contributions to industrial and innovation networks to accelerate technology commercialization, NRC will be well positioned to address the biggest innovation challenges in areas such as healthcare, the environment, energy, and information and communication technologies. Our focus: creating benefits for Canada.

NRC is proud to support Canada's Digital Economy through the NRC-IRAP implementation of a new Digital Technologies Adoption Pilot Program (DTAPP), on behalf of Industry Canada. Through DTAPP, small and medium enterprises (SMEs) will have access to an extensive network of innovation players, internationally recognized advisory services and funding sources to accelerate their adoption of digital technologies.

It is with pleasure that I present the NRC 2012-13 Report on Plans and Priorities. This will be an exciting year as we work to stimulate Canada's socio-economic prosperity.

# Section I – Organizational Overview

## Raison d'être

The National Research Council Canada (NRC) bridges the innovation gap between early stage research and development (R&D) and commercialization, focusing on socio-economic benefits for Canadians and increasing national performance in innovation. As Canada's national research and technology organization (RTO), NRC supports the business sector in Canada to enhance innovation capabilities and capacity and become more productive in the development and deployment of innovative products, processes and services for targeted markets. With a presence in every province, NRC combines a strong national foundation with international linkages to help Canada grow in productivity and remain globally competitive. To ensure a multi-disciplinary and integrated approach, NRC works in collaboration with industry, governments, and academia.

## Responsibilities

NRC is a departmental corporation of the Government of Canada, reporting to Parliament through the Minister of Industry. NRC works in partnership with members of the Industry Portfolio to leverage complementary resources to promote the innovation of firms, to exploit synergies in key areas of science and technology (S&T), to promote the growth of SMEs, and to contribute to the economic growth of Canadian communities. The government-appointed members of the NRC Council provide independent strategic direction and advice to the President and review organizational performance. The President provides leadership and strategic management and is responsible for the achievement of NRC's long-range goals and plans with the guidance of the NRC Council. Seven members of NRC's senior management team are responsible for activities comprised of research programs, initiatives and/or corporate services. Vice Presidents and NRC managers are responsible for executing against plans and priorities to ensure successful achievement of objectives for program activities.

**NRC MANDATE**

Under the [1] *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 and 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.

NRC is in the midst of transitioning to a new strategy that forms the basis of plans and priorities for 2012-13. These priorities will focus on the way NRC determines and conducts its business, placing emphasis on changing business models and client relationship management to be more market-driven and more in tune with the needs of industry. NRC's strategic intent is founded upon a vision and mission designed to support federal S&T priorities.

**NRC VISION**

To be the most effective research and technology organization in the world, stimulating sustainable domestic prosperity.

**NRC MISSION**

Working with clients and partners, we provide strategic research, scientific and technical services to develop and deploy solutions to meet Canada's current and future industrial and societal needs.

NRC's success will be demonstrated by the extent to which it is helping to build a globally competitive and prosperous Canada. NRC plans and priorities intend to generate long-term value in areas of importance to Canada by contributing to the following impact areas for its clients:

- Increased business enterprise expenditures on R&D;
- Enhanced productivity;
- Technology commercialization; and
- Job creation.

## Strategic Outcomes and Program Activity Architecture (PAA)

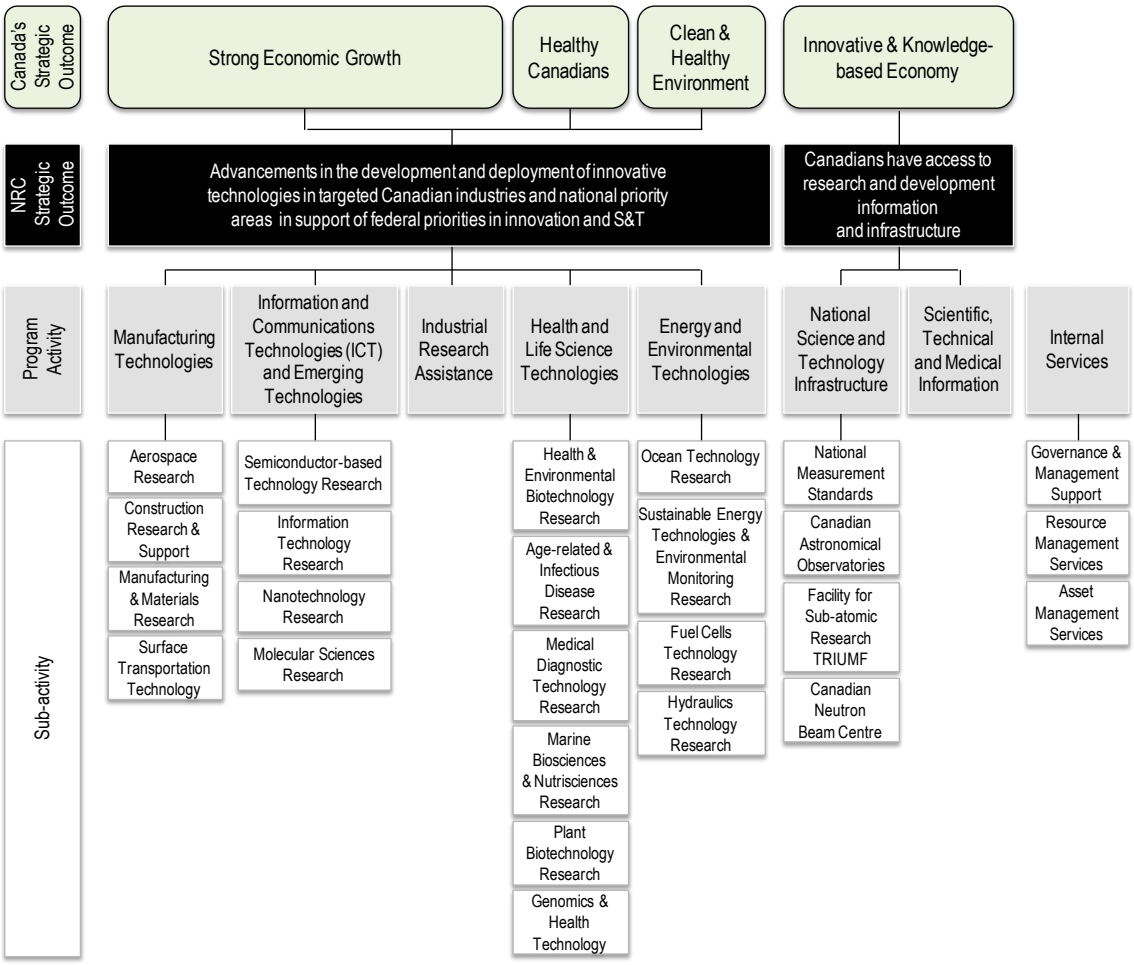
To fulfill its mandate, NRC programs are focused to achieve two Strategic Outcomes:

SO1: Advancements in the development and deployment of innovative technologies in targeted Canadian industries and national priority areas in support of federal priorities in innovation and science and technology.

SO2: Canadians have access to research and development information and infrastructure.

NRC's program activities directly support these strategic outcomes. NRC's current PAA, shown below, illustrates how activities are organized to achieve these desired results.

NRC's current PAA has been crosswalked to the new NRC strategy and is aligned with Government of Canada's Strategic Outcomes and federal priorities. As NRC's new strategy is implemented, the NRC PAA will be reviewed, and amended as necessary, to ensure continued alignment and contribution towards Canada's Strategic Outcomes.




