National Research Council Canada

2022–23

Departmental Plan

The Honourable François-Philippe Champagne, P.C., M.P.
Minister of Innovation, Science and Industry

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From the Minister

On behalf of the National Research Council of Canada (NRC), it is my pleasure to present the 2022–23 Departmental Plan. As the country continues to recover from the COVID-19 pandemic, Innovation, Science and Economic Development Canada (ISED) and its portfolio will work closely with partners across government to build a more resilient, clean and inclusive economy that benefits all Canadians.

The NRC has supported Canada in many times of need. Once again, it was called upon to help as the country faced a global pandemic. The NRC responded by mobilizing its scientific expertise, connections, business innovation support and technological solutions to address pressing economic, social and environmental challenges. In 2022–23, the NRC will continue to advance priorities that emerged as a result of the pandemic as well as to make progress on its 5-Year Strategic Plan goals and outcomes. These efforts will enable the organization to play a vital role in supporting creative, relevant and sustainable solutions for a stronger, healthier, equitable and prosperous Canada.

To ensure a fair and equitable workplace, the NRC will continue to develop and implement key strategies to build and retain a talented, diverse and healthy workforce, address barriers and foster an inclusive, accessible and anti-racist culture.

Together with Canadians of all backgrounds and in all regions, ISED and its portfolio will continue to build a strong culture of innovation for a resilient, sustainable and inclusive economic future.

The Honourable François-Philippe Champagne
Minister of Innovation, Science and Industry
Minister of Innovation, Science and Industry Mandate Letter[i]

From the President

Throughout its 106-year history, the NRC has been a valuable resource for government in addressing Canada's priorities and needs. The COVID-19 pandemic provided enormous and varied challenges and opportunities in this regard. NRC researchers and technical staff met short-term challenges, such as manufacturing buffer for COVID-19 tests when supplies ran low and converting a research lab into a testing lab to ensure over 150 million imported N95 masks met the required protection standards. The NRC also constructed the Biologics Manufacturing Centre in Montreal to provide future capacity for vaccine and therapy production. The National Research Council Industrial Research Assistance Program (NRC IRAP) and Pandemic Response Challenge Program (PRCP) provided a wide range of support for Canadian small and medium-sized enterprises (SMEs) and research collaborators to advance pandemic solutions such as vaccines, therapies, personal protective equipment (PPE) and more.

As the impacts and urgencies of the pandemic recede, the NRC is preparing to also support the government's wider agenda. We will support the Minister of Innovation, Science and Industry's mandate letter commitments by advancing three particular national priorities for 2022–23:

- *Pandemic response and building Canada's biomanufacturing capacity*: We will continue to help Canadian companies advance vaccines, therapies, testing technologies and PPE through NRC IRAP and the PRCP; operationalize the Biologics Manufacturing Centre production of vaccines; and finish building a clinical trial facility.
- *Climate action*: Our work on climate mitigation and adaptation will include collaborating with key economic sectors to reduce emissions; enabling low carbon transportation and shipping through battery and fuel cell development, supply chain expansion and advanced manufacturing support; and advancing net-zero emissions and low carbon construction through developing building and energy codes for climate resiliency.
- *Digitalization and the Internet of Things*: We will advance quantum sensor and quantum computing innovation and commercialization in Canadian companies as well as revitalize the NRC's Canadian Photonics Fabrication Centre in support of industrial compound semiconductor research, testing and prototyping.

These priorities are set against the backdrop of our current 5-Year Strategic Plan (2019-2024),[ii] intended to advance knowledge, support government policy mandates and foster business innovation across research disciplines and industries. Two important focuses in 2022–23 are:

- *Equity, diversity and inclusion*: We are committed to advancing diversity in our workforce, addressing barriers to inclusion, supporting career development and creating an accessible work environment for all. Through our programs and collaborations, the NRC will encourage the diversity and inclusiveness of the larger innovation ecosystem.
- *Collaboration and partnerships*: We will continue to collaborate in novel ways with academia, industry, other government departments, Indigenous communities and international partners to advance research excellence and accelerate innovation to address national priorities. In particular, we will add four new Challenge programs to our mission-oriented Challenge suite: Aging in Place, Applied Quantum Computing, Arctic and Northern, and Quantum Sensors. We anticipate working with around 850 university collaborators and business clients through our labs and supporting 8,000 SMEs with advancing their innovation projects through NRC IRAP.

The NRC team looks forward to working with our employees, collaborators and partners in the private sector, government and universities and colleges on achieving this important agenda in 2022–23.

Iain Stewart
President, National Research Council Canada
Mandate Letter for NRC President[iii]

Plans at a glance

The NRC has a strong foundation to build on: talented researchers across a range of sectors; deep knowledge of the business landscape; a wide network of collaborators from academia, industry and government; publicly owned research facilities across Canada; and a broad mandate on scientific and industrial research that allows mobilization in support of public interest.

The NRC's 5-Year Strategic Plan, which is in its third year of implementation, will continue to frame the organization's strategic science and research direction to effectively support the next wave of business development in Canada. The NRC will continue to pursue and advance research excellence and innovation, leveraging its research and development (R&D) expertise, skills, facilities and tools to achieve maximum impact and benefits for Canadian. It will enable the big, bold ideas burgeoning in national and international research communities and markets, which will spur jobs and growth in sectors critical to Canada's future success. Key priorities for 2022–23 include climate adaptation and mitigation, health innovation and biomanufacturing, development and application of emerging digital technologies, and continued support for Canada's economy.

Scientific and technological knowledge advances

To tackle climate change and create a more sustainable economy, NRC research will focus on reducing the environmental footprint in the construction, mining, energy and transportation sectors; advancing clean technologies; developing building codes for climate resiliency; integrating firefighter and first responder safety into the National Building Code of Canada; and helping develop and deliver a net-zero roadmap for the concrete industry.

To advance the goals of the Pan-Canadian Artificial Intelligence Strategy, the NRC will develop artificial intelligence (AI) and digital technologies for use in advanced manufacturing, aviation innovations and coastal infrastructure. It will also enhance its capabilities in support of a National Quantum Strategy to grow Canadian quantum research, technologies, companies and talent. Finally, the NRC will continue to represent Canada in astronomical endeavours on a national and international scale, maintaining the country's strong standing in the field.

As a dynamic and adaptable national R&D organization, the NRC will bring leading-edge technologies and processes to business, academia and government through its collaborative platforms such as Collaboration centres[iv] and Ideation Fund[v] projects. The NRC will continue to develop the next generation of NRC research leaders and encourage a more diverse organization through targeted actions to include more women, youth, Indigenous peoples, persons with disabilities and visible minorities among its employees, clients and collaborators.

Innovative businesses grow

Through NRC IRAP, the NRC will continue to enable Canadian wealth through innovation by supporting high-potential SMEs to grow to scale and establish global brands. By streamlining

processes, tools and program delivery, NRC IRAP will make it easier for innovative firms to access its services. The NRC will continue to support Canadian SMEs developing health innovations and be on the frontlines of Canada's response to COVID-19. It will also build Canada's future biomanufacturing capacity for vaccines and therapies by operationalizing the Biologics Manufacturing Centre.

The NRC will support the Minister's mandate to reinforce Canada's leadership in photonics research, testing and prototyping, crucial to the country's supply of electronics and photonics chips. It will help the photonics industry bring innovative technologies to market as it modernizes its fabrication facilities, including the Canadian Photonics Fabrication Centre.

Evidence-based solutions inform decisions in government priority areas

The NRC has a proven track record in developing and implementing new collaborative approaches such as its Supercluster support programs[vi] and mission-oriented Challenge programs.[vii] With the NRC as a convener, collaboration with academia, industry, OGDs, Indigenous communities and businesses, and international partners will continue to be key in addressing significant national priorities such as climate change adaptation and mitigation; health and the aging population; AI, digital and quantum science; and issues affecting remote and rural communities.

The NRC will drive collaborative climate action research and technology development in areas such as food and water safety, infrastructure resiliency, low carbon fuels and transportation and carbon-neutral construction. These efforts will help the NRC make progress on its first Departmental Sustainable Development Strategy and support the United Nations Sustainable Development Goals.

Effective delivery of internal services

To continue adapting to the new ways of working that the pandemic forced it to adopt, the NRC will leverage and modernize its common and corporate services to support research and business innovation, collaboration and program execution.

The organization will enhance its IT infrastructure, continue work related to its research facilities review, modernize security controls and improve its intellectual property (IP) licensing and commercialization processes. To promote a workplace culture built on integrity, respect, creativity, excellence and inclusivity, the NRC will improve its values, ethics, conflict resolution and research integrity processes and deliver key Human Resources initiatives to support employee well-being and mental health; equity, diversity and inclusion; and talent attraction and development.

For more information on the National Research Council's plans, see the "Core responsibility: planned results and resources, and key risks" section of this report.

Core responsibility: planned results and resources, and key risks

This section contains information on the department's planned results and resources for each of its core responsibilities. It also contains information on key risks related to achieving those results.

Science and Innovation

Description

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

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

1. Scientific and technological knowledge advances;
2. Innovative businesses grow; and
3. Evidence-based solutions inform decisions in government priority areas.

Planned commitments for 2022–23 are guided by the five areas of strategic focus in the NRC's 5-Year Strategic Plan: enabling a more sustainable economy, supporting a healthier future, innovating the everyday, creating Canadian wealth through innovation, and understanding our world.

Planning highlights

Departmental Result 1: Scientific and technological knowledge advances

As the government's largest R&D organization, the NRC has the expertise and resources to undertake impactful research resulting in publications, patents and commercialization of technology, as well as to support the next generation of talent in science, technology, engineering and mathematics (STEM).

Tackling climate change

R&D plays an essential role in generating made-in-Canada solutions to meet climate change objectives. The NRC will continue to dedicate research on new technologies and approaches that lead to a more sustainable and environmentally friendly future for Canada. To support the Minister's mandates to advance clean technologies, implement a Net Zero Accelerator Initiative and align standards for climate-resilient buildings with national climate objectives, the NRC will:

- Develop the Low Carbon Built Environment initiative as a national platform for the adoption of life cycle carbon as a measure of greenhouse gas (GHG) emissions. Repurposed and recycled products are expected to stimulate new business waste management, helping

Canada to become a leader in the design, manufacture and delivery of low carbon assets in the built environment.

- Co-lead the National Battery Innovation Strategy, under the Advanced Clean Energy program,[viii] to develop the Canadian battery supply chain with a focus on battery energy storage materials and devices, including solid state battery testing in collaboration with Natural Resources Canada (NRCan) and the Office of Energy Research and Development. Under the program, the NRC will also continue high-impact research in low carbon fuel production and use from waste feedstocks and carbon capture, utilization and storage (CCUS) technologies; and develop hydrogen standards/codes in life cycle analysis and hydrogen production/distribution for the next generation of zero-carbon fuels from renewable sources.
- Work with NRCan on the development of model building codes and standards for climate-resilient buildings, with the goal of publishing a net-zero emissions building code and model retrofit code by the end of 2024; and work to amend the National Building Code of Canada to specify firefighter and first responder safety, including the development of strategies for incentives, training programs and pilot initiatives.

To help accelerate Canada's transition to a competitive and sustainable low carbon economy, and support the green transformation of key industrial sectors such as aerospace and transportation, the NRC will:

- Contribute to clean and energy efficient technologies related to aerodynamics, alternative fuel batteries, electrical machines and hydrogen applications, and help fleet operators deploy zero emission vehicles. Priorities for this work are guided by 2020–21 internal and external consultations for the Clean and Energy-efficient Transportation program.[ix]
- Reduce GHG emissions in aviation, under the Low-emission Aviation program,[x] through early prototyping of a high-voltage battery propulsion system to enable electrification of aircraft and research to enable hydrogen combustion as an alternative fuel.
- Support the Canadian Critical Minerals Strategy, through the High-efficiency Mining program,[xi] by exploring the potential for a National Sensor Hub in Mining, expanding licensing activities for technologies developed, and building upon key mining-related technologies to make operations safer, more productive and sustainable. The NRC will also launch clean transportation projects including repair and overhaul of rail hopper cars using cold spray additive manufacturing technology, and expansion of the Train Derailment Impact Map and Analytics tool for possible road applications.

