NRC·CNRC

Delivering results for a stronger Canada

Annual Report 2024-2025

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Conseil national de recherches Canada

Canada

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2024–2025 Annual Report

Delivering results for a stronger Canada

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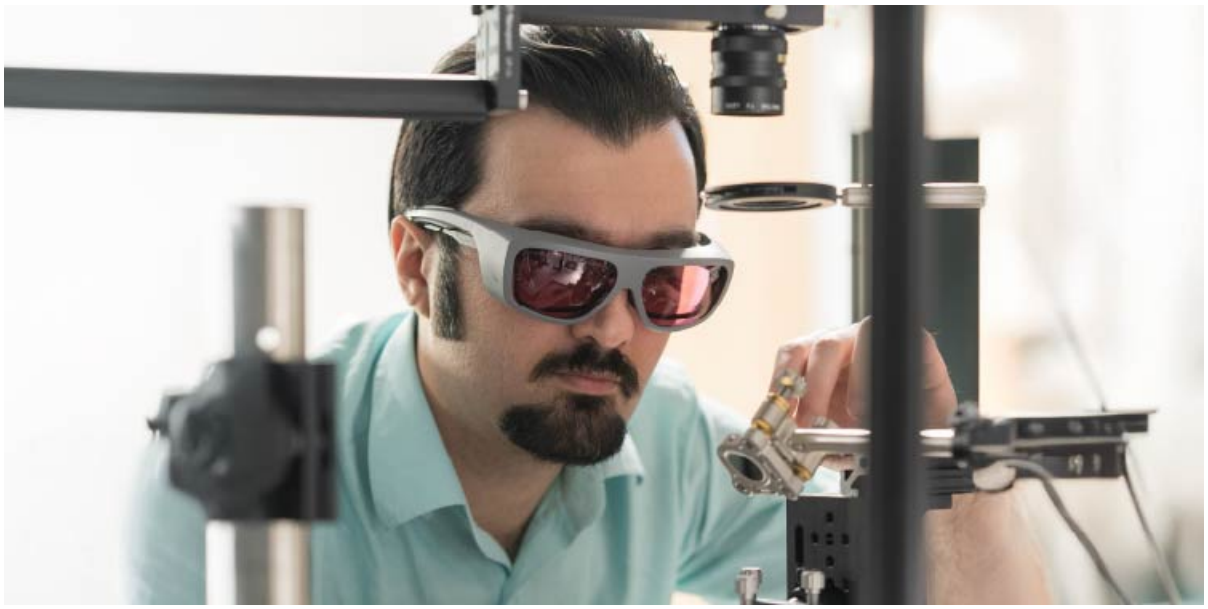
Throughout 2024–2025, the National Research Council of Canada (NRC) delivered results that are making Canada a stronger, more resilient and more secure nation.

Our experts conducted research and developed technology related to: infrastructure that is able to withstand increasingly common extreme weather events, biologics and devices for improving health and well-being, and responsible artificial intelligence applications that will accelerate scientific breakthroughs and grow competitive Canadian industries. We continued to help businesses become more vibrant, sustainable, and able to compete and lead internationally.

In everything we do, we are responding to what Canada needs—now and into the future.