## Organizational Priorities

Through [2] Canada's S&T Strategy, *Mobilizing Science and Technology to Canada's Advantage,* the Government of Canada (GoC) identified an overarching goal of creating an innovation-driven environment that allows Canadian businesses and researchers to succeed in globalized markets. Canada is committed to impacting four S&T priority areas: Environmental Science and Technologies; Natural Resources and Energy; Health and Related Life Sciences and Technologies; and Information and Communications Technologies (ICT). Enhanced Canadian innovation, with the goal of becoming a top global innovation producer, is of great importance to the GoC. This requires coordinated and collaborative efforts from all levels of government, private industry, academia and not-for-profits to overcome gaps and eliminate barriers in the innovation system. NRC plays a crucial role in these concerted initiatives by developing and deploying technology in S&T priority areas, by helping industry grow its competitive edge in the world market, and by addressing challenges in substantial national issues. In 2012-13, NRC will focus its plans and priorities on building upon Canadian successes and capacities in areas where it can make a difference.

| Priority 1 | Type | Strategic Outcome(s) |
|---|---|---|
| Cultivate business innovation to increase the productivity of Canada's industrial sectors and to support the economic growth and development of communities across Canada. | Ongoing | SO1 |

**Description**

### Why is this a priority?

- Canada's global competitiveness is currently lagging relative to established and emerging competitor nations, creating a challenge for long-term, sustainable productivity and prosperity.
- In its 2011 analysis of global competitiveness, the World Economic Forum ranked Canada 12th out of 142 nations, down from a ranking of 10 in 2010.[1]
- Canadian businesses that focus on R&D and technological achievement create high-quality, knowledge-intensive jobs.

### Plans for meeting the priority

- NRC will provide targeted R&D support and technical services to high-impact Canadian industry including the ICT, automotive, aerospace and construction sectors. In addition, NRC will continue advancing emerging technologies of increasing prominence in Canada and globally, such as green technologies for the manufacturing sector, smart buildings, and nanotechnology applications.
- NRC has developed a stream of focused, national-scale research initiatives that will have sufficient critical mass to deliver high impacts for Canada and demonstrate the capacity of NRC to make a real, measurable difference to domestic prosperity. Four such initiatives will become operational in 2012-13: Printable Electronics, Canadian Wheat Improvement, Industrial Biomaterials and Algal Carbon Conversion.
- NRC's Industrial Research Assistance Program (NRC-IRAP) will continue to help commercialization of technologies by Canadian SMEs through the provision of advisory and funding support. One initiative of priority is DTAPP which will accelerate the adoption of digital technologies by SMEs.
- NRC will continue to support industry and innovation capacity built through its activities with a focus on facilitating networks between and among industry and innovation players, like universities and other government departments, to accelerate the commercialization of products and processes in key technology areas such as medical devices and photonics.

[1] The Global Competitiveness Report 2011-2012 http://reports.weforum.org/global-competitiveness-2011-2012/

| Priority 2 | Type | Strategic Outcome(s) |
|---|---|---|
| Enhance the generation and commercialization of knowledge in Canada by providing integrated scientific support and infrastructure. | Ongoing | SO2 |

**Description**

### Why is this a priority?

- NRC has a uniquely integrated, multidisciplinary approach, with identified opportunities where it can collaborate with contributors to the innovation system to enhance Canada's capacity to generate new knowledge and translate it into real economic value.

### Plans for meeting the priority

- NRC will continue to provide Canadians with access to an array of facilities, programs, and technology platforms designed to allow them to conduct leading-edge research, as well as to enable industry to commercialize technology innovations.

| Priority 3 | Type | Strategic Outcome(s) |
|---|---|---|
| Strengthen the NRC business management model to deliver on expected results. | Ongoing | SO1 and SO2 |

**Description**

### Why is this a priority?

- Changes to NRC's business model are designed to ensure that relevant management practices are in place to achieve goals that will contribute to industry needs and federal S&T priorities.

### Plans for meeting the priority

- NRC will complete the transition to a program-based management model designed to meet the needs identified by industry. NRC research programs will be multi-disciplinary, market-oriented and collaborative, built around a sound understanding of industry value chains, with clear technology development paths.
- NRC will enhance relationships through a number of client management initiatives, such as targeted promotional activities, key account management practices and implementation of a Client Relationship Management system.
- NRC will contribute to the fulfillment of Canadian priorities with targeted international economies by building valuable relationships under Canada's S&T Agreements with other countries.

| Priority 4 | Type | Strategic Outcome(s) |
|---|---|---|
| Ensure effective and efficient resource management for a sustainable organization. | Ongoing | SO1 and SO2 |

**Description**

### Why is this a priority?

- Resource management effectiveness is critical to ensuring Canadian research initiatives produce new practical technologies and outcomes while maintaining low delivery costs.
- NRC must be a sustainable and responsive national research and technology organization in order to achieve its strategic outcomes.

### Plans for meeting the priority

- NRC will focus on human resource initiatives that attract and engage talent, plan for succession, and ensure effective management and decision-making.
- NRC will focus on financial and management initiatives to strengthen decision-making and operational efficiencies, and to establish long-term measures for sustainability.
- NRC will focus on transitioning Information Technology (IT) service delivery to the Shared Services Canada model. This change is expected to provide efficient and effective IT services at a lower cost.

## Risk Analysis

NRC's corporate risk management initiatives for 2012-13 address the organization's highest assessed corporate risks, and centre upon three key themes identified in the Corporate Risk Profile (CRP): Transition, Engagement & Communications, and Operations. Identified medium and low risks will be monitored and tracked over the year, with relevant initiatives undertaken to manage the risks, as guided by the CRP.

**Transition:** To enable implementation of its new strategy, NRC is currently undergoing an important transformation – transitioning from an institute-oriented to a program-based management model. This new business model will entail changes in internal processes, structures and culture to achieve closer alignment with industry needs. These changes include implementing: a new financial model, new approaches for developing and managing industry-focused research initiatives and projects, a new staff performance management system, a new client relationship management system and a client engagement strategy. Effectively managing these significant and complex changes will be key to addressing NRC's highest risk identified. To this end, a transition plan is under development to support the coordination and management of the changes, including critical dependencies and associated risks. Leads have been designated in each area of transition to manage the related changes.

**Engagement & Communications:** During the period of transition**,** high risks have been identified around effective engagement and communications both internally (to sustain staff engagement, manage workloads and maintain productivity) and externally (client relationship management and engagement). External risk factors such as the impact of government initiatives (e.g., the Federal R&D Review and Shared Services Canada) and their impact on NRC, its external collaborators and clients, will force greater prioritization and focus of activities - success of which will be aided by stronger engagement and communications. NRC will take a multi-initiative approach to address these risks in 2012-13 by: implementing an employee engagement plan and communications strategy;

implementing a new client relationship management system and associated policy on client information management; and developing and implementing a client engagement strategy and communications.

**Operations:** While it can be expected that productivity may temporarily decline during major transition periods, NRC seeks to manage this risk by focusing on critical operational requirements to lessen impact on productivity. High risks identified in the CRP include transition to the new systems and processes identified earlier, and maintaining security of NRC and client/partner resources (physical, information and information technology) in light of increased interactions with industry and increases in cyber attacks. Risk management initiatives include: defining and scoping managers' roles and responsibilities in the new operational structure; implementing a resource tracking/utilization system to support portfolio and project management activities; developing and delivering relevant training for managers required for new organizational processes and operations; and ensuring effective business continuity planning.

## Planning Summary

***Financial Resources ($ millions)***

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 700.5 | 727.8[2] | 713.3[3] |

For an explanation of the annual variation in spending, please refer to the discussion of the spending trend in the Expenditure Profile subsection.

***Human Resources (Full-Time Equivalent (FTE)[4])***

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 3,688 | 3,688 | 3,688 |

[2] The $27.3M increase in planned spending between 2012-13 and 2013-14 is largely due to increased statutory revenues ($22.5M).
[3] The $14.5M decrease in planned spending between 2013-14 and 2014-15 is largely due to the sunsetting of transfer payments funding for the Digital Technology Adoption Pilot Program ($29.0M) and for the Genomics Research & Development Initiative ($8.8M), offset by increased statutory revenues ($22.5M).
[4] All FTEs are forecasted based on personnel cost planning as at December 2011.