Advancing digital technologies to solve real-world problems

The NRC will continue to leverage its extensive expertise in digital technologies and AI to develop smarter and more intuitive and sustainable solutions to challenges in advanced manufacturing, autonomous flight and coastal infrastructure, by:

- Developing novel methods for a range of emerging technologies, including AI, quantum algorithms and applications, human computer interaction, robotics and vision for autonomous systems, and cybersecurity. The NRC will also develop patents for its next-generation 3D printing technologies and advance cyber physical systems, high fidelity modeling and AI with the goal of achieving sustainable manufacturing processes.
- Collaborating with Transport Canada to assess the performance of "Detect and Avoid" solutions for drones to enable deployment beyond the visual line of sight. The NRC's Bell 205 aircraft will evaluate technologies in intercept scenarios with other NRC aircraft, with the longer-term goal of completing multiple coordinated flights to collect data to determine if the technology meets requirements for safe long-range drone operation.
- Continuing work on iceberg drift forecasting and the incorporation of machine learning to augment physics-based models, and collaborating with the University of Waterloo to develop a long-term AI model to forecast sea ice freeze-up and break-up timing. The NRC will also implement a web-based open platform for its Canadian Arctic Shipping Risk Assessment System.[xii]
- Equipping the Canadian Coast Guard vessel, *Henry Larsen*, with a suite of sensors to further develop NRC algorithms for maritime autonomous surface ships; and continuing physical tests of autonomous vessel models, sensors and algorithms to inform decision making and improve autonomous technologies, including ice-related detection technologies, forecasts, route planning and vessel operation.

With revolutionary nanoscience and measurement capabilities that will enable Canada's future economic prosperity, the NRC will deliver leading microscopy innovations, cutting-edge nano-enabled solutions and accurate and reliable measurement services. The NRC will:

- Continue to develop the NanoMi[xiii] Open Source platform for transmission electron microscopy to provide cheaper and more powerful instrumentation to Canadian academia and industry. The NRC will work with multiple Canadian universities to refine and adapt NanoMi hardware to enable easier use in R&D applications and potential avenues for piloting its use in remote and Indigenous community colleges.
- Launch a new collaboration in nanomaterials and nano-enabled sensors with Waterloo's Institute of Nanotechnology; and collaborate with Defence Research and Development Canada to advance technologies for nano-enhanced ceramics in armour applications.
- Enable a strong and secure Canadian measurement system by advancing and maintaining primary national realizations of the System of Units (SI); providing the Canadian marketplace with reliable access to traceable measurements; and helping establish a common framework for the digital SI, and shaping joint research priorities and the direction of the National Metrology Institute community.

Supporting Canada's astronomy community

An authority on astronomy and astrophysics, the NRC maintains Canada's largest national observatories and represents Canada in leading global astronomy initiatives. The NRC will continue to support research that aligns with the needs of the Canadian astronomy community and contributes to Canada's position as a world leader in the field, by:

- Participating in a two-year cooperation agreement with the SKA (Square Kilometre Array) Observatory and delivering "the brain" behind one of the world's largest networks of radio telescopes.
- Supporting the Canadian Space Agency in advancing the Cosmological Advanced Survey Telescope for Optical and UV Research (CASTOR) as a Canadian-led international space mission.
- Advancing instrumentation projects for international telescopes such as the Atacama Large Millimetre-submillimetre Array (ALMA) and Gemini telescopes.
- Completing upgrades to domestic telescopes at the Dominion Astrophysical Observatory (DAO) and Dominion Radio Astrophysical Observatory (DRAO).

Increasing equity in STEM

The NRC believes that advancing diversity and inclusiveness in the workplace helps bring insights from the many different perspectives needed to address the complex challenges facing Canadians and to create better opportunities for everyone. The NRC will:

- Continue to implement its student programs to build a diverse STEM pipeline, including opportunities for students, post-doctoral fellows and research associates.
- Expand staffing advertisements to reach broader and more representative audiences, shape job posters to be more inclusive, and design recruitment campaigns and communications material that better reflect and attract diverse talent.
- Introduce executive sponsoring of diverse talent with supporting tools/practices.
- Make self-declaration and self-identification questionnaires more inclusive.
- Regularly track, monitor and report on equity, diversity and inclusion (EDI) indicators.
- Build Indigenous STEM capacity and student recruitment opportunities through initiatives under the NRC's Indigenous Engagement Network.

The National Killam Program

In 2021–22, the National Killam Program was transitioned from the Canada Council for the Arts to the NRC. The program, which is open to Canadian scholars in the engineering, natural sciences, health sciences and social sciences and humanities, features the Killam Prize to recognize and celebrate inspiring scholars and thought leaders, and Killam Research Fellowships to support outstanding scholars carrying out ground-breaking projects. In its redesign of the fellowships, to be relaunched in spring 2022, the NRC will engage experts in government, academia and the private sector to help shape a renewal of the program.

Supporting collaborative, transformative research

Through pan-Canadian networks and collaborations with universities and research organizations in Canada and abroad, the NRC will continue to explore opportunities that encourage collaborative research in areas of importance to Canada. Collaboration centres help develop internationally recognized expertise in specific fields to amplify the impact of science and engineering, encourage collaboration and leverage funding to pursue research excellence.

The NRC will also continue to support collaborative research through its Ideation Fund projects with universities and SMEs to encourage, test and validate transformative research ideas. Round four of the New Beginnings and Small Teams initiatives are expected to launch between May and June 2022. The NRC has undertaken internal consultations and reviews to improve the success rates of applicants for continuous improvement to simplify processes and funding agreements.

Departmental Result 2: Innovative businesses grow

The NRC's scientific and industrial expertise and support enables its partners to accelerate commercial development and advance research that leads to scientific breakthroughs and innovation. Using its national funding program, the NRC supports industry by providing advice, connections and funding to help Canadian businesses develop capacity, scale-up and expand to international markets.

Creating Canadian wealth through innovation

NRC IRAP will enhance its support to innovative businesses by improving its processes, delivery mechanisms and frameworks, facilitating student placements and collaborating with other government departments (OGDs) to solve pressing challenges. Specifically, NRC IRAP will:

- Create and refine tools to better support program delivery, explore further use of digitalization and advance the Enterprise Roadmap to optimize the client journey.
- Continue to improve its Large Value Contribution Framework, which integrates robust selection criteria with an expanded approach to identify and develop value-added services that address gaps and challenges faced by SMEs during scale-up, including addressing the economic impact of COVID-19.
- Continue to provide support to Employment and Social Development Canada's Youth Employment and Skills Strategy, through placing graduates within SMEs to improve young professionals' access to quality employment in their field of study.
- Continue to collaborate with Innovative Solutions Canada (ISC) and other partner organizations, such as Health Canada, Public Health Agency of Canada, Environment and Climate Change Canada (ECCC), and Public Services and Procurement Canada, to sponsor and support Canadian SMEs to help solve challenges including innovative solutions for COVID-19.

Crucial to Canada's supply of electronics and photonics chips, the NRC's Canadian Photonics Fabrication Centre[xiv] (CPFC) offers foundry services to allow the Canadian photonics industry to take innovations from concept to market. The NRC will leverage Budget 2021 funding to modernize its fabrication facilities including the CPFC and Advanced Technology Fabrication facility. In addition to helping address critical supply chain vulnerabilities, equipment upgrades will enable the NRC to maintain a strong scientific position in quantum and semiconductor photonics as the facilities will provide an end-to-end solution from basic research to technology deployment. The NRC will also leverage current ISC challenges for nanomaterial fabric production and single-photon detection to support development and commercialization of materials and to explore opportunities in the newly announced quantum technology stream.

Supporting pandemic response and building Canada's biomanufacturing capacity

Following the global COVID-19 pandemic declaration in March 2020, the NRC pivoted quickly to support the government's response to help protect the health and safety of Canadians. The pandemic emphasized the need for increased domestic biomanufacturing capacity and innovative solutions to health challenges. To advance health technologies and solutions, the NRC will:

- Operationalize the Biologics Manufacturing Centre (BMC) to deliver a biologics production capacity of up to 4000L/month, complete the design of its governance and operational model for long-term sustainability, and collaborate with ISED and key players to align the BMC governance role within Canada's biomanufacturing and life sciences strategy.
- Advance rapid protein production, pilot the use of a pool approach for COVID antigens, and improve the scalability of the CHO expression platform by improving engineering aspects of the bioreactor environment.
- Advance development of the HEK293SF-3F6 platform to create robust processes for next-generation cells, including cell line packaging, and gene therapy vector applications.
- Continue NRC IRAP support for innovative SMEs to bring novel COVID-19 technologies to market.

Strengthening international partnerships and collaboration

International partnerships accelerate the pace of innovation and SME growth, which is why the NRC will continue to find ways to link Canadian and international R&D capabilities and strengthen global partnerships and collaboration.

- NRC IRAP will continue to support the growth of client exports and increased SME integration into global value chains through international research calls, connections to other economies and the administration of the CanExport Program with Global Affairs Canada.
- As Canada's Eureka Secretariat, the NRC will seek renewal of its membership in the network of 40+ economies, an established platform for international SME co-innovation. 2022–23 will mark the 10-year anniversary of Canada's membership, which has helped

Canadian SMEs grow and scale-up, including successfully facilitating client access to key markets, partners and technologies.

- Working with the University of Alberta (UofA) and Heidelberg Instruments of Switzerland, the NRC will develop new R&D collaborations in atom-scale fabrication, leveraging the UofA/NRC Nanofrazor facility – the second of its kind in North America and the only one in Canada.
- The NRC will refine a prototype frazil ice facility by establishing final design and operating procedures, complete its first client project with Électricité de France, and market the facility's capabilities in Canada and internationally.

Departmental Result 3: Evidence-based solutions inform decisions in government in priority areas

The NRC has a long history of responding to national needs and helping meet government objectives in times of crisis – and of prosperity – by reinforcing the importance of science-based advice and world-class collaborative research. The NRC will continue evolving to better meet government priorities, including through new strategic platforms, innovative approaches to collaboration and renewed strategic focus on national priorities.

Advancing national priorities through collaboration

Collaborative R&D Programs bring together the NRC's national network of researchers and facilities with academia, industry and OGDs to work on scientific discoveries and technological breakthroughs in critical areas for Canada. NRC Challenge programs, established in 2018–19, will continue to advance projects in priority areas:

- Disruptive Technology Solutions for Cell and Gene Therapy: Advance a made-in-Canada CAR T[1] product to clinical trials, validate a lead gene therapy candidate and demonstrate the utility of program tools and platforms in the development of new therapeutic candidates for improved health outcomes.
- Materials for Clean Fuels: Continue to develop novel materials for renewably powered CO_2 conversion and hydrogen production into fuels and chemical feedstocks, by supporting other cross governmental initiatives such as the national hydrogen and CCUS strategies and collaborating with leading researchers in Germany and Japan.
- High-Throughput and Secure Networks: Continue to develop innovative technologies for secure, affordable high-speed internet services in rural and remote communities while, over time, increasing focus on higher TRL (technological readiness level) projects with industry collaborators to enable commercialization.

[1] CAR T cell therapy (Chimeric antigen receptor T cell therapy) is a type of treatment in which a patient's T cells (a type of immune system cell) are changed in the laboratory so they will attack cancer cells.

- Artificial Intelligence for Design: Launch a third wave of projects to develop AI technologies and capabilities for the acceleration and discovery of R&D and innovation processes by advancing algorithms, methods and datasets.

Key projects and innovations from the Pandemic Response Challenge program (PRCP), such as contactless sensing and genetic sequencing, will be transferred to other NRC programs, the public domain and the private sector. Project research findings will be published in high-impact journals and venues.