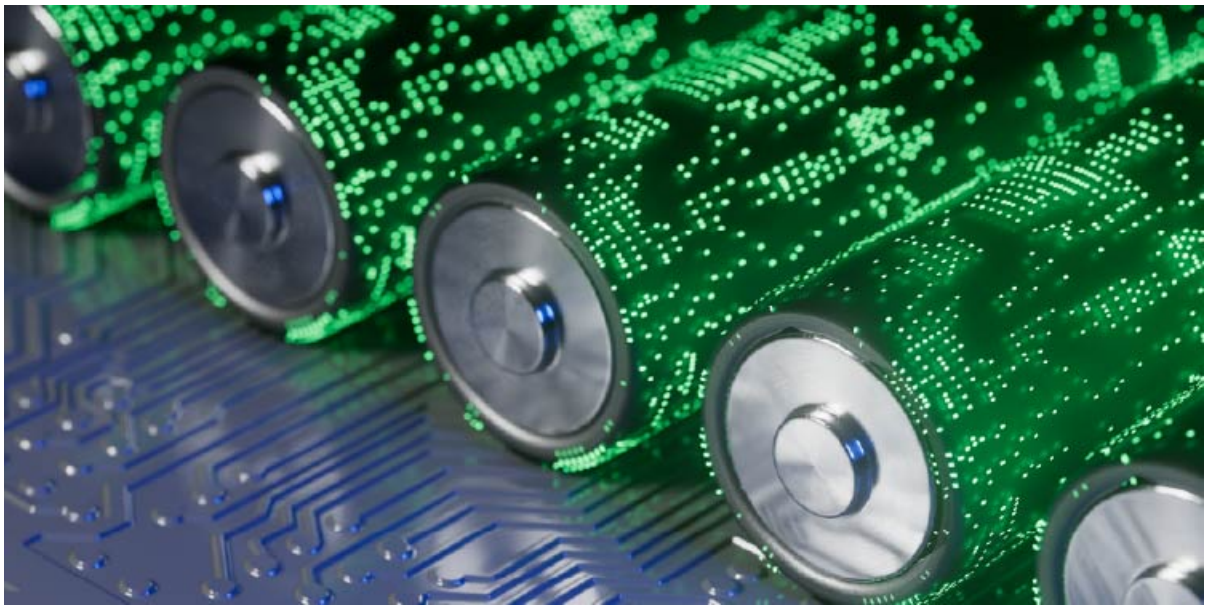
Message from the President

The NRC at a glance

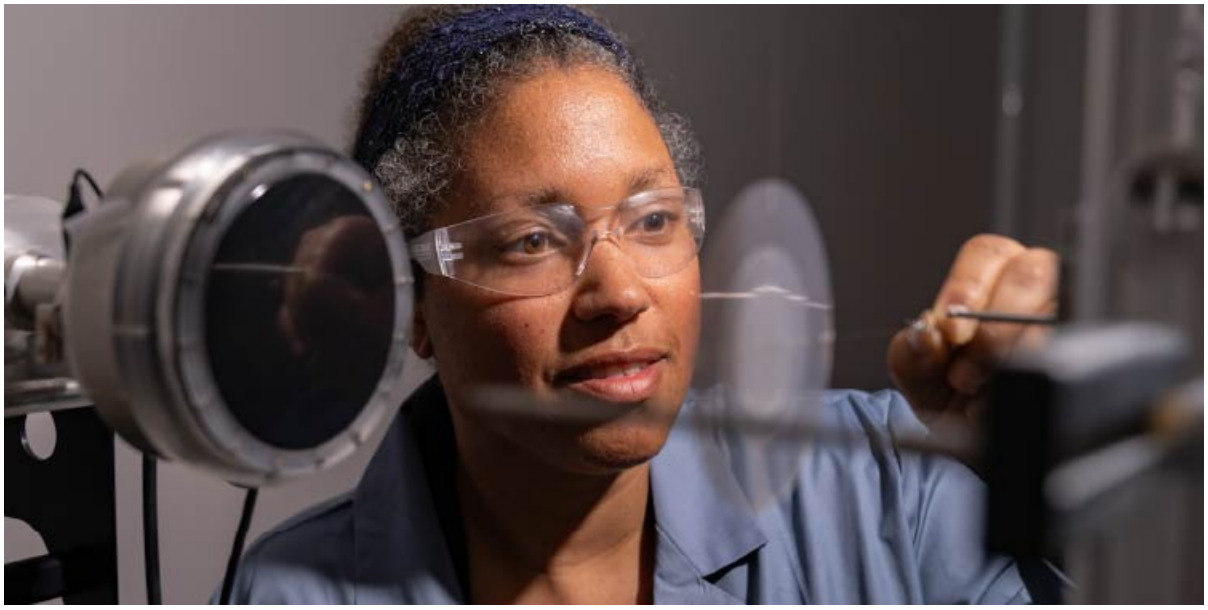


Quantum and digital technologies

Health and biomanufacturing



Climate change and sustainability



Foundational research

Support for industry

Building on our strengths

Awards and honours

NRC leadership

From: National Research Council Canada

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The world is changing. We see these major shifts flowing together in so many ways: the rise of artificial intelligence (AI), the transformation of energy systems towards sustainability, the building of resilient Canadian industries for a more prosperous future, the pursuit of secure new trade relationships with international partners. The NRC is mobilizing its talent, capabilities and relationships with urgency and determination to meet the moment—just as we have for more than 100 years.

While the realities we face now are vastly different from those that prompted our establishment in 1916, our core mission is as relevant as ever: driving science and technology to build a strong industrial base and make possible for our country an ambitious and hopeful future. The NRC has always been about delivering results for a stronger Canada, one that is more prosperous, resilient, healthy and sustainable.

Launched in 2024, our latest strategic plan sets our course in this pivotal moment, guiding our efforts on climate change and sustainability, quantum and digital technologies including AI, health and biomanufacturing, and foundational research. As the stories in this annual report demonstrate, we are making meaningful progress in all of these areas. For example, our initiatives in AI, including our support for small and medium-sized enterprises (SMEs) through

our new AI Assist program, illustrate how we are building key capabilities for Canada in this emerging technology. And our continued development of sustainable technologies, such as the work being done through our Critical Battery Materials Initiative, is reinforcing Canada's leadership in addressing the threat of climate change while advancing an industrial base that strengthens our economy and resilience.

As we reflect on this past year, I want to extend my thanks to the people of the NRC. I am inspired by your commitment and potential to move Canada forward. I would like to also thank our collaborators and clients with whom we have built trusting relationships that are foundational to tackling big challenges and succeeding together. Fostering enduring partnerships with industry, academia and other research institutions across our country and around the world will always be core to our approach. Together, we are creating momentum to build a stronger Canada and a better future.

I would also like to thank those who serve Canada by giving their time and expertise to provide sound governance for the NRC. We appreciate your contributions to our success through the NRC Council, the Departmental Audit Committee and our new Procurement Oversight Board.

In my first year back at the NRC, I engaged with employees in research facilities in every province. I heard them speak to their passion and commitment to promising projects and to their pride in the difference they make for Canada. Our people make big things possible for their country and themselves. Today, we are in a moment that calls on us all to work together to deliver on the ambition of a defining era. And I am confident that we are ready and eager to rise to the challenges ahead.

Mitch Davies

President

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Our vision

A better Canada and world through excellence in research and innovation.

Our mission

To have an impact by advancing knowledge, applying leading-edge technologies and working with other innovators to find creative, relevant and sustainable solutions to Canada's current and future economic, social and environmental challenges.

Our values

Integrity

Behaving at all times ethically, honestly and objectively; being impartial and transparent with our colleagues, collaborators, stakeholders, clients and the people of Canada; and exercising sound stewardship of our resources.

Excellence

Pursuing excellence in all that we do: in our research and innovation, in our collaborations, in the execution of our programs, in our support to firms and in our delivery of our common corporate services.

Respect

Valuing and respecting the knowledge, expertise and diversity of our colleagues, our workplace, our collaborators, our stakeholders and our clients to have an impact on Canada and the world.

Creativity

Harnessing our imagination, passion for excellence, scientific exploration, technology and innovation to generate new knowledge, new technologies, new business processes and new collaborations for a better NRC and a better world.

Research and innovation

Our research and innovation expertise spans **12** research centres and a business unit across **5** divisions, with facilities in **24** locations across Canada.

Digital Technologies

Digital Technologies Research Centre

Emerging Technologies

Canadian Photonics Fabrication Centre

Herzberg Astronomy and Astrophysics Research Centre

Metrology Research Centre

Quantum and Nanotechnologies Research Centre

Engineering

Clean Energy Innovation Research Centre

Construction Research Centre

Ocean, Coastal and River Engineering Research Centre

Life Sciences

Aquatic and Crop Resource Development Research Centre

Human Health Therapeutics Research Centre

Medical Devices Research Centre

Transportation and Manufacturing

Aerospace Research Centre

Automotive and Surface Transportation Research Centre

People

4,505

full-time equivalent staff

- **2,310** scientists, engineers and technicians
- **275** NRC IRAP industrial technology advisors

595

students, postdoctoral fellows and research associates (hires)

96

nationalities in our workforce

41%

women in our workforce (relative to Canadian market availability: 37.5%)

128

NRC IRAP points of service

Scientific achievements

1,473

peer-reviewed publications [1]

- **64** publications per 100 scientists/engineers/technicians

1.45

citation score [2] relative to world average

84%

co-authorship rate with external partners [1]

- **12.8%** with UK
- **12.6%** with Germany
- **5.8%** with Japan

Patents

222

patent applications in 2024–2025

1,807

active patents

- **530** active patents currently licensed
- **464** patent families

Clients and collaborators

95%

of clients say the NRC helped them achieve results [3]

646

active collaborative R&D projects [4] with **174** funded collaborators

966

R&D clients

NRC IRAP

9,187

total clients

- **3,136** funded firms
- **6,051** firms received advisory services only

13,750

total jobs supported

33%

total revenue growth of client firms [5]

13%

employee growth of client firms [5]

Financial [6]

$1,708M

total expenditures (operating, capital, grants and contributions)

- **$1,145.6M** research centres
- **$562.4M** NRC IRAP

$203.4M

total revenue

- **36%** industry
- **11%** other (e.g., academia, non-profits)

53% other government departments

$639.7M

funding programs (grants and contributions expenditures)

$437.0M NRC IRAP

$61.2M TRIUMF

$42.2M Collaborative Science, Technology and Innovation Program (CSTIP)