**Strategic Outcome 1:** Advancements in the development and deployment of innovative technologies in targeted Canadian industries and national priority areas in support of federal priorities in innovation and science and technology

| Performance Indicators | Targets |
|---|---|
| Total annual sales of NRC clients attributable to NRC S&T activities | $6.65 billion by March 2017[5] |
| Amount of BERD (Business Expenditures in R&D) conducted annually by NRC clients attributable to NRC activities in S&T | $800 million by March 2017 |
| Total R&D Fulltime Equivalents (FTEs) employed annually by NRC clients attributable to NRC S&T activities | 6,500 by March 2017 |

***Planning Summary Table ($ millions)***

| Program Activity | Forecast Spending 2011–12 | Planned Spending[6] | | | Alignment to Government of Canada Outcomes |
|---|---|---|---|---|---|
| | | 2012–13 | 2013–14 | 2014–15 | |
| Manufacturing Technologies | 115.4 | 120.7 | 130.3 | 139.7 | Strong Economic Growth |
| ICT and Emerging Technologies | 68.1 | 44.8[7] | 47.8 | 50.7 | Strong Economic Growth |
| Industrial Research Assistance | 146.2 | 162.6[8] | 164.2 | 135.2 | Strong Economic Growth |
| Health and Life Science Technologies | 102.9 | 107.5 | 113.6 | 110.6 | Healthy Canadians |
| Energy and Environmental Technologies | 31.5 | 27.9 | 29.8 | 31.7 | Clean and Healthy Environment |
| **Total Planned Spending** | | **463.5** | **485.7**[9] | **467.9**[10] | |

[5] *NRC's S&T Economic Impacts and Return on Investment Study*. [http://www.nrc-cnrc.gc.ca/eng/reports/2010-2011/dpr-index.html] NRC Strategy and Development Branch, 2011. Note that the results and methodology of the Study have undergone a review and validation process, including a validation of results by Statistics Canada. A formal international peer review of the methodology and results is now in process.

[6] Planned spending reflects best estimates of spending to year end.

[7] The $23.3M decrease in spending between 2011-12 and 2012-13 is mainly due to the sunsetting of the Cluster Initiatives.

[8] The $16.4M increase in spending between 2011-12 and 2012-13 is attributable to the funding for the Digital Technology Adoption Pilot Program.

[9] The $22.2M increase in planned spending between 2012-13 and 2013-14 is mostly attributable to increased statutory revenues ($22.5M).

[10] The $17.8M decrease in planned spending between 2013-14 and 2014-15 is largely due to the sunsetting of transfer payments in Industrial Research Assistance for the Digital Technology Adoption Pilot Program ($29.0M) and for the Genomics Research & Development Initiative ($8.8M), offset by increased statutory revenues ($22.5M).

**Strategic Outcome 2:** Canadians have access to research and development information and infrastructure

| Performance Indicators | Targets |
|---|---|
| Proportion of surveyed S&T infrastructure users who report positively on the value of the NRC infrastructure used | 85% by March 2013 |

***Planning Summary Table ($ millions)***

| Program Activity | Forecast Spending 2011–12 | Planned Spending | | | Alignment to Government of Canada Outcomes |
|---|---|---|---|---|---|
| | | 2012–13 | 2013–14 | 2014–15 | |
| National Science and Technology Infrastructure | 94.1 | 98.9 | 101.1 | 103.6 | Innovative and Knowledge-Based Economy |
| Scientific, Technical and Medical Information | 18.5 | 18.7 | 18.9 | 18.9 | Innovative and Knowledge-Based Economy |
| **Total Planned Spending** | | **117.6** | **120.0** | **122.5** | |

## Internal Services

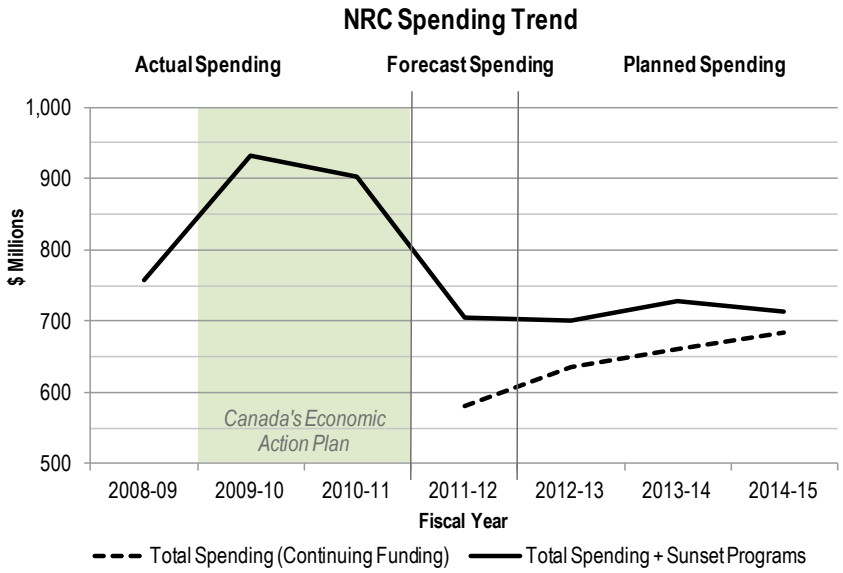
***Planning Summary Table ($ millions)***

| Program Activity | Forecast Spending 2011–12 | Planned Spending | | |
|---|---|---|---|---|
| | | 2012–13 | 2013–14 | 2014–15 |
| Internal Services | 127.1 | 119.4 | 122.1 | 122.9 |
| **Total Planned Spending** | | **119.4**[11] | **122.1** | **122.9** |

## Expenditure Profile

NRC's forecast spending for 2011-12 is $703.8 million. Over the past three years (fiscal years 2008-09 to 2010-11), actual spending has averaged $864.1 million with Canada's Economic Action Plan (CEAP) and $766.6 million without CEAP. The spending for fiscal years 2010-11 to 2011-12, as indicated in the Spending Trend graph, reflects an overall decline in the budget, mainly due to the completion of initiatives funded under Canada's Economic Action Plan and the sunsetting of the Cluster Initiatives.

[11] The $7.7M decrease in planned spending in 2012-13 is mainly due to the Administrative Services Reduction Review and to the sunsetting of Cluster Initiatives.




## Estimates By Vote

For information on NRC organizational appropriations, please see the [3] 2012–13 Main Estimates publication.

# Section II – Analysis of Program Activities by Strategic Outcome

## NRC Strategic Outcome 1

Advancements in the development and deployment of innovative technologies in targeted Canadian industries and national priority areas in support of federal priorities in innovation and science and technology.

### Program Activity 1.1: Manufacturing Technologies

***Program Activity Description***

This program develops and advances technologies for enhancing the innovation capacity and growth of Canadian manufacturing industries. This is done through multi-disciplinary collaborative research and development services in addition to specialized technical and advisory services for transferring or advancing technologies into deployed industrial solutions for the marketplace. This includes the development and testing of product and process innovations as well as the provision of coordinated access to multidisciplinary research expertise and state-of-the art facilities to ensure that industries in Canada are at the leading edge of innovation.

***Financial Resources ($ millions)***

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 120.7 | 130.3[12] | 139.7 |

***Human Resources (Full-Time Equivalent (FTE))***

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 987 | 987 | 987 |

| Expected Results | Performance Indicators | Targets |
|---|---|---|
| Manufacturing industries in Canada have coordinated access to NRC's multidisciplinary research expertise and state-of-the art facilities to ensure they are at the leading edge of innovation | Percentage of surveyed clients who report that NRC's manufacturing technologies research and facilities helped advance their innovation capacity | 77% by March 2014 |

Manufacturing industries contribute approximately 12% of Canada's Gross Domestic Product, placing them among the largest industry sectors within Canada. However, economic fluctuations in several manufacturing areas as well as global changes continue to put pressure on Canada's manufacturing industries. In order to maintain their competitiveness in the global market, Canadian companies have to stay on top of the innovation spectrum.

While the recent federal economic stimulus has proved beneficial to the industry, economic recovery is still fragile. Manufacturers continue to face the need to reduce costs, improve

[12] The $9.6M increase in planned spending between 2012-13 and 2013-14 is largely due to increased statutory revenues.

efficiencies, develop and implement new technologies, and respond to consumer expectations and preferences while complying with standards and regulations. Continually creating and seizing innovation advantages is critical to ensuring a high level of global competitiveness for manufacturing companies that will contribute to Canada's economic productivity and job creation.