In addition, the NRC will continue to develop or launch four new Challenge programs:

Aging in Place	Applied Quantum Computing
Building on the 2021–22 program launch, new collaborative projects will support a sustainable model for innovative long-term care that increases quality of life for older adults and their caregivers. Constructed around four research pillars—safety, health, connection and standards—the program will support safe and healthy aging and enable nursing homes to concentrate on older adults with the highest needs while reducing costs to the Canadian health care system.	The program launch in 2022–23 will involve the initial hiring of researchers, building relationships with collaborators, and preparing the first wave of projects. The program will align with the National Quantum Strategy, which will amplify Canada's significant strength in quantum research; grow the country's quantum-ready technologies, companies and talent; and solidify Canada's global leadership in this area.
Arctic and Northern	**Internet of Things (IoT): Quantum Sensors**
With an expected launch in 2022–23, the program's funding and scientific expertise in housing, health, food and water will help support strong and sustainable Northern communities. Applied technology and innovation in Northern-led research projects will focus on Northern capacity building.	Set to launch in 2022–23, the program will begin research activities with the goal of developing a disruptive generation of quantum sensors. Projects that bring together government, academic and business researchers will be established and launched in 2023–24.

NRC Supercluster support programs[xv] build scientific expertise and strong collaboration with innovators in both industry and academia to support ISED's Innovation Superclusters Initiative. In 2022–23, the NRC will continue work under its Supercluster support programs to develop and scale high-potential technologies in advanced and digital manufacturing, AI, health care, bioscience, clean resources, infrastructure, and transportation.

Supporting a healthier future through collaboration

The NRC conducts important collaborative research for the benefit of Canadians in vaccines and therapeutics, microfluidics and bioscience, sustainable aquaculture and ocean health, and Northern agriculture. To advance leading-edge technologies, the NRC will:

- Partner with OGDs and research institutions to develop made-in-Canada vaccines and therapeutics for emerging infections and rare Canadian genetic disorders, establish collaborative projects on rare diseases, explore therapeutics from bench to biomanufacturing, and identify early therapeutic candidates through the Collaborative Unit for Translational Research.

- Support continued development of NRC COVID-19 antigen platforms using rapid production technologies for next-generation COVID-19 vaccine applications, license a multifunctional biologic against COVID-19 to an industrial partner, and support preclinical development and technology transfer up to the clinical trial stage.
- Strengthen collaborations with the University of Toronto and hospitals to accelerate the translation of microfluidic devices to health care as part of collaborative projects funded under the Centre for Research and Applications in Fluidic Technologies (CRAFT), and develop Canada-first models for technology accelerator groups in microfluidics (Canada-on-a-Chip) and virtual care (V-Care).
- Leverage expertise in marine bioresources and algal technologies for research in biosensing technologies to monitor the health of ocean environments, bioprospecting and value-added marine products, and novel feed sources for sustainable aquaculture.
- Foster strategic relationships with academic, industry, OGD and Indigenous partners in Northern agriculture, and develop a controlled environment model test facility for evaluation of novel technologies and concepts for deployment in Northern and isolated communities, and integrate engineering and plant biotechnology to optimize crop production in controlled environments as well as model nutrient sequestration and drought resiliency to study the impact of climate change on Canadian agriculture environments.

Driving a more sustainable economy through collaboration

The NRC is well-positioned to support the shift to a sustainable economy with science and technology expertise related to areas that heavily influence sustainability, including low carbon fuels and transportation, food and water safety, the circular economy, resilient infrastructure and carbon-neutral construction. Conducting this research in its labs and in collaboration with OGDs, international partners and Indigenous communities and businesses, the NRC will:

- Continue to develop world-class expertise in particulate emission measurements, working with Transport Canada and international partners towards cleaner and more sustainable fuels.
- Develop measurement capabilities and reference materials for cyanobacterial toxins, which are an increasing concern for drinking water supplies due to climate change; and work with ECCC and NRCan to advance the IoT platform for environmental sensing of water, building on participation in the Global Environmental Measurement and Monitoring initiative.
- Collaborate with Agriculture and Agri-Food Canada to advance new nanotechnology solutions for the food sector that assess safety and advance technology readiness of a rapid detection sensing platform for pathogens and food safety. The NRC will also contribute to the circular economy[2] by supporting the development of sustainable food packaging technologies through collaboration in the innovation ecosystem in Winnipeg, Manitoba.

[2] The circular economy retains and recovers as much value as possible from resources by reusing, repairing, refurbishing, remanufacturing, repurposing or recycling products and materials.

- Foster international collaboration to develop guidelines and share best practices for resilient Building Codes; and establish and support international collaboration through the International Council for Research and Innovation in Building and Construction, a nature-based solution for climate-resilient buildings and communities.
- Collaborate with the First Nation Radon Mitigation Company to complete a passive radon stack field study in the Kitigan Zibi Anishinabeg First Nation Community; and enable development and revisions of national standards related to HVAC (heating, ventilation and air conditioning) and radon control products in support of market access and adoption of innovative products.

Gender-based analysis plus (GBA Plus)

The NRC has integrated GBA Plus into many areas of its operations to assess the potential impacts of its policies, programs and initiatives on diverse groups. The intent is to use the framework to help build an inclusive approach from ideation to outcome measurement.

The NRC has integrated GBA Plus and EDI approaches into a large cross-section of its day-to-day thinking and operations. Organizational activities, research directions and NRC IRAP initiatives that will continue in 2022–23 include:

- Monitoring and tracking statistics on under-represented groups, as well as women in STEM, supported by a streamlined set of EDI standards and performance indicators.
- Incorporating EDI and GBA Plus in Ideation, Challenge and Supercluster support programs and project proposals to increase the impact of research on and by diverse groups.
- Continuing to evolve NRC IRAP's client-focused initiatives to help remove barriers to growth for firms led by under-represented groups, by:
    - providing targeted support through its Contribution to Organization funding mechanism;
    - developing tools to support SMEs in assessing, developing and implementing a plan to foster the progression of their EDI maturity journey; and
    - continuing to amplify recruitment activities to attract, retain and advance a more diverse workforce, leveraging modern recruiting tools and marketing techniques, while refining organizational design to meet evolving program delivery requirements to further support an empowered world-class workforce.

United Nations' 2030 Agenda for Sustainable Development and the UN Sustainable Development Goals (SDGs)

In its third year of implementation, the NRC's Departmental Sustainable Development Strategy (DSDS)[xvi] outlines how the organization will contribute to 6 of the 13 long-term goals identified in the Federal Sustainable Development Strategy,[xvii] including efforts in NRC labs and facilities, collaborations with OGDs, and fee-for-service research with industry partners. Planned activities for the coming year under these six goals that will help the NRC contribute to UN SDGs include:

- SDG 7: Ensure access to affordable, reliable, sustainable and modern energy:[xviii] Evolve NRC activities in bioenergy to focus on converting low-value waste feedstocks for the production of low carbon fuels with reduced or zero emission life cycles, and use the NRC's smart grid facility to de-risk clean technologies and train operators for deployment in remote and Indigenous communities to stimulate sustainable and diverse economic growth.
- SDG 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation:[xix] Enable asset owners to incorporate life cycle carbon and total cost of ownership into their procurement decisions to help lower their carbon footprint and costs, analyze clean technology inventions by Canadian and global researchers and corporate institutions to better understand the clean technology landscape in Canada; reduce environmental impact of waste treatment in the North and support more reliable water and wastewater systems by demonstrating a bioelectrochemical wastewater treatment system, and collaborate with the United Kingdom Catapult Centre to develop satellite-based structural health monitoring technologies to improve the resilience and carbon footprint of new and existing infrastructure.
- SDG 11: Make cities inclusive, safe, resilient and sustainable:[xx] Develop new technologies and update standards and guidelines under the Addressing Air Pollution Horizontal Initiative with respect to indoor air quality; continue to monitor, risk manage and/or remediate the NRC's identified contaminated sites to reduce potential environmental and human health risks; lead an international research consortium on reducing the risk of viral contagion from airborne transmission of pathogens within building spaces through the Eureka Network project; undertake research and collaborative activities to help address the spread of COVID-19 and reduce airborne hazards in buildings; and foster interdepartmental communication with Indigenous Services Canada to share research findings on how to reduce airborne hazards and improve indoor air quality in buildings.
- SDG 12: Ensure sustainable consumption and production patterns:[xxi] Support the transition to a low carbon economy through green procurement or procurement of goods and services with a reduced environmental impact, and deliver a life cycle inventory of highest emitter building material products and life cycle analysis building guidelines to enable government partners to meet new Treasury Board Secretariat green procurement requirements.
- SDG 13: Take urgent action to combat climate change and its impacts:[xxii] Continue to lower emissions through the optimization of facility management and carbon awareness, continue implementation of measures to support the NRC's sustainable development strategy and greening government activities such as development of a National Waste Management Plan, renew the cogeneration system turbine engine and control system, and advance carbon-neutral plans for identified NRC facilities.

Experimentation

The NRC Finitiative project aimed to simplify internal processes to make it easier to do business within the organization. In 2022–23, the NRC will use project findings to inform the

development of tools and processes to improve project execution, delivery and monitoring, capacity planning, and streamlining of client-driven service projects. The NRC will also implement optimized hiring and onboarding processes from Finitiative, as well as review and simplify client engagement and material management processes to reduce administrative tasks. This will be done through employee and internal client engagement to standardize processes and integrate research project management processes.

The NRC will continue to explore opportunities to expand its TimeLink services to other areas of the country to provide more accurate, secure and reliable time. (TimeLink is a remote time system that can maintain the official time for Canada down to the nanosecond.) In 2022–23, the NRC will advance efforts to deploy TimeLink at Shared Services Canada (SSC) Enterprise Data Centres so that TimeLink can be adopted as the standard time source for SSC networks and clients. The NRC will also complete the setup of TimeLink at the NRCan Inuvik Satellite Station Facility and NRC Victoria to expand the reach of and quality of TimeLink services.

Building off the NRC IRAP pilot programs established in 2019–20 with the Business Development Bank of Canada (BDC) and the National Bank, NRC IRAP will explore and test collaboration efforts with the BDC for expansion of the client referral process and common client support.

Key risks

The NRC is exposed to a range of economic, social, technological, legal and environmental factors that have the potential to impact its ability to achieve results in support of its core responsibility. Competition for knowledge and scarce resources, accelerating industry transformations, cybersecurity threats and climate change are examples of external forces creating uncertainty for the NRC as an organization, the research it conducts and the businesses it supports. In consideration of its risk context and operating environment, in 2022–23 the NRC will focus on corporate risks related to the evolving pandemic, security threats and competition for highly skilled talent. With each subsequent risk cycle, the NRC continues to make process improvements, such as broadening internal stakeholder engagement and embedding risk management tools and best practices at various levels within the NRC.

Planned results for Science and Innovation

The following table shows, for Science and Innovation, the planned results, the result indicators, the targets and the target dates for 2022–23, and the actual results for the three most recent fiscal years for which actual results are available.

Departmental Result	Performance Result Indicator	Targets	Date to achieve target	2018–19 Actual results	2019–20 Actual results	2020–21 Actual results
Scientific and technological knowledge advances	Citation score of NRC-generated publications relative to the world average	Greater than 1.40	March 31, 2023	1.51	1.38	1.38
	Number of peer-reviewed publications generated by the NRC	Greater than 975	March 31, 2023	1,030	1,003	1,090
	Number of patents issued to the NRC	Greater than 100	March 31, 2023	156	173	118
	Number of licence agreements	Greater than 40	March 31, 2023	31	37	54
	Ratio of the NRC's workforce made up of underrepresented groups relative to Canadian average labour market availability in STEM[3]	Greater than 1.00	March 31, 2023	1.02	1.01	1.02
Innovative businesses grow	Percentage of R&D clients who report positive benefits of working with the NRC	Greater than 86%	March 31, 2023	90%	92%	87%
	Percentage revenue growth of firms engaged with the NRC (NRC IRAP-engaged firms)[4]	Greater than 20%	March 31, 2023	27%	31%	32%
	Percentage growth in Canada's science and technology related jobs through NRC supported firms (NRC IRAP-engaged firms)[4]	Greater than 10%	March 31, 2023	18%	20%	20%
	Revenue earned from clients and collaborators	Greater than $85.0M	March 31, 2023	$79.7M	$88.5M	$65.1M
Evidence-based solutions inform decisions in government priority areas	Revenue earned from other federal government departments	Greater than $75.0M	March 31, 2023	$93.1M	$77.7M	$76.4M
	Number of NRC peer-reviewed publications co-authored with other federal government departments	Greater than 50	March 31, 2023	35	51	62

The financial, human resources and performance information for the National Research Council's program inventory is available on GC InfoBase.[xxiii]

[3] The target and results in the table are focused on the workforce representation of women. Internal targets for the other employment equity groups will be set as part of the NRC's annual target setting process and results will be reported through the Departmental Results Framework footnotes of the NRC's Departmental Results Reports. Results for Aboriginal peoples (Indigenous) were 0.44 in 2020–21 and 0.38 in 2019–20. Results for persons with disabilities were 0.33 in 2020–21 and 0.27 in 2019–20. Results for members of visible minorities were 0.99 in 2020–21 and 0.95 in 2019–20. 2018–19 results are based on 2011 census data; 2019–20 and 2020–21 results are based on 2016 census data.