$74.3M telescopes

$23.5M Biologics Manufacturing Centre

$1.5M other G&Cs

1	Calendar year 2024
2	3-year average (2022–2024 calendar years)
3	Positive impacts on clients' capabilities and knowledge, technology or product development, and financial performance (Client Impact Survey)
4	Collaborative Science, Technology and Innovation Program funded projects
5	Average compound annual growth rate (2021 to 2023)
6	Unaudited results

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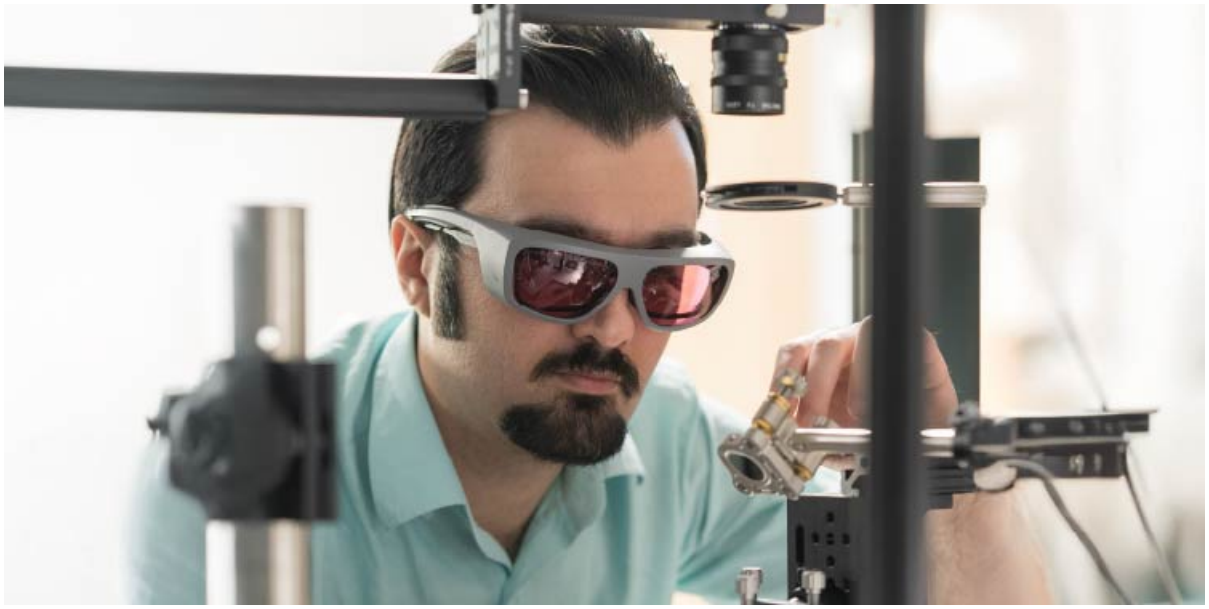
Drawing on decades of experience and strong partnerships, in 2024–2025, we delivered results that will help Canada meet its needs and become a stronger, more resilient nation. Discover the NRC's major highlights and achievements of the past year.