NRC's expertise and competencies, particularly in the aerospace, automotive and construction industries, enable it to provide directed research and technology development support to these high-impact sectors in Canada. NRC's integrated and multidisciplinary approach ensures that scientific and engineering capabilities work in collaboration with private and public partners to address the immediate and future needs of each sector. Research, development and technology demonstration will be translated into tangible results for industry that help to create an attractive business environment, maximize the contribution of sectors to the economy, and support long term domestic growth.

***Planning Highlights***

- The aerospace industry is highly R&D intensive with approximately $1.4 billion in annual spending. An ever increasing pressure on this sector is the need to become more "green" and apply innovative technologies to reduce costs as well as the environmental footprint. NRC will focus its efforts on alternative fuels, light-weight materials, aerodynamic designs and performance improvements. In 2012-13, NRC will collaborate with industry and other government departments on the development of advanced coatings for high temperature aircraft engines and advanced thermal spray coatings for landing gear applications. NRC will continue working with the Department of National Defence to develop unique expertise and facilities for the fabrication and testing of advanced high temperature coatings, ice-phobic coatings and multi-functional coatings to enhance the operational safety and reduce the maintenance costs of Canadian Forces Fleets. Collaborative industry projects include the development and testing of coatings for high temperature aircraft engines with Pratt and Whitney Canada, and advanced coatings for landing gear applications with Messier Dowty. The anticipated outcome of this research is technology transfer to industry to strengthen the competitiveness of Canadian companies. NRC will also provide continued technical services to industry and government clients, such as icing tests at the Global Aerospace Centre for Icing and Environmental Research (GLACIER) in Manitoba.
- Canada's core strengths in auto-related innovation include advanced materials, design, visualization, manufacturing, and communications technology. NRC will strengthen the role of Canadian companies in the automotive manufacturing process by conducting and supporting technology development in light-weight materials and bio-composites as well as alternative propulsion systems. Natural fibres made of Canadian flax-seed straw are now being introduced into thermoplastic composites for automotive structures. NRC will continue these next-generation R&D activities through collaborations with industry, academia and other stakeholders, such as the Magna-NRC Composite Centre for Excellence, a public-private partnership in Concord, ON. This collaboration will contribute to the federal government initiative "Automotive Partnership Canada". By using newly installed high pressure resin transfer moulding technology at the Centre, it will be possible to demonstrate the application of high performance structural composites for light-weight automotive structures.
- The Canadian construction industry faces increasing demands for energy efficient, environmentally friendly technologies, including building materials, energy efficiency aspects and indoor environment improvements. NRC's R&D activities will focus on the use of bio-materials in residential and commercial buildings, as well as the building envelope and intelligent sensor systems to control light, ventilation, heating and air conditioning systems in order to minimize energy use without reducing the comfort of

the space. One research program focused on high performance buildings will transform how energy is viewed by owners of industrial and commercial buildings. NRC will work with a consortium of committed industry leaders to develop breakthrough technologies in energy conservation, generation, storage, and management. NRC will continue to play a national leadership role in the development of model building codes for the health and safety of all Canadians. In 2012-13, NRC will focus on new model energy efficiency requirements to meet performance targets established by provinces and territories.

## Program Activity 1.2: Information and Communications Technologies (ICT) and Emerging Technologies

### *Program Activity Description*

This program develops and advances technologies to enhance the innovation capacity and growth of Canadian industries in emerging technology sectors and in the Information and Communications Technologies (ICT) sector. This activity is undertaken through multidisciplinary collaborative research and development and through specialized technical and advisory services. Technologies are developed into industrial solutions for the marketplace in the areas of energy, health and ICT, with particular emphasis on the Digital Economy. Activities include assembling and integrating product innovations at the prototype stage and providing access to research expertise and state-of-the art facilities to keep Canadian industry at the leading edge of innovation.

### *Financial Resources ($ millions)*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 44.8 | 47.8 | 50.7 |

### *Human Resources (Full-Time Equivalent (FTE))*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 300 | 300 | 300 |

| Expected Results | Performance Indicators | Targets |
|---|---|---|
| Advancements in innovative technology solutions in emerging and ICT sectors | Revenue from service contracts and successful Intellectual Property (IP) transferred to emerging industry sectors | $1.5 million by March 2013 |
| | Percentage of clients reporting positively on the impact of NRC R&D on client growth | 85% by March 2013 |

ICT is a leading driver of innovation, competitiveness and productivity. The ICT sector performs 38% of Canada's private R&D, employs more than half a million Canadians and generates approximately 5% of GDP.[13] ICT and other emerging technologies play a transformative role, enabling entirely new applications to enter the marketplace. NRC works with the ICT industry through NRC-IRAP, research collaborations and technical services, such as those provided by the NRC Canadian Photonics Fabrication Centre (NRC-CPFC), to ensure that leading ICT is available to enhance the competitiveness of Canadian firms. NRC's broad range of ICT capabilities are also used as research tools and as enablers in other sectors.

Innovations in nanotechnology will have an impact on a wide array of applications, from materials sciences and biomedicine to ICT, itself an enabling technology. According to the

[13] Canadian ICT Sector Profile, Industry Canada http://www.ic.gc.ca/eic/site/ict-tic.nsf/eng/h_it07229.html

Organisation for Economic Co-operation and Development (OECD), Canada ranked in the top eight countries in terms of filing nano-related patents in the period 2005-09.[14] Canada shows particular strength in nanoelectronics, an area that may help Canada's ICT industry to recover from the current downturn. Equally important will be the standards required to bring these new technologies to market: The Conference Board of Canada estimates that the development of new standards creates 17% of the growth in labour productivity or 9% of growth overall.[15]

In the ICT sector, optical communications are undergoing the first fundamental technology shift since the deployment of wavelength division multiplexed (WDM) systems 20 years ago. This global transformation is driven by the massive data flow required to support anywhere-anytime connectivity, HD video and cloud computing. The industry recognizes that traditional photonic communication technologies are clearly inadequate to meet the challenge. NRC currently has the largest concentration of expertise and facilities for photonic devices, photonics materials, and semiconductor manufacturing in Canada, with a proven track record of developing and commercializing optical communication technologies. NRC is therefore extremely well positioned to support Canadian industry leadership in next generation communications and to drive Canadian competitiveness in the digital economy.

### *Planning Highlights*

- NRC will build on its achievements to develop new ICT capabilities with an emphasis on security applications such as encryption, data mining, syndromic surveillance and system interoperability enabling rapid response to emergency situations. Many of these technologies have multiple applications and effectively support [4] Canada's Digital Economy strategy by engaging industry partners in significant collaborations that will lead to new products for global markets while contributing to national security priorities. For example, NRC data mining technologies will be applied to the health sector to track trends and identify pandemics. Similar techniques could be used for triage in emergency situations. NRC will be identifying key areas for further development.
- NRC-CPFC, a collaboration among NRC, Carleton University and the Province of Ontario, supports the growth of photonics in emerging ICT markets by providing world-class engineering and manufacturing assistance, commercial grade foundry services and pilot-run production facilities. NRC-CPFC staff assist clients to develop and fabricate next-generation materials, devices, components, and systems. Its services significantly lower the risk and barriers of entry to emerging ICT markets for SMEs in Canada. In 2012-13, NRC-CPFC will add to its suite of services, supporting opportunities that flow from the convergence of nanotechnology, environmental technologies and photonics. Solutions will address key emerging markets including:
    - Next generation optical communication components to enable Canadian companies to scale up fibre optic communication network capacity, with emphasis on new technologies that can be deployed within five years to meet the anticipated data traffic growth; and
    - Power electronics, i.e. electronic components that enable environmental solutions in alternative energy, including energy storage.
- NRC is a world leader in organic photovoltaics (ICT), advanced building envelopes, energy use forecasting (ICT), electrical storage, sensor technologies (ICT), and human factors that can be combined into integrated systems for controlling energy consumption, energy storage and indoor environments. As part of this thrust, NRC will continue to

[14] OECD (2009), OECD Science, Technology and Industry Scoreboard 2009, OECD Publishing http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-scoreboard-2009_sti_scoreboard-2009-en

[15] *Economic Value of Standardization*, Conference Board of Canada, July 2007

work with Natural Resources Canada (NRCan), in the area of data mining for Smart Grid integration to commercial buildings.