[4] Measured over a period of two calendar years and lagging by two years.

Planned budgetary spending for Science and Innovation

The following table shows, for Science and Innovation, budgetary spending for 2022–23, as well as planned spending for that year and for each of the next two fiscal years.

2022–23 budgetary spending (as indicated in Main Estimates)	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
1,290,738,548	1,290,738,548	1,235,005,171	1,126,292,353

Financial, human resources and performance information for the National Research Council's program inventory is available on GC InfoBase.[xxiii]

Planned human resources for Science and Innovation

The following table shows, in full-time equivalents, the human resources the department will need to fulfill this core responsibility for 2022–23 and for each of the next two fiscal years.

2022–23 planned full-time equivalents	2023–24 planned full-time equivalents	2024–25 planned full-time equivalents
3,417.8	3,420.8	3,317.9

Financial, human resources and performance information for the National Research Council's program inventory is available on GC InfoBase.[xxiii]

Internal Services: planned results

Description

Internal services are the services that are provided within a department so that it can meet its corporate obligations and deliver its programs. There are 10 categories of internal services:

- management and oversight services
- communications services
- legal services
- human resources management services
- financial management services
- information management services
- information technology services
- real property management services
- materiel management services
- acquisition management services

Planning highlights

Managing talent and resources effectively

Each year, the NRC implements key corporate initiatives and strategies to support the effective management and strategic positioning of the organization. By reinforcing excellence, the NRC will continue to improve its internal service delivery to support workforce development and enable continued delivery of results.

In 2022–23, the NRC will continue to implement Human Resources initiatives to support employee well-being and mental health, EDI and talent attraction and development.

- In year two of its Wellness Strategy, the NRC will create and maintain a Wellness Ambassadors Network to support the NRC Wellness Champion and promote wellness initiatives across Canada, continue to implement wellness training with a focus on mental health, support and enable employee-led wellness activities and communities, and regularly monitor and report on wellness performance indicators and implementation of the Wellness Strategy and programming.
- Implementation of year two initiatives for the refreshed NRC Workforce and Workplace EDI Strategy will include inclusive recruitment training for hiring managers and Human Resources practitioners, development of an initiative to prioritize members of designated employment equity groups through an NRC aspiring management repertoire, forums for dialogue and learning and promotion of EDI and anti-racism resources, and continued work to meet requirements of the *Accessible Canada Act* and *Pay Equity Act*.

- The NRC will develop and implement a multi-faceted Talent Attraction Strategy and well-defined value proposition for recruitment, and continue to improve the process for identifying and supporting high-potential employees across the organization.

Aligned with the Truth and Reconciliation Commission Calls to Action, in 2021–22 the NRC began developing a strategic framework to build intercultural competency and improve Indigenous participation in the STEM workforce as a first step towards long-term relationships with First Nation, Métis and Inuit communities. Two mobilizing bodies were formed to support the framework: an Indigenous Engagement Network and an External Advisory Committee on Indigenous Engagement and Culture. The NRC will also identify opportunities and challenges related to the Indigenous Procurement Strategy, in which five percent of NRC procurement spending is directed to Indigenous businesses.

In 2022–23, the NRC will continue to improve its values, ethics, conflict resolution and research integrity processes, by:

- Continuing to implement its new Policy on Conflict of Interest, including delivery of training sessions and review of declarations in the new system.
- Delivering additional tools, guidelines and training in support of the new Policy on Workplace Harassment and Violence Prevention and Resolution.
- Creating capacity on the Research Ethics Board to review protocols involving Indigenous research and develop NRC policy on Indigenous research ethics.

The impact of the pandemic on security operations has required continued adaptions for security protocols. In 2022–23, the NRC will continue to improve the screening risk analysis program, enhance internal security training and education, improve processes and systems to monitor and manage access to laboratories and sensitive areas, and support the identification, recording and control of sensitive inventories.

Leveraging the NRC's three-year review of research facilities completed in early 2021–22, the NRC will continue to assess, upgrade and renew its facilities, by:

- Reviewing and implementing recommendations for potential upgrades and improvements to research facilities.
- Establishing a prioritization framework for potential investment projects and exploration of funding opportunities to acquire or access state-of-the-art facilities.
- Continuing to engage in four Laboratories Canada science hubs (Atlantic Science Enterprise Centre, Regulatory and Security Science, Terra Canada, and Transportation Safety and Technology Science) to secure new collaborative facilities and equipment for enhanced interdisciplinary research.

IP plays a key role in research excellence and in recognizing the commercial benefits of R&D efforts. In 2022–23, the NRC will launch NRC IRAP's IP Assist to deliver support services to

SMEs for the protection (including cybersecurity support), monetization and commercialization of their IP. The NRC will also improve the management of its own IP, including rolling out and communicating the NRC IP Strategy to research areas and integrating it in program design, developing a mature model to support licensing and commercialization of new IP, and developing and implementing frameworks to support patenting and IP licensing decisions.

The COVID-19 pandemic highlighted opportunities for improvement and adaptions to internal service delivery, governance and communications. In 2022–23, the NRC will continue to modernize its services, policies and directives to reflect a new and evolving environment.

- The NRC will continue to adapt Human Resources operations and processes to manage the new operating environment, including implementing additional mental health supports and new policy frameworks related to the COVID-19 vaccination mandate.
- The NRC's audit and evaluation team will implement agile approaches to streamline processes, increase use of data analytics and data visualization techniques to support management decision making and reduce risk exposure, and provide real-time advisory services to areas of highest risk to the organization such as new program areas and investments.
- The NRC will develop an overarching communications plan for 2022–23, with an emphasis on its digital first approach on social and digital media. The aim will be to highlight the NRC as a leader in science, research excellence and innovation and to promote the impact of NRC research on Canada and Canadians. The organization will also continue to publish proactive content on NRC research at regular intervals, focusing primarily on the strategic pillars of climate action, life sciences and digital/quantum sciences.
- In the fall of 2020, the NRC launched the Future of Work project to create a vision and plan that would support a flexible, agile and resilient work structure. In 2022–23, the NRC will build on work already completed to support staff during the pandemic, such as the deployment of technologies to connect staff across the country. In particular, work will include implementation of the new Telework Policy; coordination of training for supervisors and employees; and advice, guidance and support to supervisors and employees throughout the implementation of the project. Health, safety, security and operational issues will be considered throughout the return to the workplace and Future of Work initiatives.

Planned budgetary spending for internal services

The following table shows, for internal services, budgetary spending for 2022–23, as well as planned spending for that year and for each of the next two fiscal years.

2022–23 budgetary spending (as indicated in Main Estimates)	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
146,649,676	146,649,676	150,614,537	150,956,019

Planned human resources for internal services

The following table shows, in fulltime equivalents, the human resources the department will need to carry out its internal services for 2022–23 and for each of the next two fiscal years.

2022–23 planned full-time equivalents	2023–24 planned full-time equivalents	2024–25 planned full-time equivalents
1,009.4	1,009.4	1,009.4

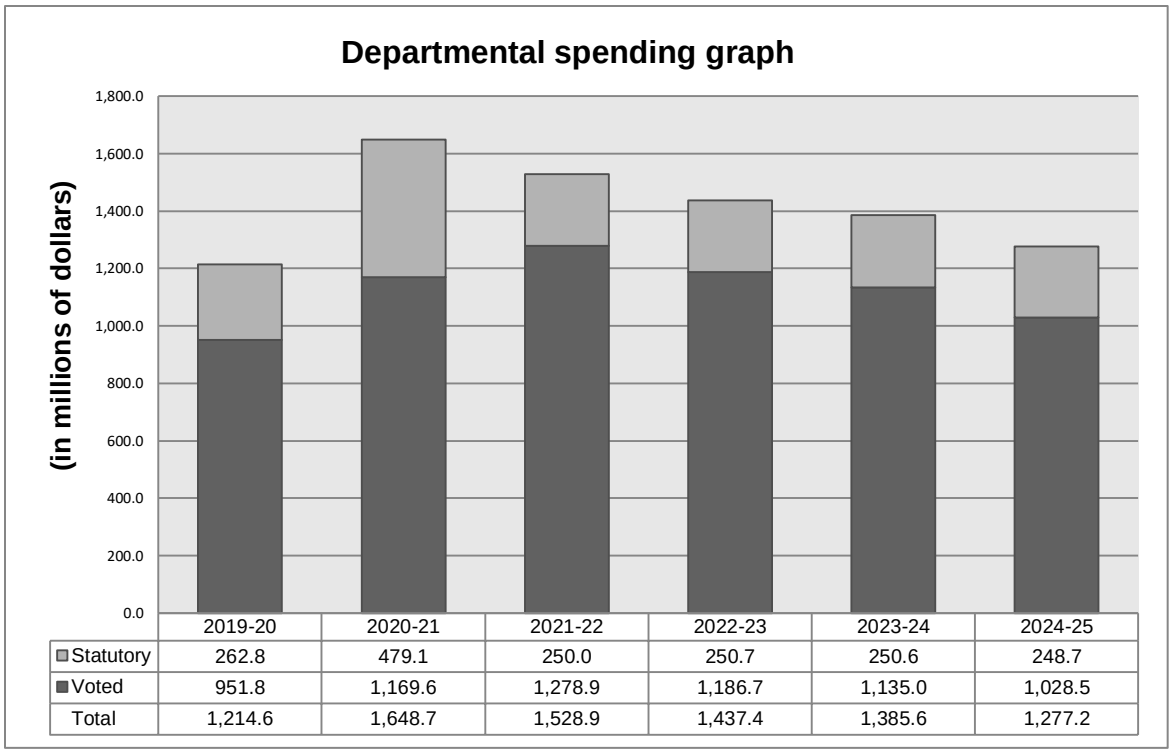
Planned spending and human resources

This section provides an overview of the department's planned spending and human resources for the next three fiscal years and compares planned spending for 2022–23 with actual spending for the current year and the previous year.

Planned spending

Departmental spending 2019–20 to 2024–25

The following graph presents planned spending (voted and statutory expenditures) over time.



	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Statutory	262.8	479.1	250.0	250.7	250.6	248.7
Voted	951.8	1,169.6	1,278.9	1,186.7	1,135.0	1,028.5
Total	1,214.6	1,648.7	1,528.9	1,437.4	1,385.6	1,277.2

The $119.8M decrease in 2021–22 forecast spending ($1,528.9) in comparison to authorities used in 2020–21 ($1,648.7M) is mainly attributable to temporary statutory funding received and delivered by NRC IRAP in 2020–21 for the Innovation Assistance Program, offset by increased funding received through Budget 2021.

The decrease in total planned spending in 2022–23, 2023–24 and 2024–25 relates to sunsetting funds.

The following table summarizes the primary year-over year funding variances contributing to changes in planned spending for each fiscal year.

(in millions of dollars)			
Items[5]	**2022–23**	**2023–24**	**2024–25**
Total Planned Spending	**1,437.4**	**1,385.6**	**1,277.2**
Variance over prior year	(91.5)	(51.8)	(108.4)
Primary Funding Variances			
Contributions for Medical Research and Vaccine Developments	(56.0)	(35.0)	
Grants provided for Innovation Solutions Canada challenges	(15.1)		
Capital and Operating for Bio-Manufacturing capacity expansion at Royalmount	(55.2)		(19.6)
Contributions for Youth Employment and Skills Strategy	(50.7)	(9.3)	
Budget 2021 – Contributions delivered through NRC IRAP supporting Small and Medium sized Enterprises	13.5	(2.6)	(27.0)
Budget 2021 – Capital and Operating to revitalize the Canadian Photonics Fabrication Center (CPFC)	11.3	4.6	(3.0)
Contributions for Canada's participation in the Thirty Meter Telescope (TMT)	31.6	(0.1)	(55.3)
Contributions to TRIUMF	3.2	(3.3)	(2.6)
Total Funding Variance	**(117.4)**	**(45.7)**	**(107.5)**

Budgetary planning summary for core responsibility and internal services (dollars)

The following table shows information on spending for the National Research Council's core responsibility and for its internal services for 2022–23 and other relevant fiscal years.