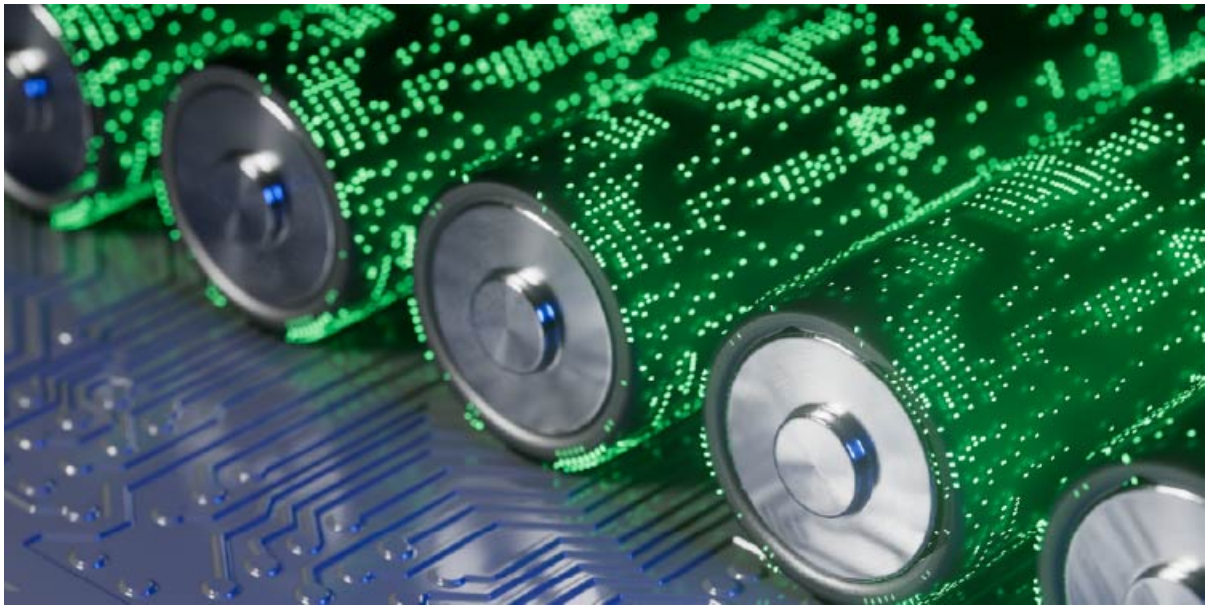


Quantum and digital technologies

Developing quantum, AI and other digital technologies to benefit all Canadians

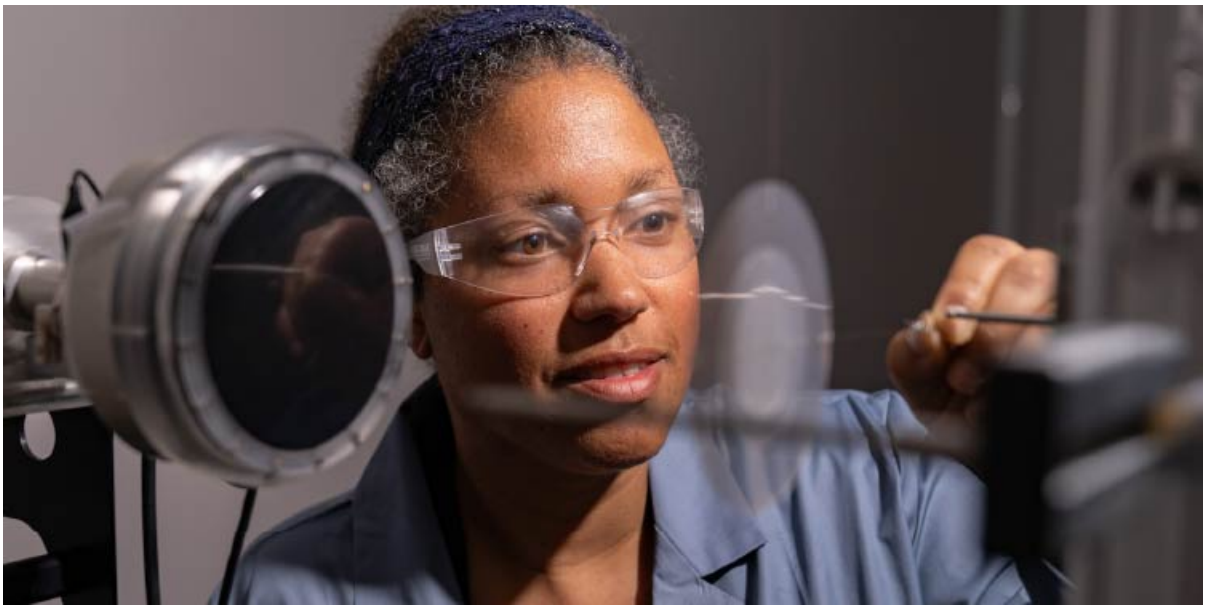
Health and biomanufacturing

Improving the health of people in Canada through lifesaving technologies



Climate change and sustainability

Advancing projects to strengthen Canada's climate resilience and clean energy sectors



Foundational research

Leading exploratory science with global reach

Support for industry

Building the capacity of industries and businesses across the country

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More compute capacity for AI researchers in Canada

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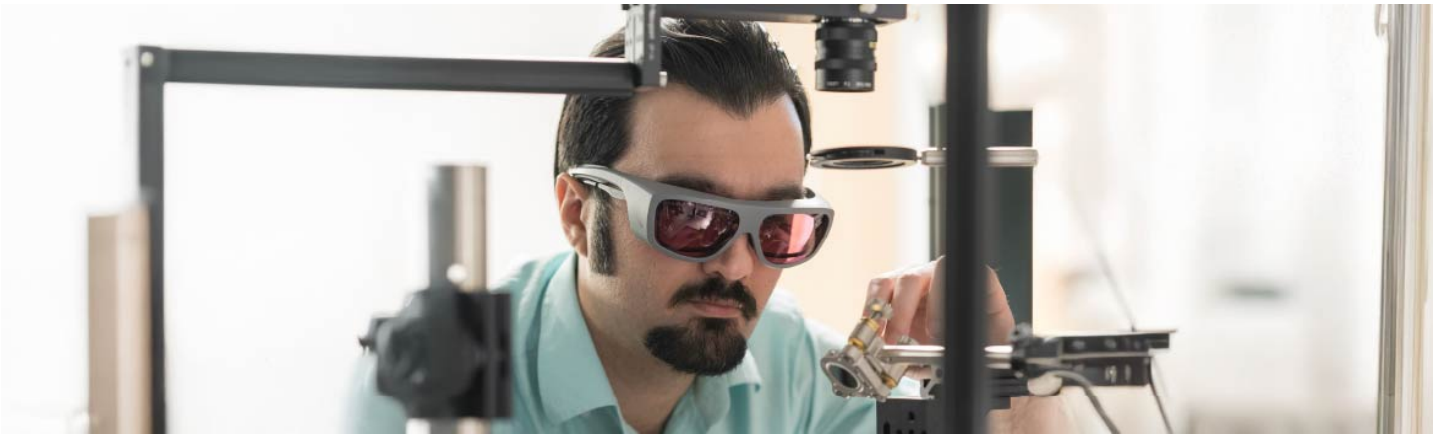
- A joint effort to advance the science of AI safety



Realizing the potential of AI, quantum and digital technologies

For more than 30 years, we have worked to build the expertise and infrastructure needed to keep Canada at the forefront of technological innovation and position us to seize the moment presented by advancements in areas like AI. We continued this work in 2024–2025, pursuing projects that will help bring the benefits of AI, quantum sensing and other digital technologies to all people in Canada.

Faster, more accurate disease diagnosis made possible by AI-enhanced medical imaging analysis

Healthcare and biochemical research are among the most promising areas where AI tools and quantum technologies can better the lives of people across Canada and around the world. For example, by using AI to detect abnormalities in computed tomography (CT) scans, x-rays, ultrasounds and other medical imaging, doctors can diagnose diseases faster and more accurately. In 2024–2025, we advanced an AI solution to do just that, working closely with researchers from the University of Waterloo and McGill University. Together, the interdisciplinary team designed an AI system for medical image analysis. This work could greatly improve medical diagnostics and create new opportunities for preventative care.

The AI framework, known as the Trustworthy Deep Learning Framework for Medical Image Analysis (TRUDLMIA), was originally developed for COVID-19 diagnosis, but the team has since applied it to diseases such as pneumonia and melanoma with great success.

The deep learning system is trained on large sets of general and domain-specific data, such as medical and clinical diagnosis data, which it draws on to analyze medical imaging. A key milestone in 2024–2025 was the development of AI models for lung health assessment using

point-of-care ultrasound scans, a portable and widely accessible imaging technique. Development on TRUDLMIA continues, with a focus on preparing for future pandemics and diagnosing the long-term effects of COVID-19.

This work has demonstrated that AI can match or even exceed traditional diagnostic methods, which is especially important in underserved or rural communities where access to specialists is limited. Automating parts of the diagnostic process also eases the burden on healthcare systems, reduces costs and improves efficiency to the benefit of patients and practitioners alike.

"I've always been passionate about using technology to address real-world problems, and healthcare is one of the most meaningful areas where AI can make a difference. What drew me in was the opportunity to work on interdisciplinary teams with clinicians, engineers and researchers all striving toward a common goal: improving human health. There's something deeply fulfilling about knowing that our algorithms might help detect a disease earlier or bring diagnostic capabilities to remote regions where such services are scarce."

— Dr. Pengcheng Xi, Senior Research Officer, Digital Technologies Research Centre

More compute capacity for AI researchers in Canada

As part of the Government of Canada's new Canadian Sovereign AI Compute Strategy, a $25-million investment was announced to expand the NRC's Beatrix Graphics Processing Unit (GPU) cluster facility, which is purpose-built for AI-based research and innovation. The expansion will add more compute capacity to Canada's AI ecosystem, supporting the near-term needs of industry, government researchers and academic collaborators. The Beatrix facility is named after Canada's first female computer scientist, Beatrice Helen Worsley, a pioneer in the field who worked at the NRC as a research officer in 1947.

Quantum sensors that can see into the brain

Cerebral metabolism is an important indicator of brain health, associated with functions like blood flow and oxygen consumption. Monitoring oxygen levels during cardiac surgery is critical to prevent brain injury. But the imaging technique used to monitor it today, positron emission tomography (PET), is time-consuming, costly and complex, requiring patients to be injected with a radioactive drug called a tracer.

With funding and support through the Quantum Sensors Challenge program, a team of researchers introduced a new technique that uses quantum sensor technology to monitor brain activity safely and non-invasively at the bedside, by beaming a laser through the skull.