- Through the Printable Electronics (PE) initiative, NRC will contribute to an emerging field that is at the intersection of well-established Canadian industries: ICT and printing – it presents a transformative opportunity to add intelligence to printed products. NRC will help position the packaging, commercial and security printing industries to be early adopters of emerging solutions, making them global leaders. In 2012-13, PE will be launched and will focus on developing technologies related to functional inks and printing processes that will allow electronic circuits to be mass manufactured and integrated into everyday objects at a very low cost. This ability to mass produce low cost ubiquitous electronics to enhance branding, secure payment, authentication and identification will enable the Canadian printing and packaging industries to create the "Internet of Things".
- Nanotechnology is an enabler that spans a broad range of applications from construction to health care and from manufacturing to communications. NRC is positioning its considerable nano capabilities to contribute not only to research breakthroughs at the nanoscale, but also to the competitiveness of Canadian firms and the development of highly qualified personnel that will lead the next wave of nanotechnology developments. NRC will concentrate on four key areas: Energy Generation and Storage; Hybrid Nanoscale Electronics; Metabolomic Sensor Systems; and Nano-enabled Biomaterials. NRC will work closely with industrial receptors to respond directly to industry needs, and evolve a capability to design and build devices to assist industry in creating prototypes on which finished products can be built. In collaboration with the University of Alberta, NRC will ensure the engagement of students and post-graduate researchers in key projects that will launch the next phase of nanotechnology research.

  A key challenge will be to ensure that metrology is in place to ensure the repeatability of results and permit the manufacturing of nano-based products in the future, as well as establishing safety standards for the handling of nanomaterials and their by-products.

## Program Activity 1.3: Industrial Research Assistance

### *Program Activity Description*

The program supports small and medium-sized enterprises (SME) growth by stimulating innovation capacity and increasing the adoption and/or commercialization of technology-based products, services, or processes in Canada. Assistance is provided to increase opportunities for SME success through: 1) technical and business advice provided to SMEs by a cross-Canada network of field professional staff located in some 100 communities; 2) cost-shared merit-based non-repayable contributions to SMEs engaged in technological innovation of products, services and processes; 3) referrals to partner organizations and key contacts whose resources and international business networks benefit SMEs; and 4) expanding the knowledge-base and capacity of SMEs by increasing access to college and university graduates in SMEs done through NRC-IRAP's participation in the delivery of Human Resources and Skills Development Canada's Youth Employment Strategy (YES).

### *Financial Resources ($ millions)*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 162.6 | 164.2 | 135.2[16] |

[16] The $29.0M decrease in planned spending between 2013-14 and 2014-15 is due to the sunsetting of transfer payments for the Digital Technology Adoption Pilot Program ($29.0M).

### *Human Resources (Full-Time Equivalent (FTE))*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 340 | 340 | 340 |

| Expected Results | Performance Indicators | Targets |
|---|---|---|
| SMEs in Canada have merit-based access to effective and efficient innovation support resulting in increased wealth | Average return in dollars to the Canadian economy (i.e. wealth creation in terms of increased sales and decreased cost) per dollar of Program cost | 7 by March 2013 |
| | Number of jobs financially supported | 2,500 by March 2013 |

SMEs comprise over 99% of goods- and services-producing companies in Canada, and they employ one in every six Canadians. Accordingly, Canadian growth and prosperity is highly dependent on SME growth and prosperity[17]. Growth can be difficult for SMEs due to a multitude of factors such as high business risk, lack of funding to move from research and development to commercialization, and challenges in accessing international markets. Barriers to innovation vary by industry and market, translating into the need for tailored advisory services in addition to financial support for R&D that is critical to SME growth.

As Canada's national RTO, NRC plays a key role in helping to move innovations to market. By virtue of its positioning, NRC has a strong relationship with various industry sectors, both nationally and internationally. This provides an avenue to gather timely intelligence on market forces and provide financial assistance to SMEs in critical technology areas. NRC-IRAP has an international reputation and has been identified as the top program in Canada providing innovation support to Canadian SMEs[18]. With a broad suite of innovation services, NRC-IRAP is able to customize its offerings to help SMEs prepare for the future.

### *Planning Highlights*

- In 2012-13, NRC-IRAP will continue to help Canadian SMEs successfully commercialize technologies through the provision of technical and business advisory services as well as funding to support their R&D and other innovation-related activities. This includes continuation of ongoing activities to strengthen NRC-IRAP's capacity to deliver new governmental initiatives and to assist SMEs. Efforts will continue to increase SME access to needed services, to encourage collaborations with other programs, organizations and levels of government, and to build effective community innovation through relationships and services that benefit SMEs.
- NRC-IRAP will implement the new DTAPP, on behalf of Industry Canada, to accelerate the adoption of digital technologies by SMEs. DTAPP will be realized through the provision of advisory services and, in some cases, funding to SMEs using a co-investment model to defray the risk of adopting the new technology. Colleges and other organizations will also receive funding to deliver training and advice and to further develop their capacities to support technology adoption. A key goal of this pilot program is to better understand the needs of Canadian SMEs in the digital technology adoption process in order to facilitate more effective support via direct government services and through other organizations, including colleges.

[17] Key Small Business Statistics July 2010 http://www.ic.gc.ca/eic/site/sbrp-rppe.nsf/eng/rd02493.html
[18] The State of Science & Technology in Canada 2006
http://www.scienceadvice.ca/en/assessments/completed/science-technology.aspx

- In 2012-13, NRC-IRAP will continue to focus on performance management and reporting. Key projects will include the enhancement of information management and information technology infrastructure, including online reporting tools for DTAPP. This will ensure that program impacts continue to be in line with departmental and federal accountability requirements, that NRC-IRAP has the necessary agility to respond to new program delivery requests from government, and that benefits to Canada are clearly demonstrated.

## Program Activity 1.4: Health and Life Science Technologies

### *Program Activity Description*

In support of the Health and Related Life Sciences and Technologies priority of the federal S&T Strategy, this program develops and advances technologies and techniques that can enhance the innovation capacity and growth of Canadian industries in the health and life sciences sector. This is done through multi-disciplinary collaborative research and development services in addition to specialized technical and advisory services for transferring or advancing technologies into industrial solutions for the marketplace. This includes the development and testing of product and process innovations as well as the provision of coordinated access to multidisciplinary research expertise and state-of-the art facilities to ensure that industries in Canada are at the leading edge of innovation.

### *Financial Resources ($ millions)*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 107.5 | 113.6 | 110.6 |

### *Human Resources (Full-Time Equivalent (FTE))*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 751 | 751 | 751 |

| Expected Results | Performance Indicators | Targets |
|---|---|---|
| Canadian health and life science industries have greater access to effective and innovative technology solutions | Revenue from successful IP transferred to Health & Life Science industries | $2 million by March 2013 |
| | Percentage of respondents from the health and life science industrial collaborators who respond positively on value of NRC innovative contributions | 85% by March 2013 |

Canadians, and their governments, are concerned about the financial sustainability of the health care system, particularly with an ageing population facing chronic and infectious diseases. Hospital-acquired infections (HAIs) are on the rise globally, and according to a 2011 World Health Organization study[19] Canada's rate of HAIs is more than 50% higher than the rate reported for high income countries. Less costly and more effective therapies and procedures are more critical than ever before. Biologics are increasingly used for the treatment of diseases for which no other effective therapies are available. Because they are so effective, with few side effects, they help prevent disease complications and long hospital stays.

[19] Report on the Burden of Endemic Health Care Associated Infection Worldwide: Clean Care is Safer Care at http://whqlibdoc.who.int/publications/2011/9789241501507_eng.pdf

By 2050, the global population is expected to reach between nine and 10 billion people, doubling the requirement for food.[20] Wheat is one of the world's most important cereal grains. The predicted increase in global population and the associated demand for food places a responsibility on, and an opportunity for, Canada to increase production as rapidly as possible.