Core responsibility and Internal Services	2019–20 actual expenditures	2020–21 actual expenditures	2021–22 forecast spending	2022–23 budgetary spending (as indicated in Main Estimates)	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Science and Innovation	1,059,106,699	1,503,588,404	1,382,028,118	1,290,738,548	1,290,738,548	1,235,005,171	1,126,292,353
Internal Services	155,495,166	145,066,909	146,866,444	146,649,676	146,649,676	150,614,537	150,956,019
Total	1,214,601,865	1,648,655,313	1,528,894,562	1,437,388,224	1,437,388,224	1,385,619,708	1,277,248,372

[5] Zero indicates there is no variance.

Planned human resources

The following table shows information on human resources, in full-time equivalents (FTEs), for the National Research Council's core responsibility and for its internal services for 2022–23 and the other relevant years.

Human resources planning summary for core responsibility and internal services

Core responsibility and Internal Services	2019–20 actual fulltime equivalents	2020–21 actual fulltime equivalents	2021–22 forecast fulltime equivalents	2022–23 planned fulltime equivalents	2023–24 planned fulltime equivalents	2024–25 planned fulltime equivalents
Science and Innovation	3,115.5	3,270.3	3,326.8	3,417.8	3,420.8	3,317.9
Internal Services	993.9	991.1	1,009.4	1,009.4	1,009.4	1,009.4
Total	4,109.4	4,261.4	4,336.2	4,427.2	4,430.2	4,327.3

The NRC's total FTEs of 4,336.2 in 2021–22 plans will remain relatively stable over the following three years, with fluctuations associated with temporary funding. The increase of 74.8 in planned FTEs for 2021–22 primarily relates to expanded biomanufacturing capacity in Royalmount and additional FTEs supported through Budget 2021 funding.

Estimates by vote

Information on the National Research Council's organizational appropriations is available in the 2022–23 Main Estimates.[xxiv]

Future-oriented condensed statement of operations

The future-oriented condensed statement of operations provides an overview of the National Research Council's operations for 2021–22 to 2022–23.

The forecast and planned amounts in this statement of operations were prepared on an accrual basis. The forecast and planned amounts presented in other sections of the Departmental Plan were prepared on an expenditure basis. Amounts may therefore differ.

A more detailed future-oriented statement of operations and associated notes, including a reconciliation of the net cost of operations with the requested authorities, are available on the National Research Council website's Financial and Performance Reporting page.[xxv]

Future-oriented condensed statement of operations for the year ending March 31, 2023 (dollars)

Financial information	2021–22 forecast results	2022–23 planned results	Difference (2022–23 planned results minus 2021–22 forecast results)
Total expenses	1,473,814,000	1,450,331,000	(23,483,000)
Total revenues	174,218,000	187,522,000	13,304,000
Net cost of operations before government funding and transfers	1,299,596,000	1,262,809,000	(36,787,000)

The NRC's 2022–23 planned expenses and revenues are based on the Annual Reference Level Update (ARLU). They include the NRC's portion of the expense accounts of the Canada-France-Hawaii Telescope Corporation (CFHT) (net impact of $2.4M) and TMT International Observatory LLC (TIO) (net impact of $0M) after elimination of inter-entity transactions. Revenues are composed of research services ($78.6M), technical services ($85.3M), intellectual property, royalties and fees ($7.1M), sale of goods and information products ($2.9M), rentals ($6.7M), and grants and contributions ($1.5M). Also included is ($5.5M) of accrued adjustments mainly from the consolidation of the revenue accounts of CFHT ($1.9M), TIO ($1.0M) and Lease Inducement ($2.5M).

The 2021–22 forecast includes funding related to COVID-19 initiatives. This includes $125.6M in grants and contributions, $30.6M in operating expenditures and $66.8M in capital expenditures. Grants and contributions composed of $60M for the Youth Employment Strategy, $56M for vaccines and therapeutics, $8M for Innovative Solutions Canada and $1.6M for the Pandemic Response Challenge Program. Operating expenditures include $20.0M for the Biologics Manufacturing Centre, $4.6M for the Pandemic Response Challenge Program, $2.8M for Student Employment, $2M for Innovative Solutions Canada and $1.2M for the Clinical Trial Material Facility. Capital expenditures include $54.8M for the Biologics Manufacturing Centre and $12M for the Clinical Trial Material Facility.

The forecasted revenues are lower than planned results ($13.3M lower) due to the continued slowdown of activities caused by the COVID-19 pandemic.

Corporate information

Organizational profile

Appropriate minister: The Honourable François-Philippe Champagne, P.C., M.P., Minister of Innovation, Science and Industry

Institutional head: Iain Stewart, President

Ministerial portfolio: Innovation, Science and Economic Development

Enabling instrument(s): *National Research Council Act*,[xxvi] R.S.C. 1985, c. N-15

Year of incorporation / commencement: 1916

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

Raison d'être, mandate and role: who we are and what we do

Information on National Research Council's raison d'être, mandate and role is available on the National Research Council website's Corporate page.[xxvii]

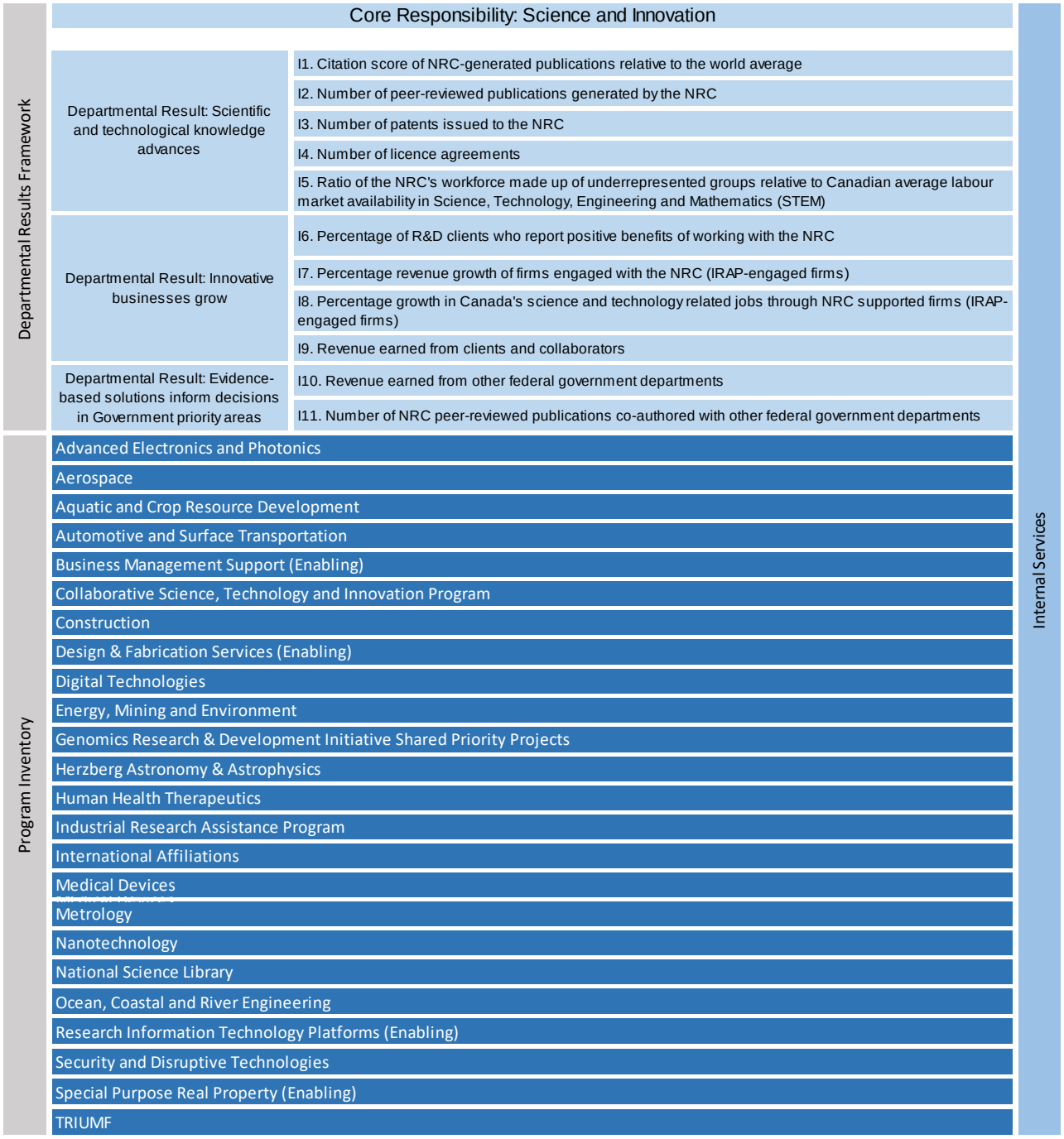
Information on National Research Council's mandate letter commitments is available in Minister's mandate letter.[i]

Operating context

Information on the operating context is available on the National Research Council website's Financial and Performance Reporting page.[xxv]

Reporting framework

The National Research Council's approved departmental results framework and program inventory for 2022–23 are as follows.



Changes to the approved reporting framework since 2021–22

Structure	2022–23	2021–22	Change	Reason for change
CORE RESPONSIBILITY	Science and Innovation	Science and Innovation	No change	Not applicable
PROGRAM	Advanced Electronics and Photonics	Advanced Electronics and Photonics	No change	Not applicable
PROGRAM	Aerospace	Aerospace	No change	Not applicable
PROGRAM	Aquatic and Crop Resource Development	Aquatic and Crop Resource Development	No change	Not applicable
PROGRAM	Automotive and Surface Transportation	Automotive and Surface Transportation	No change	Not applicable
PROGRAM	Business Management Support (Enabling)	Business Management Support (Enabling)	No change	Not applicable
PROGRAM	Collaborative Science, Technology and Innovation Program	Collaborative Science, Technology and Innovation Program	No change	Not applicable
PROGRAM	Construction	Construction	No change	Not applicable
PROGRAM	Design & Fabrication Services (Enabling)	Design & Fabrication Services (Enabling)	No change	Not applicable
PROGRAM	Digital Technologies	Digital Technologies	No change	Not applicable
PROGRAM	Energy, Mining and Environment	Energy, Mining and Environment	No change	Not applicable
PROGRAM	Genomics Research & Development Initiative Shared Priority Projects	Genomics Research & Development Initiative Shared Priority Projects	No change	Not applicable
PROGRAM	Herzberg Astronomy & Astrophysics	Herzberg Astronomy & Astrophysics	No change	Not applicable
PROGRAM	Human Health Therapeutics	Human Health Therapeutics	No change	Not applicable
PROGRAM	Industrial Research Assistance Program	Industrial Research Assistance Program	No change	Not applicable
PROGRAM	International Affiliations	International Affiliations	No change	Not applicable
PROGRAM	Metrology	Metrology	No change	Not applicable
PROGRAM	Medical Devices	Medical Devices	No change	Not applicable
PROGRAM	Nanotechnology	Nanotechnology	No change	Not applicable
PROGRAM	National Science Library	National Science Library	No change	Not applicable
PROGRAM	Ocean, Coastal and River Engineering	Ocean, Coastal and River Engineering	No change	Not applicable
PROGRAM	Research Information Technology Platforms (Enabling)	Research Information Technology Platforms (Enabling)	No change	Not applicable
PROGRAM	Security and Disruptive Technologies	Security and Disruptive Technologies	No change	Not applicable
PROGRAM	Special Purpose Real Property (Enabling)	Special Purpose Real Property (Enabling)	No change	Not applicable
PROGRAM	TRIUMF	TRIUMF	No change	Not applicable

Supporting information on the program inventory

Supporting information on planned expenditures, human resources, and results related to the National Research Council's program inventory is available on GC InfoBase.[xxiii]

Supplementary information tables

The following supplementary information tables are available on the National Research Council website's Financial and Performance Reporting page:[xxv]

- Details on transfer payment programs
- Gender-based analysis plus

Federal tax expenditures

The National Research Council's Departmental Plan does not include information on tax expenditures.