The quantum biosensor is sensitive enough to measure light down to a single photon, making it safer for patients. It also works faster and across a wider range of frequencies than a PET scan while costing at least 10 times less. Testing is currently underway on this new method of bedside neuromonitoring, which will one day allow physicians to immediately detect potential issues during interventions like cardiac surgery, so they can act faster to prevent potential damage.

> "The capacity of quantum sensor technology to solve clinical problems could open up applications that we can't even envision until users come up with disruptive ideas. This project proves the importance of investment in fundamental science, because you never know what might come out of it."
>
> — Dr. Mamadou Diop, Associate Professor, Department of Medical Biophysics, Schulich School of Medicine and Dentistry, Western University, and Scientist, Lawson Research Institute

Insight into the effects of urban airflows on drones

As drones are increasingly used to deliver everything from ordinary mail packages to lifesaving medical supplies, it is critical to understand how the airflows around buildings in urban environments affect drone stability. To investigate this, our Aerospace Research Centre partnered with Transport Canada and InDro Robotics to conduct a field study in downtown Montréal, Quebec. This first-of-its-kind study used drone- and rooftop-mounted wind sensors, as well as wind tunnel testing, to measure wind speed and turbulence along a pre-defined route through the city. These test flights were the longest ever conducted in a downtown core in Canada and yielded results that will help inform regulations, standards and capabilities for safer drone use in the country.

Autonomous sea ice management for ships

Ships passing through ice-covered waters, such as those along Northern shipping channels, are slowed by sea ice that quickly closes over again once parted by an icebreaker. Experts at our Ocean, Coastal and River Engineering Research Centre and Memorial University are exploring a new approach: a swarm of smaller, self-driving vessels that can keep channels clear in an icebreaker's wake. The AI model uses distributed intelligence comparable to the behaviours seen in colonies of insects, like ants and bees all working toward a shared goal. To test the performance of the vessels, the team will run experiments first in a simulated environment and then in the NRC's offshore engineering basin research facility, which can recreate real-world conditions. This research will help establish Canada as a pioneer in the growing field of marine autonomous surface ships.

Light-based 3D printing for rapid optical device prototyping

In 2024–2025, we showed the promise of a new method of producing microlenses to accelerate and simplify the design and fabrication of optical devices. Developed by our Digital Technologies and Quantum and Nanotechnologies research centres, blurred tomography (a method of producing a 3D image of a solid object) offers a faster, more affordable alternative to existing tomographic methods using projected light and 3D printing, with the ability to produce commercial-grade optical components in as little as 30 minutes. This method could also underpin the development of future technologies, eventually allowing optical designers to rapidly prototype new devices at the relatively low cost of materials and a 3D tomographic printer.

A new service that helps businesses unlock AI's advantages

AI tools can analyze vast stores of data, identify patterns and trends, and generate actionable insights in seconds. A new service available through the NRC's Data Analytics Centre helps public- and private-sector organizations unlock this analytical power. The service draws on the expertise of researchers in AI, data science and machine learning to help Canadian companies extract the strategic value hidden in their data through tailored AI. With access to this expertise, along with the Data Analytics Centre's state-of-the-art algorithms and powerful computing clusters, companies in Canada can gain a competitive edge with AI.

Generative AI tools for more efficient government operations

As we help Canadian firms realize the benefits of AI, we are also exploring applications of this technology within our own operations. In 2024–2025, we developed prototypes for 2 new AI use cases. One of these, a suite of generative AI tools named BlueskAI, is designed to enhance the ability of the NRC Industrial Research Assistance Program (NRC IRAP) field staff to more efficiently and effectively access data to support Canadian small and medium-sized enterprises.

The tool allows staff to use natural language queries instead of traditional keyword searches, making it easier for them to find and summarize information about Canadian firms. Our AI experts also worked with Public Services and Procurement Canada to develop an AI-driven recommendation engine for NewsDesk, a platform that provides more than 70 Government of Canada departments with access to digital media content. By eliminating the need to manually rate NewsDesk articles for relevancy, this project has the potential to bring significant time savings.

While we are testing commercially available AI tools to determine if they can be used safely and responsibly in our work, we also built our own. NRC employees are increasingly embracing AI Zone, the generative AI chatbot we developed which is hosted in our own internal cloud to protect our sensitive intellectual property and data. AI Zone's custom tools and extensions can help solve technical problems, summarize long documents, write computer code and more—and the chatbot continues to evolve with new features and functionality. Additionally, we launched student AI projects to help meet needs across the NRC such as automating processes and staying on top of tasks.

An open-source framework for building Indigenous language grammar apps

We continue to work with Indigenous communities and language experts to develop digital tools that will help people more easily learn Indigenous languages. The newest is Gramble, an open-source framework that allows Indigenous educators to create grammar apps in an intuitive, user-friendly way, through a spreadsheet-like interface.

So far, Gramble has supported the development of verb conjugator tools for the Mi'kmaq, Michif and Anishnaabe languages. Verb conjugators for several new languages, including Nêhiyawêwin (Plains Cree), Oneida and SENĆOŦEN (Saanich), are also in development.

Canada's one-of-a-kind photonics fabrication facility supports the AI boom

The data centres that train and run generative AI models demand huge amounts of energy to power racks of servers, all containing numerous chips and wires, as well as industrial cooling systems needed to manage the heat they generate. To help solve the AI energy problem and data capacity issues, lasers from the NRC's Canadian Photonics Fabrication Centre (CPFC), the only facility of its kind in North America, are being used by Ottawa-based Ranovus. Its light-based hardware, called co-packaged optics, fits onto a chip the size of a quarter.

Sitting beside the processors that train and run AI models, the technology fires photons down glass fibre to move data between chips. Compared to traditional copper cables, the technology carries more information and can move it further while using less power. The CPFC will continue to provide critical components for technologies like these, supporting advancements in AI, quantum and other growing fields.

Canadian-made quantum magnetometer gets tested in space

Magnetometers use the Earth's magnetic signals to find shipwrecks and debris under water, uncover suitable mining sites, and locate and classify objects. With support from the NRC's Quantum Sensors Challenge program, Sherbrooke-based SBQuantum developed a diamond-powered quantum magnetometer that increases sensitivity by 100 times over previous prototypes.

In 2025, that technology was launched into space as part of the U.S. National Geospatial-Intelligence Agency's MapQuest Challenge, which aims to discover a more precise and efficient way to measure the World Magnetic Model used by navigation, attitude and heading reference systems to help prevent magnetic field interference.

An exploration of district heating system efficiency on Canadian Forces bases

The NRC's Earth Observation and Microgravity Group and McGill University's Applied Remote Sensing Laboratory are working to quantify how much heat is lost in district heating systems on Canadian Forces bases and the associated carbon emissions.

District heating systems are made up of underground networks of water pipes that can bring heating to multiple buildings within an area. As the heated water travels through the pipes, some of the energy is lost before it can reach the buildings where people live and work, but is still contributing to costs and emissions on Canadian Forces bases.