NRC is positioned to help tackle these substantial issues by working with partners across industry, government, and academia, bringing a multi-disciplinary and integrated focus to the development of timely and cost-effective solutions. NRC has world-class competencies across Canada in the life sciences field that can be leveraged to develop and bring to market integrated approaches to improve health care, reduce health care costs, and increase agricultural productivity and food security.

### *Planning Highlights*

- Vaccinations against preventable diseases not only help keep populations healthy, they reduce health care costs, through reduced government spending on hospitalizations, and reduced visits to physicians. NRC will focus on reducing the impact of vaccine preventable diseases in adult and immuno-compromised populations by helping SMEs and multinationals with a footprint in Canada to improve their vaccine pipelines and accelerate the commercialization of their products. NRC will develop technologies and provide core facilities that address identified gaps in Canada's vaccine development innovation system and thus help address Canada's vaccine needs, as well as enable Canadian companies to increase their global competitiveness.
- Canada's strong generics industry is beginning to increase its focus on biologics, making this the right time to capture this opportunity. The development of biosimilars (generic versions of successful biologics) will reduce health care costs as they are projected to cost 20-35% less than the biologics they replace. NRC will enhance the development and commercialization of effective therapeutics, such as Biologics and the less expensive Subsequent Entry Biologics. NRC has a range of competencies, including the generation of therapeutic antibody candidates, bioprocessing, biomarker identification, molecular modeling, and cell culture optimization for industry level production, that can assist both innovative SMEs and manufacturer partners in Canada to bridge early stage innovation gaps. NRC will help Canadian SMEs advance their technologies to clinical development and successful commercialization and increase their market valuation due to acceleration of the proof-of-concept stage, deployment of enabling processes, and effective advancement of their products.
- The development of technologies to combat HAIs will not only improve the quality of healthcare, but also result in meaningful reductions in direct health care spending due to the reduction of hospitalization and post-discharge costs. NRC will begin to align its expertise in immunology, cell biology, materials science, nano- and micro-systems, information technologies and other disciplines, to develop a public-private collaboration to surmount the significant health threat from and increased health care costs associated with HAIs. Working with partners, NRC will develop technologies in support of rapid screening for pathogens, novel materials to help prevent the spread of infections and point-of-care diagnostics.
- In 2011-12, the interdepartmental Genomics R&D Initiative (GRDI), was renewed for a fifth three-year funding cycle, Phase V. Genomics research supported by the GRDI seeks to uphold regulatory, public policy, and operational mandates in important areas such as health, food safety, sound management of natural resources, a sustainable and competitive agriculture sector, and environmental protection, with strong collaborations

[20] "How to Feed the World in 2050", http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

with university and private sectors. New to Phase V of the GRDI is the mobilization of resources for concerted research on issues that are beyond the mandates of single departments. In 2012-13, two interdepartmental pilot projects will be pursued: 1) Protection of Canadian biodiversity and trade from the impacts of global change through improved ability to monitor invasive alien and quarantine species; and 2) Strengthening food and water safety in Canada through an integrated federal genomics initiative. NRC will continue to provide program management functions for the entire interdepartmental initiative on behalf of the seven federal departments and agencies that receive GRDI funds: Agriculture and Agri-Foods Canada (AAFC), Fisheries and Oceans Canada, Environment Canada, Health Canada, NRCan, Public Health Agency of Canada and NRC. The Canadian Food Inspection Agency will also be given the opportunity to participate in Phase V projects.

- It is imperative that Canadian wheat producers have access to improved varieties that are high-yielding, require less fertilizer, and are profitable. By engaging with stakeholders and investing in wheat development, NRC contributions will decrease the timelines and costs for wheat variety development and create major economic benefits for Canadian farmers. Through the Canadian Wheat Improvement initiative, NRC will work strategically with AAFC, the province of Saskatchewan and others, under a Consortium model (the Canadian Wheat Improvement Consortium), to develop new wheat varieties for Canadian farmers that will improve the competitiveness of their products for both the domestic and export markets. Contributing NRC expertise in genomics and genetic mapping, marker-assisted breeding, and microbial metagenomics will help accelerate the development of varieties that will produce enhanced sustainable yields, cope with variable climates and require less fertilizer. Once established, this five year consolidated effort will represent one of the most significant co-ordinations of crop research in Canada ever. Economic modeling indicates that this collaborative initiative can generate an estimated $4.8 billion in net earnings for our Canadian farmers over the decade 2020-29.

## Program Activity 1.5: Energy and Environmental Technologies

### *Program Activity Description*

In support of the Natural Resources and Energy priority and the Environmental Science and Technologies priority of the federal S&T Strategy, this program develops and advances technologies and techniques for enhancing the innovation capacity and growth of Canadian industries in the natural resources sector and to address Canadian environmental issues. This is done through multi-disciplinary collaborative research and development services in addition to specialized technical and advisory services for transferring or advancing technologies into industrial solutions for the marketplace. This includes the development and testing of product and process innovations as well as the provision of coordinated access to multidisciplinary research expertise and state-of-the art facilities to ensure that industries in Canada are at the leading edge of innovation.

### *Financial Resources ($ millions)*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 27.9 | 29.8 | 31.7 |

### *Human Resources (Full-Time Equivalent (FTE))*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 298 | 298 | 298 |

| Expected Results | Performance Indicators | Targets |
|---|---|---|
| Collaborative contributions on improving sustainability of Canada's natural resources and protection of Canada's environment through innovation | Percentage of responding collaborators who respond positively on the value of NRC contributions to natural resource sustainability and environmental protection innovations | 85% by March 2014 |

Canada, as well as many other highly industrialized countries, faces major challenges related to environmental sustainability and climate change. Critical issues include air, land, biodiversity and water quality and availability, and the protection of natural resources. These issues can significantly affect the health and well-being of the population in the near future and beyond.

For more than two decades, sustainable development has been promoted as a means of reconciling industrial development with ecological systems. The path to fully sustainable development and decision-making is key to public policy in Canada and around the world. Development that is not sustainable will inevitably lead to negative economic, environmental, and social repercussions. Advancing technologies that enhance sustainability is about safeguarding Canada's future and improving the quality of life of Canadians.

NRC's multidisciplinary and collaborative approach will build the critical mass needed to address sustainability challenges and support Canada's needs. This program activity combines efforts from across NRC to address clean energy, climate change and the "green" needs of industry and society. NRC will focus on technology development aligned with the federal S&T Strategy priorities and other government initiatives, in particular complementary initiatives at NRCan. Planned research initiatives will focus on progression and improvement in the areas of bio-sourced industrial materials, energy conversion and storage, energy efficiency, $CO_2$ conversion, green buildings, water scarcity management, and arctic sciences.

### *Planning Highlights*

- NRC will continue to be a strong player in the R&D of advanced energy storage technologies for stationary storage applications (e.g., batteries) and sustainable transportation, addressing Canada's innovation needs by responding to market pull across the value chain. This value chain spans raw materials, specialty chemicals and materials, device producers, original equipment manufacturers and device integrators, specialty applications, broad scale applications and recyclers. NRC will collaborate with industry and other stakeholders to provide research and technical support for the development and manufacturing of energy storage technologies. NRC will develop the safety and performance standards of energy storage technologies, while reducing the costs to venture into broader markets. NRC's broad range of expertise and established networks of collaborators enable it to address key technical problems as well as optimize power distribution efficiency through integrated solutions that include sensor systems, smart metering and decision software.
- NRC will play a central role in the growth of the Canadian industrial biomaterials sector. Through the Industrial Biomaterials initiative, NRC will tie together the opportunities identified by industrial collaborators with NRC's expertise in biofibres, bioresins, and biocomposites and manufacturing processes to ensure commercial success in Canada.