Tax expenditures are the responsibility of the Minister of Finance. The Department of Finance Canada publishes cost estimates and projections for government-wide tax expenditures each year in the Report on Federal Tax Expenditures.[xxviii] This report provides detailed information on tax expenditures, including objectives, historical background and references to related federal spending programs, as well as evaluations, research papers and gender-based analysis plus.

Organizational contact information

Mailing address

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Ottawa, Ontario, Canada K1A 0R6

Telephone: (613) 993-9101 or toll-free 1-877-NRC-CNRC (1-877-672-2672)

Fax: (613) 991-9096

Email: info@nrc-cnrc.gc.ca

Website: https://nrc.canada.ca/en/[xxix]

Appendix: definitions

appropriation (crédit)

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

budgetary expenditures (dépenses budgétaires)

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

core responsibility (responsabilité essentielle)

An enduring function or role performed by a department. The intentions of the department with respect to a core responsibility are reflected in one or more related departmental results that the department seeks to contribute to or influence.

Departmental Plan (plan ministériel)

A document that sets out a department's priorities, programs, expected results and associated resource requirements, covering a three-year period beginning with the year indicated in the title of the report. Departmental Plans are tabled in Parliament each spring.

departmental result (résultat ministériel)

A change that a department seeks to influence. A departmental result is often outside departments' immediate control, but it should be influenced by program-level outcomes.

departmental result indicator (indicateur de résultat ministériel)

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

departmental results framework (cadre ministériel des résultats)

A framework that consists of the department's core responsibilities, departmental results and departmental result indicators.

Departmental Results Report (rapport sur les résultats ministériels)

A report on a department's actual performance in a fiscal year against its plans, priorities and expected results set out in its Departmental Plan for that year. Departmental Results Reports are usually tabled in Parliament each fall.

experimentation (expérimentation)

The conducting of activities that explore, test and compare the effects and impacts of policies and interventions in order to inform decision-making and improve outcomes for Canadians. Experimentation is related to, but distinct from, innovation. Innovation is the trying of something new; experimentation involves a rigorous comparison of results. For example, introducing a new mobile application to communicate with Canadians can be an innovation; systematically testing

the new application and comparing it against an existing website or other tools to see which one reaches more people, is experimentation.

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

gender-based analysis plus (GBA Plus) (analyse comparative entre les sexes plus [ACS Plus])
An analytical tool used to support the development of responsive and inclusive policies, programs and other initiatives; and understand how factors such as sex, race, national and ethnic origin, Indigenous origin or identity, age, sexual orientation, socio-economic conditions, geography, culture and disability, impact experiences and outcomes, and can affect access to and experience of government programs.

government-wide priorities (priorités pangouvernementales)

For the purpose of the 2022–23 Departmental Plan, government-wide priorities are the high-level themes outlining the Government's agenda in the 2021 Speech from the Throne: **building a healthier today and tomorrow; growing a more resilient economy; bolder climate action; fighter harder for safer communities; standing up for diversity and inclusion; moving faster on the path to reconciliation and fighting for a secure, just, and equitable world.**

horizontal initiative (initiative horizontale)
An initiative in which two or more federal organizations are given funding to pursue a shared outcome, often linked to a government priority.

non-budgetary expenditures (dépenses non budgétaires)
Net outlays and receipts related to loans, investments and advances, which change the composition of the financial assets of the Government of Canada.

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

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

planned spending (dépenses prévues)

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

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

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

program inventory (répertoire des programmes)
An inventory of a department's programs that describes how resources are organized to carry out the department's core responsibilities and achieve its planned results.

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

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

target (cible)
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 (dépenses votées)
Expenditures that Parliament approves annually through an Appropriation Act. The vote wording becomes the governing conditions under which these expenditures may be made.

Endnotes

i. Minister of Innovation, Science and Industry Mandate Letter, https://pm.gc.ca/en/mandate-letters/2021/12/16/minister-innovation-science-and-industry-mandate-letter
ii. The NRC Strategic Plan, https://nrc.canada.ca/en/corporate/planning-reporting/nrc-strategic-plan-2019-2024
iii. Mandate Letter for NRC President, https://nrc.canada.ca/en/corporate/about-nrc/mandate-letter-mr-iain-stewart-september-6-2018
iv. Collaboration centres, https://nrc.canada.ca/en/research-development/research-collaboration/collaboration-centres
v. Ideation Fund, https://nrc.canada.ca/en/research-development/research-collaboration/programs/ideation-fund-where-breakthroughs-begin
vi. Supercluster support programs, https://nrc.canada.ca/en/research-development/research-collaboration/programs/supercluster-support-programs
vii. Challenge programs, https://nrc.canada.ca/en/research-development/research-collaboration/programs/challenge-programs
viii. Advanced Clean Energy program, https://nrc.canada.ca/en/research-development/research-collaboration/programs/advanced-clean-energy-program
ix. Clean and Energy-efficient Transportation program https://nrc.canada.ca/en/research-development/research-collaboration/clean-energy-efficient-transportation-program
x. Low-emission Aviation program, https://nrc.canada.ca/en/research-development/research-collaboration/programs/low-emission-aviation-program
xi. High-efficiency Mining program, https://nrc.canada.ca/en/research-development/research-collaboration/programs/high-efficiency-mining-program
xii. Canadian Arctic Shipping Risk Assessment System, https://nrc.canada.ca/en/research-development/products-services/technical-advisory-services/canadian-arctic-shipping-risk-assessment-system-casras
xiii. NanoMi, https://nrc.canada.ca/en/research-development/nanomi-worlds-first-open-source-transmission-electron-microscope
xiv. Canadian Photonics Fabrication Centre, https://nrc.canada.ca/en/research-development/nrc-facilities/canadian-photonics-fabrication-centre
xv. NRC Supercluster support programs, https://nrc.canada.ca/en/research-development/research-collaboration/programs/supercluster-support-programs
xvi. NRC Departmental Sustainable Development Strategy, https://nrc.canada.ca/en/corporate/planning-reporting/departmental-sustainable-development-strategy-2020-2023
xvii. Federal Sustainable Development Strategy, https://www.fsds-sfdd.ca/index.html#/en/goals/
xviii. Sustainable Development Goal 7, https://www.un.org/sustainabledevelopment/energy/
xix. Sustainable Development Goal 9, https://www.un.org/sustainabledevelopment/infrastructure-industrialization/
xx. Sustainable Development Goal 11, https://www.un.org/sustainabledevelopment/cities/
xxi. Sustainable Development Goal 12, https://www.un.org/sustainabledevelopment/sustainable-consumption-production/
xxii. Sustainable Development Goal 13, https://www.un.org/sustainabledevelopment/climate-change/
xxiii. GC InfoBase, https://www.tbs-sct.gc.ca/ems-sgd/edb-bdd/index-eng.html#start
xxiv. 2022–23 Main Estimates, https://www.canada.ca/en/treasury-board-secretariat/services/planned-government-spending/government-expenditure-plan-main-estimates.html
xxv. National Research Council Financial and Performance Reporting webpage, https://nrc.canada.ca/en/corporate/planning-reporting/financial-performance-reporting
xxvi. *National Research Council Act*, https://laws-lois.justice.gc.ca/eng/acts/N-15/
xxvii. National Research Council Corporate page, https://nrc.canada.ca/en/corporate
xxviii. Report on Federal Tax Expenditures, https://www.canada.ca/en/department-finance/services/publications/federal-tax-expenditures.html
xxix. NRC website, https://nrc.canada.ca/en/

Supplementary Information Tables: 2022–23 Departmental Plan

National Research Council Canada

Canada

List of supplementary information tables for the 2022–23 Departmental Plan

Details on transfer payment programs

3-year plan for Assessed Contribution to the Bureau International des Poids et Mesures (BIPM)

Start date	Canada signed the Metre Convention and became a member state of BIPM in 1907
End date	Ongoing
Type of transfer payment	Contribution
Type of appropriation	Estimates
Fiscal year for terms and conditions	2018–19
Link to departmental results	Scientific and technological knowledge advances Innovative businesses grow Evidence-based solutions inform decisions in Government priority areas
Link to the NRC's Program Inventory	Core Responsibility: Science and Innovation Program: Metrology
Purpose and objectives of transfer payment program	The assessed contribution to the BIPM is an obligation accepted by Canada as a signatory to the international treaty known as the Metre Convention. By representing Canada on the international metrology stage through its affiliation with the BIPM and associated regional metrology organization *Sistema Interamericana de Metrologia* (SIM), the NRC can more effectively and efficiently respond to its mandated responsibility for maintenance of national measurement standards, as articulated in the *NRC Act* and the *Weights and Measures Act*.
Expected results	By maintaining international recognition in measurement science through its interactions with the BIPM and SIM, the NRC can continue to provide metrology research and services that help transform ideas into market-ready technologies that benefit Canadian society, the economy and the environment.
Fiscal year of last completed evaluation	2021–22
Decision following the results of last evaluation	Continuation
Fiscal year of next planned evaluation	2025–26

General targeted recipient groups	International organizations and foreign countries. BIPM is an annual assessed contribution reflecting Canada's status as a State Party to the Metre Convention Treaty since 1907.
Initiatives to engage applicants and recipients	The NRC participates in the activities and meetings relative to the BIPM and associated regional metrology organization SIM. The NRC provides professional expertise and laboratory facilities required to deliver its Metrology Program to achieve socio-economic impact for Canadian citizens and businesses.

Financial information (dollars)

Type of transfer payment	2021–22 forecast spending	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Total grants	-	-	-	-
Total contributions	659,000	659,000	659,000	659,000
Total Transfer Payments	**659,000**	**659,000**	**659,000**	**659,000**

3-year plan for the Collaborative Science, Technology and Innovation Program (CSTIP)

Start date	April 1, 2018
End date	Ongoing
Type of transfer payment	Grants & Contributions
Type of appropriation	Estimates
Fiscal year for terms and conditions	2018–19
Link to departmental results	Scientific and technological knowledge advances Innovative businesses grow Evidence-based solutions inform decisions in Government priority areas
Link to the NRC's Program Inventory	Core Responsibility: Science and Innovation Program: Collaborative Science, Technology and Innovation Program
Purpose and objectives of transfer payment program	Provides grant and contribution funding for external collaborators with complementary capabilities [e.g. small and medium-sized enterprises (SMEs), post-secondary institutions and non-profit research organizations]. The program comprises 1) NRC Collaborative Research & Development (R&D) initiatives – funding external collaborators working with NRC researchers on projects that make up a series of large-scale collaborative R&D programs in priority areas; 2) the Ideation Fund – funding external collaborators working with NRC personnel to encourage, test and validate transformative self-directed, exploratory research ideas; and 3) the Outreach Initiative – funding to support conferences, workshops, symposia or other outreach initiatives, in order to promote engagement of Canadians, particularly those in under-represented groups, interested in Science, Technology, Engineering and Mathematics (STEM).
Expected results	Enable new and potentially disruptive technologies to be developed with targeted recipient groups. Strengthen collaborations across industry, academia and governmental levels to address issues of national importance related to the Canadian economy and quality of life, and to find solutions to some of Canada's serious public policy challenges. Create stronger innovation ecosystems in specific sectors currently experiencing gaps.
Fiscal year of last completed evaluation	Not applicable

Decision following the results of last evaluation	Not applicable
Fiscal year of next planned evaluation	2022–23 (five-year cycle)
General targeted recipient groups	Academic organizations, SMEs; Not-for-Profits; Canadian government departments, agencies, crown corporations, research technology organizations; international organizations; social enterprises; Indigenous governments; individuals; non-Canadian recipients.
Initiatives to engage applicants and recipients	For NRC Collaborative R&D Initiatives, potential collaborators, stakeholders and eligible recipients are invited by the NRC to participate in designing the R&D focus as well as proposed projects intended to achieve outcomes for each specific initiative. External researchers are invited to work with NRC researchers through a mix of directed and open calls where applicants will develop team proposals to compete for project funding. Projects are selected against criteria such as research excellence, impact, collaborations, and feasibility/probability of success. For the Ideation Fund, annual open calls within the NRC are launched for individuals or small teams to submit proposals to conduct exploratory research with collaborators. Projects are selected against criteria such as: research excellence, innovation/creativity, deliverables, collaboration and feasibility. The NRC Outreach Initiative provides non-recurring grant funding to support a variety of outreach science or innovation-based events, conferences or symposia. As of 2021, the program was updated to be more transparent and accessible for applicants. Applications are now accepted on a semi-annual basis and details of the program can be found online. Projects are selected against criteria such as: research excellence and advancing science policy; NRC strategic alignment and reach of the initiative; STEM talent development and inclusion of under-represented groups; value and impact.