Our collaborative research measures this heat loss using sensors on remotely piloted aircraft systems, along with light detection and ranging (LiDAR) techniques. Our most recent survey, at the base in Comox, British Columbia, revealed a minimum annual energy loss equivalent to the amount of total energy used by 321 average Canadian homes. This work will help us better understand the mechanisms of the heat loss and inform improvements to district heating systems.

AI-based tools to support aging in place

In 2024–2025, we unveiled 2 new tools developed through the support of our Aging in Place Challenge program that will help older adults in Canada live independently in their homes and communities.

In collaboration with the University of Waterloo, we developed an AI model that can analyze and segment photos of food on a plate, or even at the end of a utensil, to quickly and accurately predict calories, mass, protein, fat and carbohydrates. This technology could help older adults better manage their eating habits and nutritionists create more effective dietary plans.

Meanwhile, in partnership with Carleton University, we advanced a driver assessment system that combines a network of onboard vehicle sensors with data from more than 30,000 drivers to predict changes in safety risk based on an older adult's driving patterns. Feedback can then be shared with the driver as well as their family and caregivers. In addition to empowering older drivers to travel more safely, this project adds to our understanding of how assistive driving features, such as lane keeping assist, affect driver safety.

Our vision for digital transformation in research

During this fiscal year, we launched our new vision for the digital transformation of research at the NRC. This 5-year plan will guide our application of leading digital technologies, such as advanced computing and AI, to accelerate innovation and enhance collaboration across scientific fields.

It includes 4 foundational pillars: enhancing data collection through advanced sensors, ensuring trustworthy and well-governed data, maximizing the value of data through technologies like AI and analytics, and using automation to improve R&D processes.

Through this vision, we will meet the highest standards of ethics, legality and security to deliver trustworthy solutions that serve Canada's priorities.

A unified centre for quantum and nanotechnology research

To better align our quantum, photonic and semiconductor science and technology objectives, in 2024–2025, we combined our Nanotechnology, Security and Disruptive Technologies, and Advanced Electronics and Photonics research centres into a single entity. Working with collaborators in Canada and internationally, the new Quantum and Nanotechnologies Research Centre will accelerate and de-risk innovative solutions in quantum communications, quantum sensing and imaging, photonics, nanotechnologies, advanced materials for additive manufacturing, semiconductors, and more.

A joint effort to advance the science of AI safety

In November 2024, the Government of Canada launched the Canadian Artificial Intelligence Safety Institute (CAISI) to support the safe and responsible development and deployment of AI. The NRC is pleased to be part of CAISI and conduct research that aims to better understand and mitigate the risks of AI systems.

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Promising treatments enter clinical trials

Boosting biomanufacturing capabilities for CAR T-cell production

Success stories

- Further milestones in cancer treatment
- A comprehensive platform for research into brain health and wellness
- Remote biosensing software for more robust telehealth
- New partnerships to promote pandemic preparedness
- Joint funding with the UK for therapeutic manufacturing and product development
- A compact platform for food pathogen detection in remote communities
- A digital approach to heart failure assessment
- Support for next-generation antibody therapies

Improving the health of people in Canada through research and innovation

One of the most important areas of our work is advancing technologies that have the potential to improve health and save lives. We pursued numerous such projects throughout 2024–2025, driving momentum toward lifesaving new cell and gene therapies, stronger domestic biomanufacturing processes, and more.

Promising treatments enter clinical trials

Two novel treatments co-developed by experts in our Human Health Therapeutics Research Centre entered clinical trials in 2024–2025: a vaccine for *Haemophilus influenzae* type a (Hia) and a new chimeric antigen receptor (CAR) T-cell therapy.

The Hia vaccine, which began in 2012 as a joint development effort between the NRC and the Public Health Agency of Canada, entered clinical trials in 2024–2025, in collaboration with Dalhousie University and McGill University and with the support of our licensee, InventVacc Inc. Hia is a bacterial infection that can lead to pneumonia, lethal meningitis, septic arthritis and bloodstream infections. This milestone brings us closer to a new vaccine that can protect people in Canada and around the world from this dangerous infection.

The other therapy that entered clinical trials in 2024–2025 was the first fully made-in-Canada CAR T-cell therapy, which modifies a specific type of white blood cell, the T-cell, so it can target and destroy cancer cells in the body. Infused with the CAR gene, T-cells can recognize and bind to a specific protein on the surface of cancer cells, killing those cells while sparing healthy ones. The highly targeted nature of this therapy significantly increases efficacy against difficult-to-treat cancers, and CAR T-cell therapies targeting the CD19 protein on leukemia and lymphoma cells have already helped patients worldwide.

Enabled by our Cell and Gene Therapy Challenge program, development of this therapy was a collaboration with the Canadian-led Immunotherapies in Cancer program (which was founded by researchers at The Ottawa Hospital, BC Cancer and BioCanRx) and funded by our Collaborative Science, Technology and Innovation Program (CSTIP). The NRC's key contribution to this CAR T-cell therapy was the development of a nanobody to target the CD22 protein on leukemia and lymphoma cells, along with support for the selection of the lead targeting nanobody.

With subsequent national competitive grant funding from the Canadian Institutes of Health Research, clinical trials are running in multiple sites across Canada, focusing on pediatric and young adult lymphoblastic leukemia. The team also secured funding from CSTIP, Ovarian Cancer Canada and BioCanRx for a Phase I clinical trial with BC Cancer of another novel CAR T-cell therapy construct for ovarian cancer and other solid tumors. If successful in preclinical and clinical trials, these therapies could lead to development of fully made-in-Canada treatments that will greatly benefit cancer patients at home and abroad.

"I am so proud that we have made a major breakthrough in developing these CAR-T products in Canada. From my earliest days in the field of antibody engineering, I've dreamed of developing therapeutic products that could remedy patients with cancers and other diseases and improve lives. It is my dream that, before my retirement, these CAR T-cell therapies and other antibody-based products are ready to treat solid and non-solid cancers in patients across Canada and around the world."

— Dr. Mehdi Arbabi Ghahroudi, Senior Research Officer, Human Health Therapeutics Research Centre

"It is very exciting to work on such innovative projects as novel CAR T-cell therapies, which are, quite literally, life-changing solutions for relapsed and refractory cancer patients. With our NRC colleagues, BC Cancer is thrilled that our CAR T-cell therapy targeting CD22 is now in clinical trials. We are very optimistic that this will pave the way to making other made-in-Canada therapies available and accessible for patients in Canada."

— Dr. Kevin Hay, Associate Scientist, BC Cancer

Boosting biomanufacturing capabilities for CAR T-cell production

Cell and gene therapies like CAR T-cell therapy hold a lot of promise in the treatment of cancer and other diseases. But existing approved CAR T-cell therapies are manufactured outside Canada, making them expensive and leading to long wait times to access them—

time cancer patients can't afford. This is why we need to enhance the biomanufacturing capacity of Canadian hospitals, many of which currently lack on-site facilities to produce the vectors and cells used in CAR T-cell therapy.