  This activity will focus on automotive and construction markets, the two largest elements of the North American composites market. NRC contributes to three broad areas of technical expertise that will have a unique impact:

    - Materials development – bioresins, biofibres, and biocomposites;
    - Manufacturing processes for advanced composites and biocomposites; and
    - Materials and systems performance – involving materials certification, process simulation & optimization, performance evaluation and life cycle analysis

- NRC contributes to the implementation of Canada's Northern Strategy through the development of new technologies and new operational models. The major challenges identified by stakeholders and mandated departments and agencies are: healthy housing, safe and cost effective transportation, sustainable energy solutions for remote communities, cost effective means for surveillance of the northern frontier, and environmentally sensitive development of natural resources. NRC, in close collaboration with Aboriginal Affairs and Northern Development Canada and other federal, territorial and local stakeholders, has identified specific technology opportunities, each with a compelling value proposition, within each of these broad areas. The immediate outcomes of application of these new technologies will be to reduce ongoing operational costs and hence fiscal burden for the maintenance of northern communities, to bring living conditions and the performance of northern systems closer to the standards expected in the rest of Canada, and to engage and employ northerners in the delivery of those systems. The long-term impact will be a suite of northern specialist technologies and expertise that Canada will market to the rest of the polar world.

  Potential technology opportunities include improved building systems to reduce the cost of operation (heating and ventilation) for northern housing, Navigation Decision Tools to reduce the risk and cost of shipping, autonomous vehicles for security and surveillance in remote regions, village scale multi-mode energy systems, and the means to reduce the environmental risk of oil spills from offshore production systems.

- Through the Algal Carbon Conversion (ACC) initiative, NRC will work with the Canadian oilsands industry and SMEs who are working on technology development, to convert carbon dioxide emissions into biomass. This will be done using algae in photo-bioreactors to produce products, such as biofuels, methane via anaerobic digestion, valuable proteins, and animal feed, while at the same time remediating wastewater and capturing carbon dioxide. With a stable, long-term mandate to pursue algal technologies for carbon conversion, NRC is poised to make Canada into a world-leader in this field. ACC will create value for Canada by mitigating $CO_2$ emissions, remediating wastewater, and potentially substituting renewable fuels for fossil fuels, while in the process producing high value biomass by-products such as protein rich nutraceuticals or animal feed. Proving the technology will help create markets for Canadian bioreactor producers and its implementation in the oil sands will help the environmental image of that industry.

## NRC Strategic Outcome 2

Canadians have access to research and development information and infrastructure.

### Program Activity 2.1: National Science and Technology Infrastructure

***Program Activity Description***

This program manages national science facilities and infrastructure critical to research, development and innovation by Canadian scientific and technological communities. Facilities include the TRIUMF sub-atomic research facility and a suite of neutron-scattering spectrometers at Chalk River Laboratories. They also include astronomical observatories and the laboratory for national measurement standards as mandated by the *National Research Council Act.*

***Financial Resources ($ millions)***

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 98.9 | 101.1 | 103.6 |

***Human Resources (Full-Time Equivalent (FTE))***

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 282 | 282 | 282 |

| Expected Results | Performance Indicators | Targets |
|---|---|---|
| Canada's national science and technology facilities are up-to-date and accessible to Canadians in accordance with federally legislated and assigned mandate and/or evolving national needs | Percentage of surveyed clients reporting positively on their perceived value of NRC R&D infrastructure used | 85% by March 2013 |
| | Number of Canadian users of major NRC science infrastructure | 1,200 by March 2013 |

NRC provides critical scientific services that support Canadian excellence in R&D. NRC will continue to work with academic, industrial and government partners to ensure that national S&T facilities are managed progressively and made accessible to Canadians in accordance with its assigned mandate and with evolving national needs.

Canadian researchers access an array of national facilities and programs designed to allow them to conduct their frontier scientific research. NRC provides stewardship over facility maintenance and access, develops supporting tools and instrumentation and also develops the measurement standards that allow emergent scientific innovations to be commercialized.

***Planning Highlights***

- NRC's National Measurement Standards initiative builds competitive advantage for Canada by disseminating measurement standards, providing calibration services to government and industry and facilitating trade by developing standards and methods of measurement that impact directly on the ability of Canadian firms to trade internationally. NRC will continue to facilitate Canada's entry into global markets for new technologies by developing measurement standards for emerging technologies such as nanotechnology, biotechnology and leading edge ICT.

- In alignment with its mandate, NRC provides Canadian astronomers with access to state-of-the-art international astronomical observatories, and collects and distributes astronomical data through the Canadian Astronomy Data Centre. The Square Kilometre Array, a next-generation radio telescope array, continues to be a leading priority for the Canadian astronomical community. NRC plans to continue to be a major contributor to this astronomical observatory in the pre-construction phase. NRC will also continue to create instrumentation for Canada's facilities, including a new generation spectropolarimeter for the Canada-France-Hawaii Telescope, planned for launch in 2015.
- A key part of NRC's stewardship of Canada's S&T Infrastructure, NRC's Canadian Neutron Beam Centre (NRC-CNBC) is accessed continually by researchers from universities, government laboratories and industry from across Canada and abroad. Knowledge generated by neutron beam measurements on materials is translated into advancement of science, and development of materials for industrial sectors such as health, energy, environment, transportation and communication. In 2012-13 users of the NRC-CNBC will focus on research related to light metal alloys for automotive and aerospace applications.
- Canada's national laboratory for particle and nuclear physics, TRIUMF, is owned and operated as a joint venture by a consortium of eleven Canadian universities. The core operating budget is supported via a Contribution Agreement through NRC, with additional support from tri-council funding agencies, the Canada Foundation for Innovation and the Government of British Columbia.

  In 2012-13 TRIUMF will continue to support the Canadian and international particle and nuclear physics community in alignment with the subatomic-physics Long Range Plan. In particular, TRIUMF will:
  - Support extracting and analyzing the physics from the T2K experiment in Japan, the ATLAS and ALPHA experiments at CERN and the PiENu experiment at TRIUMF;
  - Support the development of Canadian leadership in nuclear medicine and molecular imaging through the production and delivery of medical isotopes for the Pacific Parkinson's Program and the British Columbia Cancer Agency and outfit and utilize the MHESA nuclear-medicine laboratory with Nordion for collaborative R&D; and
  - Complete the civil construction of the Advanced Rare IsotopE Laboratory (ARIEL) by March 31, 2013. ARIEL will house a superconducting electron linear accelerator (e-linac) to produce isotopes. When completed in 2014, the e-linac together with the main cyclotron at TRIUMF will offer Canada global leadership in the production and study of isotopes for physics and medicine.

### Program Activity 2.2: Scientific, Technical and Medical Information

#### *Program Activity Description*

As mandated by the *National Research Council Act*, this program operates and maintains the national science library, specifically holding the national collection of Scientific, Technical and Medical (STM) information, and offers information services. The program provides Canada's research and innovation communities with access to global STM information to facilitate knowledge discovery, cross discipline research, innovation and commercialization.

#### *Financial Resources ($ millions)*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 18.7 | 18.9 | 18.9 |

### *Human Resources (Full-Time Equivalent (FTE))*

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 93 | 93 | 93 |

| Expected Results | Performance Indicators | Targets |
|---|---|---|
| High value information that advances research and innovation in the areas of science, technology and health/medicine | Percentage of clients who reported that NRC Canada Institute for Scientific and Technical Information (NRC-CISTI) information services contributed to advancing their research and development, technology commercialization or planning and decision-making. | 85% by March 2014 |

This program activity provides the information that Canadian researchers and senior decision makers need to help them address issues of national interest. STM information, and increasingly, business-related information and research data, are all important inputs into research and development programs seeking practical applications related to the health of Canadians, and to developing sustainable energy solutions and technologies to protect the environment. NRC will continue to operate the national science library, providing all Canadians access to published scientific literature and NRC publications. It will expand the access to research data by working with Canadian data centres, and it will continue to provide information services to other government departments and agencies, thus allowing them to focus on their core areas of expertise. This activity also contributes to NRC's own efforts to become more market-focused and responsive to the needs of Canadian industry. New information services will be introduced to help identify the areas where NRC can have the most impact in both the short and long term.