Financial information (dollars)

Type of transfer payment	2021–22 forecast spending	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Total grants	28,445,201	28,600,000	29,000,000	29,400,000
Total contributions	7,655,610	8,339,479	3,000,000	3,000,000
Total Transfer Payments	**36,100,811**	**36,939,479**	**32,000,000**	**32,400,000**

3-year plan for NRC Industrial Research Assistance Program (NRC IRAP)

Start date	September 1, 2018 (terms & conditions renewal date; original start date: April 1, 1965)
End date	Ongoing
Type of transfer payment	Contribution
Type of appropriation	Estimates
Fiscal year for terms and conditions	2018–19
Link to departmental results	Scientific and technological knowledge advances Innovative businesses grow Evidence-based solutions inform decisions in Government priority areas
Link to the NRC's Program Inventory	Core Responsibility: Science and Innovation Program: NRC Industrial Research Assistance Program (NRC IRAP)
Purpose and objectives of transfer payment program	The program contributes to the growth and prosperity of Canadian 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 has the following streams: Contributions to Firms; Contributions to Organizations; and Youth Employment Program). NRC IRAP supports the placement of graduates in SMEs through its participation in the delivery of the Youth Employment Program sponsored by Employment and Social Development Canada's Youth Employment and Skills Strategy. With the onset of the COVID-19 pandemic, NRC IRAP established a suite of ten temporary Subject Expert Teams to coordinate and accelerate support to Canadian SMEs who presented viable solutions to detect, prevent and treat COVID-19. NRC IRAP supported projects to further technology development, capacity building and manufacturing scale-up in response to COVID-19. Recipients are not required to repay funds obtained under this transfer payment program.
Expected results	• Stimulation of innovation in SMEs in Canada. • Increased growth of innovative SMEs and creation of wealth for Canada. See the Main portion of the NRC's Departmental Plan for additional plans pertaining to NRC IRAP.
Fiscal year of last completed evaluation	2017–18

Decision following the results of last evaluation	Continuation
Fiscal year of next planned evaluation	2022–23
General targeted recipient groups	Industry-related — For-profit businesses (SMEs) and Non-profit Organizations
Initiatives to engage applicants and recipients	NRC IRAP is a national program managed on a regional basis delivered by a network of over 265 Industrial Technology Advisors (ITAs) located in approximately 110 communities across the country, who provide customized advice to growth oriented technologically innovative SMEs. ITAs engage with client SMEs throughout the entire contribution management process, from building project proposals through to project completion. At the end of their funded project, recipients are required to complete an online Post-Project Report. This assessment captures information on the recipient's experience with NRC IRAP and, along with published service standards, is used by the program to develop continuous program improvements. NRC IRAP has an Advisory Board composed of 10 to 12 members from the industry sector and industry associations. This Board provides advice to NRC IRAP management and brings an external perspective on the strategic directions and management of the program. NRC IRAP is actively engaged with the Treasury Board Secretariat (TBS) Grants and Contributions Reform. Participation in workshops and constant alignment with recent TBS policy and guidelines has enabled the program to steadily move toward principles such as a Recipient Engagement Strategy.

Financial information (dollars)

Type of transfer payment	2021–22 forecast spending	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Total grants	-	-	-	-
Total contributions	562,823,632	469,092,050	421,514,000	394,514,000
Total Transfer Payments	**562,823,632**	**469,092,050**	**421,514,000**	**394,514,000**

3-year plan for Innovative Solutions Canada (ISC)

Start date	2017–18 The first NRC challenge posted in December 2017, to coincide with the program launch.
End date	2021–22
Type of transfer payment	Grant and Procurement
Type of appropriation	Estimates
Fiscal year for terms and conditions	The NRC received authority for the Innovation, Science and Economic Development (ISED)-led terms & conditions for Innovative Solutions Canada (ISC) grants in 2017–18 (January 2018).
Link to departmental results	ISC is an ISED-led program, with the NRC as one of 20 federal departments mandated to participate. Program results will be reported by ISED.
Link to the NRC's Program Inventory	Within the NRC, this ISED-led program is administered by NRC IRAP.
Purpose and objectives of transfer payment program	ISC is a grant and procurement program that enables participating departments and agencies to support the scale-up of Canadian small and medium-sized businesses through early-stage, pre-commercial R&D. The program allocates a portion of departmental funding to: • Fuel the development and adoption of technological innovation in Canada. • Grow Canadian companies through direct funding to support early stage, pre-commercial R&D, late stage prototypes, and to accelerate commercialization. • Encourage procurement from companies led by under-represented groups, such as women, Indigenous peoples, youth, disabled individuals, LGBTQ+ and others. • Foster greater industry-research collaboration through the release of challenges for solutions that address key Government of Canada priorities. • Provide federal departments and agencies with opportunities to develop new capabilities to meet their R&D needs and thereby advance government priorities.
Expected results	The expected results of the ISC program are aligned with the priorities of the Innovation and Skills Plan (ISP) to grow domestic small businesses in the innovation economy and deliver on three key areas for action: • **People and Skills:** This program will help build a culture of innovation in Canada, where Canadians see opportunity to take smart risks and embark upon the paths of discovery that lead to entrepreneurship and inclusive growth. ISC will help increase the number of science and technology-related jobs in the Canadian economy by allowing small Canadian businesses greater access to government procurement, which can develop and grow the expertise of scientists, engineers, and business people, create high-quality jobs and retain talent in the country.

	• **Research, Technology, Commercialization:** The ISC program offers small businesses the opportunity to find customers who are willing to design, develop, test and adopt their innovations; support R&D; and understand how collaboration helps advance and bring leading-edge technologies to market. As a result, the ISC will support the ISP by increasing the value spent on business-led R&D, and increasing the number of research collaborations between industry and research institutes. • **Companies, Investment, Scale-Up and Clean Growth:** The ISC program will offer opportunities for Canadian companies to grow domestically, provide wins, and gain experience to compete internationally. As a marquee customer through ISC, the government will be supporting companies by increasing the number of firms achieving high growth and increasing the dynamism of the Canadian economy.
Fiscal year of last completed evaluation	Not applicable
Decision following the results of last evaluation	Not applicable
Fiscal year of next planned evaluation	The Internal Audit Directorate at ISED is conducting an advisory review of the ISC program.
General targeted recipient groups	SMEs
Initiatives to engage applicants and recipients	As one of 20 participating federal government departments, the NRC submits challenges to ISED for posting. NRC IRAP works with NRC research, branch and NRC IRAP leads to: • Assess and select proposals for funding. • Engage clients by developing and managing grants or contracts for proof of concept to prototype development.

Financial information (dollars)

Type of transfer payment	2021–22 forecast spending	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Total grants	16,205,368	5,500,000	5,500,000	5,500,000
Total contributions	-	-	-	-
Total Transfer Payments	**16,205,368**	**5,500,000**	**5,500,000**	**5,500,000**

3-year plan for International Affiliations Program

Start date	1958
End date	Ongoing
Type of transfer payment	Grant
Type of appropriation	Estimates
Fiscal year for terms and conditions	2011–12
Link to departmental results	Scientific and technological knowledge advances
Link to the NRC's Program Inventory	Core Responsibility: Science and Innovation Program: International Affiliations
Purpose and objectives of transfer payment program	Canada's membership in international science and technology (S&T) organizations promotes international research and innovation, networking, advocacy, leadership opportunities as well as access to benchmarking possibilities, enabling Canadian science, technology, and industry to remain competitive.
Expected results	• Enhance Canada and the NRC's international visibility and Canada's reputation as a global leader in science, technology and innovation (STI). • Enhance Canadian influence in solidifying interdisciplinary science-based global policy making to increase impact. • Contribute to the development of Canadian STI leaders via opportunities for leadership development and leadership opportunities including implementing Equity, Diversity and Inclusion (EDI) approaches. • Increasing market-oriented innovation opportunities for Canadian SMEs and export growth via global value chains to ensure Canadian excellence and competitiveness.
Fiscal year of last completed evaluation	2019–20
Decision following the results of last evaluation	Continuation
Fiscal year of next planned evaluation	2025–26
General targeted recipient groups	International organizations and foreign countries (foreign recipients which are international S&T organizations having two or more states as members. As well, non-foreign recipients are non-governmental Canadian delegates who attend related meetings hosted by these foreign recipients).

Initiatives to engage applicants and recipients	Regular interactions via email and at least one meeting per year with representatives of each Canadian National Committee (CNC) have established a process that allows for the ongoing assessment of evolving priorities, benefits of the program to participants and needs for each international affiliation's CNC. Each CNC also completes an annual reporting questionnaire, in a standardized format, to facilitate program evaluation. In addition, the program indicators have been updated to track Canadian participation at international affiliation events as well as membership on international affiliation committees and executives; these updated indicators better represent the effectiveness of the program and individual affiliations. To increase impact for Canada, an ongoing dialogue has been established with Canadian CNCs not funded by the Grants for International Affiliations to coordinate activities and input to international initiatives and nominations. The Advisory Committee for the program meets semi-annually, drawing on cross government science departments and agencies and deploying expertise to leverage Canadian international science objectives. Regular, frequent interactions ensure continuous engagement and coordination. Two sub-committees have been formed to address criteria for funding of CNCs and to support EDI initiatives. In addition, engagement with international affiliations management and other countries' international affiliation programs has intensified. This will continue to increase Canada's profile and opportunities for Canadian researchers, as well as to coordinate efforts – for example efforts to address EDI.

Financial information (dollars)

Type of transfer payment	2021–22 forecast spending	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Total grants	565,368	560,000	560,000	560,000
Total contributions	-	-	-	-
Total Transfer Payments	**565,368**	**560,000**	**560,000**	**560,000**

3-year plan for International Astronomical Observatories Program

Start date	1978
End date	Ongoing
Type of transfer payment	Contribution
Type of appropriation	Estimates
Fiscal year for terms and conditions	2015–16
Link to departmental results	Scientific and technological knowledge advances Innovative businesses grow Evidence-based solutions inform decisions in Government priority areas
Link to the NRC's Program Inventory	Core Responsibility: Science and Innovation Program: Herzberg Astronomy & Astrophysics
Purpose and objectives of transfer payment program	Astronomy is a global science. The increasing cost of leading-edge observatories and the scarcity of ideal observation sites have led to a greater focus on international collaboration for large-scale astronomy projects which lead to advances in our knowledge and understanding of the universe. The NRC, in collaboration with other international bodies, provides financial contributions to support the management and operations of offshore ground-based observatories and their related facilities, including the Canada-France-Hawaii Telescope (CFHT), the twin telescopes of the Gemini Observatory and the Atacama Large Millimetre-submillimetre Array (ALMA). The NRC participates in the oversight and direction of these facilities and their research capabilities. The NRC also represented Canada in the Square Kilometre Array (SKA) consortium for the pre-construction phase of the telescope and signed a cooperation agreement in November 2021 to continue Canada's participation in the Square Kilometer Array Observatory (SKOA). In 2015, Canada joined the international partnership to participate in the Thirty Meter Telescope (TMT). International agreements governing these observatories are long-term commitments that specify contributions to support preconstruction design and development, construction, operation and maintenance, capital improvements (e.g., development of new astronomical instruments and other facility upgrades) and decommissioning of the international ground-based observatories and their related facilities. These agreements also include commitments to support the university-based user communities to ensure a fair and progressive use of these observatories. The NRC participates in the governance of these international facilities on behalf of the Canadian astronomy research community and provides appropriate support, including sophisticated data management services and instrumentation. Through the NRC's financial and in-kind contributions, the Canadian astronomy community is assured merit-based access to these facilities with appropriate support. Recipients are not required to repay funds obtained under this transfer payment program.