Our Cell and Gene Therapy Challenge program made progress on this issue in 2024–2025, supporting investments for collaborative projects that aim to make cell and gene therapies more accessible and affordable, and contributing to a network of centres with the capacity for on-site CAR T-cell production. By facilitating manufacturing, enabling multi-site trials, and aiding product development and design, the network will help bring down costs and help make these lifesaving therapies accessible to more people in Canada and abroad.

Further milestones in cancer treatment

The efforts of our Human Health Therapeutics Research Centre to find and advance treatments for cancer yielded further milestones in 2024–2025. The NRC's lentivirus vector will help advance cancer research globally. This new vector will serve as a consistent reference for assessing the effectiveness of in-development cancer immunotherapies. Six thousand vials of this lentiviral reference material have been prepared and can be distributed for use to labs across Canada and around the world, ensuring the quality and quantity they report is comparable to that of other studies using the same vector.

Additionally, in November 2024, the U.S. Food and Drug Administration approved the cancer therapy Ziihera®. Used to treat bile-duct and gallbladder cancer, the therapy was developed by the NRC-supported Canadian biotherapeutics company Zymeworks. The approval follows years of research and development, during which we provided the biologics expertise and laboratory resources that helped Zymeworks select and validate its lead candidate and secure strategic partnerships with multinational pharmaceutical companies.

A comprehensive platform for research into brain health and wellness

Developed by our Medical Devices Research Centre, the virtual reality platform for cognitive care, bWell, is evolving into a tool for studying brain health and wellness. By using AI to bring together and analyze cognitive assessments, digital health tracking and biological data analysis, bWell 2.0 provides a comprehensive view of individual health that could help researchers better understand the relationship between behaviour, thinking and biology.

In 2025, the bWell team furthered development of the updated platform with new functionality for emotion detection (through analysis of facial muscles and heart rate) and saliva sample analysis. We also launched a new industrial project with a Montréal-based company looking to apply bWell for stress and sleep management. The new version of bWell even has applications outside the medical clinic, such as for high-performance athlete training.

Remote biosensing software for more robust telehealth

Developed by our Medical Devices Research Centre, the VitalSeer software makes it possible to measure heart rate, respiratory rate and oxygen saturation through the camera on a computer or mobile device. Backed by rigorous scientific testing, this remote biosensing capability has the potential to keep patients out of emergency rooms by allowing them to monitor their vital signs from home, making it possible to provide accurate, high-quality data to healthcare providers during phone or virtual consultations.

The team is now working to test and validate VitalSeer to ensure medical-grade performance, as well as investigating the potential for continuous monitoring to assess additional markers such as balance and stability, further supporting the well-being of older adults who wish to age in place.

New partnerships to promote pandemic preparedness

In 2024–2025, the NRC's expertise in rapid screening, bioprocess development and analytics was put forward as part of several successful Canadian Biomedical Research Fund proposals to advance strategies and technologies that will support future pandemic response. Through the funded projects, we will explore rapid diagnostics and surveillance platforms for infectious threats, rapid and scalable vaccine and therapeutics manufacturing, AI-enabled therapeutics and vaccine components, and other initiatives across multiple NRC research centres.

These projects will strengthen Canada's defence against emerging viruses while accelerating innovation in the life sciences sector. In addition, our clinical trial material facility has joined a network of other facilities that are compliant with good manufacturing practices (GMP), supporting partnerships that will help understand and address gaps in the Canadian biomanufacturing ecosystem.

Joint funding with the UK for therapeutic manufacturing and product development

Addressing global challenges in critical sectors like biomanufacturing and pandemic preparedness is the focus of the Canada–UK Biomanufacturing Collaboration, a joint initiative between the NRC and UK Research and Innovation. Since the memorandum of cooperation was signed in June 2023, 2 joint calls for proposals were launched by the organizations.

Through those calls, Canada and the UK have jointly awarded funding to 5 projects in round 1, and an additional 9 projects awarded in early 2025–2026. Each project was proposed by consortiums that include small and medium-sized enterprises in both countries and research institutions including the NRC labs in some cases.

These projects include the development of an AI-driven platform that could accelerate and improve drug discovery, as well as the creation of automated biomanufacturing devices for antibody drug conjugate production that can enhance efficiency and reduce costs. For Canada, this work will help increase readiness for future public health challenges and keep the country at the forefront of biomanufacturing innovation.

A compact platform for food pathogen detection in remote communities

A team of researchers is using the NRC's PowerBlade platform to help Indigenous communities in Canada's North combat the growing threat of food contamination caused by pathogens resulting from climate change and industrial activity. Developed by our Medical Devices Research Centre, PowerBlade is a compact centrifuge that uses lab-on-a-chip technology to rapidly detect pathogens like *E. coli, Salmonella* and *Listeria.* It offers an on-site alternative to conventional methods of testing food safety, which are slow and impractical in remote regions.

This project is a collaboration with Health Canada, Crown-Indigenous Relations and Northern Affairs Canada, and Manitoba Keewatinowi Okimakanak, which represents 26 First Nations in northern Manitoba. Working directly with First Nations communities, the team will co-develop training and support programs to further refine the platform to better meet specific community needs.

A digital approach to heart failure assessment

Each year, more than 100,000 people in Canada are diagnosed with congestive heart failure, which highlights the need for faster, more cost-effective heart failure screening methods. Experts from our Medical Devices Research Centre are working with the Quebec-based HOP Tech to explore digital approaches for assessing patients for signs of heart failure.

The method being studied combines machine learning algorithms with digital biomarkers from wearable devices and smartphone apps—work that could lead to a faster, more accessible way of identifying signs of heart failure compared to blood tests, questionnaires and physical assessments.

Support for next-generation antibody therapies

With support from NRC IRAP and bispecific antibody development expertise from our Human Health Therapeutics Research Centre, Vancouver-based biotech startup Reverb Therapeutics advanced an innovative antibody-based platform called Amplify•R™. The platform is able to redirect naturally produced cytokines (small proteins that trigger the immune system) to target specific tissues, such as cancerous tumours.

Reverb Therapeutics secured $12 million in seed funding to further the development and clinical study of the promising platform, which could one day save lives in Canada and around the world.