This program activity benefits key Canadian industry sectors and researchers within NRC, across government, and in SMEs, by providing timely access to the world's STM information to support their information and decision-making needs. Improving access to research data and NRC publications and creating a strong infrastructure for managing multiple types of information are important aspects of this activity. The information services provided under this activity benefit Canadian industries by helping NRC identify the opportunities for working with them to develop technologies of immediate value and commercialization potential. These services also provide analyses that identify longer-term trends of importance to the development of research initiatives and directions that will have the most impact. Evidence-based decision-making supported by the best information available will help NRC meet its goals in supporting Canadian industries and addressing issues of importance to all Canadians.

### *Planning Highlights*

- NRC will develop information services to help it become more market-focused and supportive of Canadian industries. These services will provide the relevant information and insights needed to make sound decisions on program development and operation. The two main services will be Foresight and Competitive and Market Intelligence (CMI). Foresight services will allow NRC to detect important industry trends and identify potential opportunities for working with Canadian industries by extrapolating long-term outcomes of a proposed line of R&D. The resulting analyses will provide a solid foundation for decision-making on future investments that align to the areas where NRC can have the most impact. CMI encompasses a suite of services aimed at providing short to medium-term evidence-based analyses of the market for a particular technology, and the identification of the leading Canadian companies who could most benefit from

involvement with NRC as a customer, co-developer or licensee for a particular technology.

- NRC will continue to extend access to research data and other types of STM information. Following up on the discussions at the [5] 2011 Canadian Research Data Summit and the creation of the infrastructure for registering Canadian research data sets, NRC will now work with Canadian data centres to identify relevant data sets and make them more accessible through links to published articles and other research outputs.

## Internal Services

The following program activity supports all strategic outcomes within this organization.

***Financial Resources ($ millions)***

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 119.4 | 122.1 | 122.9 |

***Human Resources (Full-Time Equivalent (FTE))***

| 2012–13 | 2013–14 | 2014–15 |
|---|---|---|
| 637 | 637 | 637 |

***Planning Highlights***

As NRC continues its transition to a program-based RTO in 2012-13, it will develop research programs in areas where it can deliver significant impacts to Canada's S&T priority areas. NRC's success will be sustained through sound business practices that support the needs of initiatives, activities and operations. Specifically in 2012-13, internal service priorities will be based upon key guiding principles: program-based management; focus; sustainability; communications; and efficiency.

- **Program Management:** NRC's move to a program-based management model will ensure effective administration and oversight of its research program, project and investment management processes, tools and reporting systems across the organization. Business systems will be further developed and integrated to permit real-time portfolio and project reporting for NRC executives and managers. The research program life cycle for R&D will be fully documented along with guidelines and decision-making criteria for use by NRC staff, and a methodology for 3-year performance reviews will be established to ensure a rigorous approach for R&D activity renewal or closure decisions.
- **Integrated Client Focus and Management:** NRC will continue to strengthen its business capacity and implement more effective business services to become more market-focused and generate long-term value for clients. To support increased value for its clients, NRC will focus more heavily on client needs, and implement key account management and a Client Relationship Management system to effectively manage business opportunities across all of NRC (e.g., client accounts, sales and pipelines, agreements). Internal business experts will contribute to the successful development of NRC initiatives.
- **Communications:** Activities will be guided by three main communications priorities: supporting customer engagement, managing NRC's reputation and supporting employee engagement. A key component of activities will be the continuation of integrating communications with the business function in order to better connect with Canadian industry. Particular emphasis will be placed on raising awareness and use of NRC

services through targeted promotional activities aligned with NRC's business priorities. A more focused approach will also be taken in securing coverage of NRC news and events in traditional and trade media outlets, as well as in social media platforms.

- **International Relations:** NRC will develop an international strategy to improve Canada's global competitiveness by helping Canadian industry deploy technology and access global supply chains. NRC will assist Canadian businesses to connect to global networks and key actors for development of strategic global relationships. One such example is Canada's associate membership in EUREKA, a business-driven European network of firms, universities and RTOs co-operating on near-market oriented R&D.
- **Business and Financial Management:** A new business model and financial management framework will be implemented in 2012-13 to support an increasing reliance on client revenues, as well as an outcome-based approach to research program planning, budgeting, management and reporting. Policies and business processes will be streamlined and integrated to strengthen effective support of research programs and projects, increase operational efficiencies and reduce overhead, and, most importantly, to enable research initiatives to focus on clients' and partners' needs. A new common services delivery model will be adopted to provide an integrated financial management system, reporting tools, training, and variance analyses.
- **Human Resource Management:** NRC will define roles and responsibilities for all staff within the new program-based management model, transition staff to new operational units and assist supervisors and employees to define performance expectations. NRC will also develop an approach to evaluate, monitor and build employee engagement throughout the transition process. Based on the outcome of a comprehensive needs assessment and consultations, NRC will develop a learning strategy and prioritize learning investments for the next three years. Learning activities related to competency development in areas such as financial management, project management, client service, and change management/leadership will commence in 2012.
- **Information Management Services:** NRC will strengthen its information management by undertaking several initiatives. It will develop an enterprise information architecture that identifies information components and their interrelationships. This architecture will drive the development of principles, standards and guidelines to allow NRC to effectively manage its documents and records. NRC will also pilot an electronic information working environment to demonstrate the advantages of having a single environment for document collaboration and management enterprise-wide. These initiatives will result in improved sharing and reuse of information within and across NRC research activities to foster informed and effective decision making.
- **IT Services:** Over the next two years, NRC will transition to a new IT service delivery model through Shared Services Canada (SSC). SSC will deliver and manage all networking, data centre and e-mail services while NRC will provide distributed computing and common business and research application services. Individual research units will continue to support research-specific application development services to support relevant business and research needs. This new model represents a significant change from the way NRC delivered its IT services in the past, and it is expected to provide efficient and effective IT services at lower cost.

# Section III – Supplementary Information

## Financial Highlights

The future-oriented financial highlights presented within this RPP are intended to serve as a general overview of NRC's financial position and operations. They are prepared on an accrual basis to strengthen accountability and improve transparency and financial management. More detailed future-oriented financial statements can be found on [6] NRC's Web site.

**Future-Oriented**
**Condensed Statement of Operations**
For the Year (ended March 31)
**($ millions)**

| | $ Change | Future-Oriented 2012-13 | Future-Oriented 2011-12 |
|---|---|---|---|
| Total Expenses | -46.5 | 807.2 | 853.7 |
| Total Revenues | 7.8 | 181.2 | 173.4 |
| **Net Cost of Operations** | **-54.3** | **626.0** | **680.3** |

**Future-Oriented**
**Condensed Statement of Financial Position**
For the Year (ended March 31)
**($ millions)**

| | $ Change | Future-Oriented 2012-13 | Future-Oriented 2011-12 |
|---|---|---|---|
| Total assets | -24.4 | 771.9 | 796.3 |
| Total liabilities | -15.6 | 283.4 | 299.0 |
| Equity | -8.8 | 488.5 | 497.3 |
| **Total** | **-24.4** | **771.9** | **796.3** |

## List of Supplementary Tables

The following tables are located on [7] Treasury Board of Canada Secretariat's web site:

- Details on Transfer Payment Programs (TPPs)
- Greening Government Operations
- Horizontal Initiatives
- Sources of Respendable and Non-Respendable Revenue
- Summary of Capital Spending by Program Activity
- Upcoming Internal Audits and Evaluations over the next three fiscal years

# Section IV – Other Items of Interest

## Organizational Contact Information

Questions and requests for information may be directed to:

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## Online References

[1] http://laws.justice.gc.ca/eng/N-15/index.html
[2] http://www.ic.gc.ca/eic/site/ic1.nsf/eng/00857.html
[3] http://www.tbs-sct.gc.ca/est-pre/20122013/me-bpd/info/info-eng.asp
[4] http://de-en.gc.ca/eic/site/028.nsf/eng/home
[5] http://rds-sdr.cisti-icist.nrc-cnrc.gc.ca/eng/news/data_summit.html
[6] http://www.nrc-cnrc.gc.ca/eng/reports/corporate-publications.html
[7] http://www.tbs-sct.gc.ca/rpp/2012-2013/info/info-eng.asp