Expected results	• Canadian astronomers have access to leading-edge facilities and technology. • Qualified students and post-doctoral researchers have access to facilities to advance their training. • Canada plays a prominent role in international scientific endeavours. • Scientific benefit of telescopes to the Canadian and the global community is maximized through progressive science programs using leading-edge instrumentation. • Canadian industry has opportunities to participate in advanced scientific projects and opportunities to benefit from contracts and technology development.
Fiscal year of last completed evaluation	Evaluation of NRC Herzberg Astronomy and Astrophysics (HAA) Portfolio completed in 2021–22.
Decision following the results of last evaluation	Continuation
Fiscal year of next planned evaluation	2026–27
General targeted recipient groups	Foreign States, intergovernmental organizations or corporations that operate international observatories that have entered into agreements with Canada (NRC) to support costs related to ground-based astronomical observatories. In the case of intergovernmental organizations, Canada and one or more foreign states are members. An eligible recipient can be a Canadian Crown Corporation or other delivery partner.
Initiatives to engage applicants and recipients	The NRC manages ground-based observatories established or maintained by the Government of Canada for the benefit of the Canadian astronomy research community, aligning its contributions to the priorities of the community's Long Range Plan for Astronomy and Astrophysics. The NRC participates on the Boards which oversee the observatories to ensure that the science directions and programs of the facilities reflect Canadian strengths and interests. In addition, the NRC ensures these activities increase opportunities for Canadian researchers and firms to develop relevant instrumentation for the observatories. To carry out its roles effectively, the NRC provides current information about each observatory to research community-based committees of scientists which provide expert advice on observatory operations and development. The NRC provides extensive support to the user community through numerous services extending from administering the time allocation process for Canadian researchers through to delivery of science-ready data (through its Canadian Astronomy Data Centre).

Financial information (dollars)

Type of transfer payment	2021–22 forecast spending	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Total grants	-	-	-	-
Total contributions	33,126,691	64,704,472	64,811,189	-
Total Transfer Payments	**33,126,691**	**64,704,472**	**64,811,189**	**-**

3-year plan for TRIUMF

Start date	April 1, 1977
End date	Ongoing
Type of transfer payment	Contribution
Type of appropriation	Estimates
Fiscal year for terms and conditions	2020–21
Link to departmental results	Scientific and technological knowledge advances Innovative businesses grow Evidence-based solutions inform decisions in Government priority areas
Link to the NRC's Program Inventory	Core Responsibility: Science and Innovation Program: TRIUMF
Purpose and objectives of transfer payment program	TRIUMF is Canada's particle accelerator centre. The laboratory is one of Canada's key investments in large-scale research infrastructure. It provides world-class facilities for research in sub-atomic physics, accelerator science, life sciences, and materials science. An incorporated non-profit with charitable status, TRIUMF is owned and operated by a consortium of Canadian universities, with its core operations funded through five-year contribution agreements. The NRC plays an important oversight and stewardship role for TRIUMF on behalf of the Government of Canada. Recipients are not required to repay funds obtained under this transfer payment program.
Expected results	TRIUMF will support the Canadian and international particle and nuclear physics community in alignment with the current 2017–2021 Canadian Subatomic Physics Long Range Plan (LRP), the forthcoming 2022–2026 LRP, and TRIUMF's own Five-Year Plan (2020–2025). In the third year of the new Five-Year Plan, TRIUMF will deliver impact across the three core dimensions of Science and Technology, People and Skills, and Innovation and Collaboration. TRIUMF expects to: • Conduct world-class science across TRIUMF's core programs. • Support Canada and TRIUMF's research communities in recovery from the COVID-19 pandemic. • Advance completion of the ARIEL facility and continue to deliver science from the new CANadian Rare isotope facility with Electron Beam ion source (CANREB) facility. • Lead and participate in top-tier international research collaborations. • Provide hands-on training to students and early career researchers, as well as enable the exchange of global talent. • Support the development of new industry and community partnerships in pursuit of increased economic and societal benefits for Canada. • Streamline processes and improve operational efficiency.

Fiscal year of last completed evaluation	2018–19
Decision following the results of last evaluation	Continuation
Fiscal year of next planned evaluation	2022–23
General targeted recipient groups	Non-profit organizations (TRIUMF)
Initiatives to engage applicants and recipients	The NRC chairs the Agency Committee on TRIUMF (ACT), which includes the federal agencies that fund and oversee activities at TRIUMF, providing TRIUMF management the opportunity to present progress and discuss future directions for the facility. The NRC also convenes and oversees the Advisory Committee on TRIUMF (ACOT), an expert panel composed of international experts within disciplines that span the research and technology activities of TRIUMF. ACOT meets biannually, and reports to the NRC and shares its findings with TRIUMF senior management. ACOT makes recommendations on programs and management, and reports on the scientific and technological achievements of TRIUMF programs and facilities, helping to ensure TRIUMF discharges its responsibilities under the Contribution Agreement. Observer representatives from the Natural Sciences and Engineering Research Council of Canada, the Canada Foundation for Innovation, the Canadian Institute of Nuclear Physics, the Canadian Institute of Particle Physics, the materials science community and TRIUMF’s user community ensure TRIUMF's directions are well aligned with the research community's needs, and that TRIUMF is working with all its constituencies across Canada. The Committee considers all aspects of the TRIUMF program, with a particular emphasis on science and technological issues, to ensure the relevance, impact, and world-class standing of TRIUMF's activities. Through NRC activities in ACT and ACOT, the NRC maintains a close relationship with TRIUMF. The NRC also maintains observer status on the TRIUMF Board of Governors, as well as other governance bodies. Dialogue ensures investments are optimal, the NRC meets the needs of its recipient, and provides a vehicle for feedback on the transfer payment management process. TRIUMF has approximately 430 staff and students supported via the NRC’s contribution agreement. An additional 128 positions are supported through other sources for specific designated purposes, including temporary funds to operate new capital infrastructure. In a typical year, TRIUMF provides training for more than 200 undergraduate, graduate students, and postdoctoral fellows. TRIUMF has numerous programs aimed at young people, students, teachers, and the public to ensure as many people as possible share the wonder of discovery and experience the excitement generated by the laboratory. TRIUMF also offers a suite of programs to aid in the growth and development of professional skills for its graduate students and postdocs.

Financial information (dollars)

Type of transfer payment	2021–22 forecast spending	2022–23 planned spending	2023–24 planned spending	2024–25 planned spending
Total grants	-	-	-	-
Total contributions	60,748,372	63,925,183	60,646,436	58,026,205
Total Transfer Payments	**60,748,372**	**63,925,183**	**60,646,436**	**58,026,205**

Gender-based analysis (GBA) Plus

General information

Institutional GBA Plus Capacity

The NRC is continuing to formalize its GBA Plus framework, accountability and reporting mechanisms. While the NRC does not have a specific GBA Plus policy or statement of intent, elements of the NRC's EDI Strategy align with GBA Plus principles.

The NRC's Secretary General Division holds the Responsibility Centre for GBA Plus within the Policy, Strategy and Performance Branch. The NRC has resources dedicated (in part) to developing, delivering and promoting GBA Plus within the organization, including a GBA Plus Focal Point. The NRC is represented on the Government of Canada's Interdepartmental Working Group for GBA Plus and the GBA Plus Focal Point Network.

The NRC has integrated GBA Plus into many areas of its operations to assess potential impacts of its policies, programs, and initiatives on diverse groups. The intent is to use the framework to help ensure an inclusive approach from ideation through to outcome measurement.

In keeping with this approach, the NRC is:

- Integrating GBA Plus into annual operational plans at the research centre and program level to help apply GBA Plus to existing and new R&D initiatives, program design, and monitoring and evaluation;
- Including GBA Plus in NRC programs, such as NRC IRAP and the CSTIP programs (Ideation, Challenge and Supercluster support programs). GBA Plus and EDI strategies are expected to be developed and updated on an evergreen basis;
- Using a GBA Plus lens as part of the NRC's formal evaluation of the effectiveness of NRC programs and initiatives; and
- Carrying out training and other capacity building initiatives on-demand across the organization.

Human Resources

3.5 full-time equivalents (representing a portion of many positions across the NRC).

Planned initiatives

The NRC has integrated GBA Plus/EDI approaches into a large cross-section of its day-to-day thinking and operations. These initiatives concern organizational activities, research directions, and NRC IRAP activities.

Highlights of GBA Plus Results Reporting Capacity by Program

Overall NRC	• NRC Human Resources monitors and tracks statistics on under-represented groups, as well as women in STEM. To support these efforts, the NRC has created a streamlined set of EDI standards and performance indicators, and established a regular routine for reporting on EDI progress, which will continue.

	• Led by NRC Human Resources, the NRC also refreshed its EDI strategy recently, including initiatives to help the NRC hire diverse talent; support the career development and advancement of diverse talent; foster an inclusive, accessible and anti-racist culture; address barriers in policies and systems; and enable sustained, measureable progress through governance and accountability. • In addition, the NRC has established a clear internal portal for EDI information, tools and resources; made progress in ensuring that diversity and inclusive language are reflected in NRC images, posters and materials; adopted inclusive practices such as land acknowledgements in formal gatherings; and supported the formation of grassroots networks and communities. Moving forward, the NRC is analyzing the organization's needs/approach to address anti-racism/discrimination, including providing additional training and awareness, and leveraging work underway in the federal public service to advance EDI, including strategies for recruitment and retention. • The NRC's Five-Year Strategic Plan, launched in 2019, includes employment equity (EE) targets for NRC business units. Targets at the business unit level are designed to help the NRC achieve its overall representation goals. As part of its new EDI Strategy, the NRC is updating its representation and hiring goals to move toward full representation of all designated EE groups (women, Indigenous peoples, visible minorities, and persons with disabilities). • The NRC continues to build capacity and expand awareness of GBA Plus across the organization. To date, this has included policy employees, the NRC planning community, and Program Directors. Outreach and training efforts continue and are available upon request. In October 2021, close to 200 NRC employees tuned in to an internal Women in Science and Innovation panel discussion on GBA Plus to learn more about the process and how it is applied within the NRC. • The NRC has two mandatory online courses for all staff in areas related to EDI, including a fundamentals course and unconscious bias training. A mandatory course on managing bias in hiring is required for all supervisors, and moving forward, plans are in development for training in targeted areas of the organization (e.g., executives, enabling functions). • The NRC has implemented and intends to implement further programs and initiatives with a specific focus on women researchers and students from employment equity designated groups. In 2020–21, the NRC launched a mentorship pilot focused on women in STEM that informed the creation of the broader Mentoring@theNRC program, which tailors mentor and mentee matches based on several criteria including equity-deserving groups. • The NRC has undertaken a review of its state of readiness for the implementation of the *Accessible Canada Act* with a view of developing a comprehensive implementation strategy by December 2022.
Research Centres	• For its research programs, the NRC requires EDI commitments and GBA Plus implementation in CSTIP (Ideation, Challenge and Supercluster support programs) program and project proposals. The NRC also considers language in calls for proposals to promote different and varied partnerships, and recognizes diverse attributes in teams when reviewing projects. Researchers developing projects under these programs are encouraged to use GBA Plus tools to increase the impact of research on diverse groups and are provided workshops on integrating EDI and GBA Plus into proposals within NRC. Projects reviewers are also asked to take a course on "Bias in Peer Review." • In addition, for the Ideation New Beginnings program in which NRC employees are the main applicants, the NRC collects EDI stats on NRC employees who

	applied to program and who were successful. Reviews of proposals are done “blind” so that reviewers cannot see who has submitted the proposal. The intent of this approach is to identify gaps, investigate, implement change, and look for impact.
NRC IRAP	• NRC IRAP will continue to evolve its client focused initiatives to help remove barriers to growth for firms led by under-represented groups by providing targeted support through its Contribution to Organization funding mechanism and develop tools to support SMEs in assessing, developing and operationalizing a plan to foster the progression of their EDI maturity journey. It will also continue to amplify recruitment activities to attract, retain and advance a more diverse workforce, leveraging modern recruiting tools and recruitment marketing techniques, while refining organizational design to meet evolving program delivery requirements in order to further efforts to support an empowered world-class workforce.