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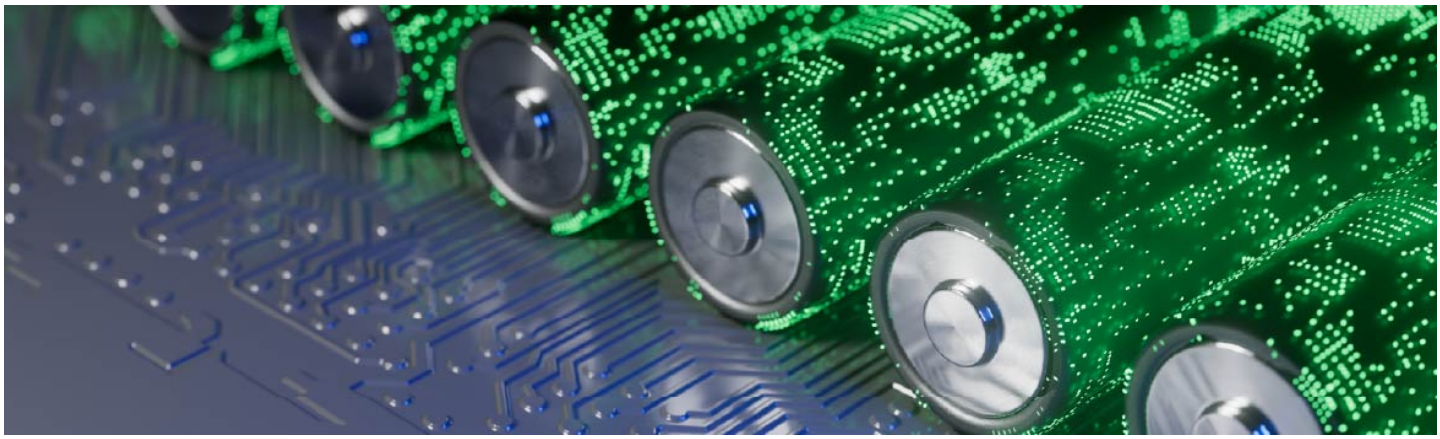

Building national resilience to climate change and leading in sustainability

With climate change among the most pressing issues facing Canada and the world, building a strong economy by leveraging low-carbon technology is more important than ever. In 2024–2025, we built partnerships and advanced research that will help achieve Canada's sustainability goals while strengthening our economic prosperity.

Filling the gaps in the supply chain for critical battery materials

Minerals and metals like lithium and nickel are needed to make the batteries that power electric vehicles and other green technologies. For Canada to lead in this growing sector, we must accelerate the discovery and processing of critical battery materials, while ensuring the approaches used are sustainable both economically and environmentally.

Hosted by our Clean Energy Innovation Research Centre, the Critical Battery Materials Initiative is dedicated to solving that challenge. At the core of the initiative are collaborative R&D projects aimed at accelerating the discovery and synthesis of new battery materials and their precursors, as well as projects to improve material recycling and recovery. This work will also help close gaps between mineral mining and battery manufacturing in Canada's supply chain, establishing one of the world's most effective networks for critical battery materials.

The work so far includes advancements in the development of technology platforms that use machine learning, AI and robotics to accelerate material discovery in an effort to keep pace with the fast-evolving battery sector. One of these is the midstream battery minerals processing acceleration platform (BattPAP), which uses machine learning to develop more efficient and sustainable processing pathways for producing battery materials from raw and recycled source materials.

As the 4-year initiative continues, collaborators will benchmark the environmental impacts of the new materials and processing pathways they discover so they can be compared to current materials and approaches.

Better performing batteries

Our Critical Battery Materials Initiative team has launched a new collaboration with Hydro-Québec's Center of Excellence in Transportation Electrification and Energy Storage to explore the use of Canadian critical minerals to enhance lithium-ion batteries. As a component in many

electric vehicles (EVs), lithium-ion batteries are in high demand; however, the insufficient energy density of some battery chemistries is a limiting factor for EV range.

Through this partnership, we will develop innovative solutions for using elements such as nickel and manganese to build batteries with higher energy densities compared to those built with existing materials. Once completed, this project will contribute not only to better EV performance, but also economic growth by increasing demand for Canadian critical minerals.

Together with our research partners, we are also investigating solid-state lithium batteries as a safer, higher-density energy option compared to lithium-ion batteries. Developing solid-state battery technology is challenging for a number of reasons, most notably the rapid loss of capacity typically seen in these batteries. In 2024, our team gained new insights into how to overcome that challenge. Using different kinds of light produced by a particle accelerator called a synchrotron, we were able to reveal the structural and chemical changes responsible for premature capacity loss. Our research into solid-state batteries will continue at the University of Saskatchewan's Canadian Light Source research facility, uncovering more insights that will advance the development of this promising energy storage technology.

"As a chemical engineer, I'm passionate about turning raw minerals into functional materials that are integrated into useful devices, especially those related to energy storage and mobility. As Canada moves toward establishing a new economic sector for batteries, the NRC's Critical Battery Materials Initiative will contribute to that goal by building local expertise, developing intellectual property, and enabling the validation and qualification of critical battery materials through close partnerships with industry."

— Nazanin Sharifrazi, Technical Officer, Clean Energy Innovation Research Centre

> "We are delighted to collaborate with the NRC's Critical Battery Materials Initiative team. By leveraging the NRC's extensive expertise in battery materials research and Hydro-Québec's unique capability to bridge lab-scale innovations to industry-relevant pilot-scale production, this collaborative project will create impactful innovations addressing technical challenges of conventional battery materials and supporting sustainable growth of the Canadian battery ecosystem by utilizing Canadian critical minerals."
>
> — Chisu Kim, Director of Research and Strategy, Hydro-Québec's Center of Excellence in Transportation Electrification and Energy Storage

Faster deep-energy retrofits in Canada's North

Long, harsh winters take their toll on housing in Canada's North and leave only a small window of good weather for construction crews to repair damage and make upgrades to improve a home's energy efficiency. With funding from our Arctic and Northern Challenge program, Whitehorse-based Earthrise Building Services has launched a 3-year project that is researching and developing new strategies to accelerate deep-energy retrofits in Northern and remote communities.

Six homes on Champagne and Aishihik First Nations land in the Yukon have been selected as sites for initial research on the benefits of energy efficiency, adequate ventilation and clean air, supported by our Construction Research Centre's expertise in ventilation and indoor air quality. A long-term outcome of the project will be a database of findings that will help builders, project delivery specialists, technology suppliers, manufacturers and communities swiftly carry out retrofits in Canada's North, promoting greater energy efficiency and healthier homes.

More productive wild blueberry plants for Northern communities

Wild blueberries have been a staple for Northern and Indigenous communities for generations, but because they yield relatively little fruit and have narrow harvest windows, it's difficult to meet demand. Experts from our Aquatic and Crop Resource Development and Quantum and Nanotechnologies research centres are working with the Kineepik Metis Local #9 community in Northern Saskatchewan to study methods to propagate the plant and enhance its production capacity, including through tissue culture technology and genetic evaluation.

This work will help us understand the potential of wild blueberry productivity to drive economic growth in Northern economies as well as reduce forest fire risks, as the plants also serve as an effective firebreak.

A tiny but vital indicator of the effects of ocean warming

Phytoplankton are microscopic organisms that are vital to oceanic ecosystems, serving a role similar to trees as absorbers of carbon dioxide. In partnership with Dalhousie University, our Aquatic and Crop Resource Development Research Centre is studying phytoplankton in the Northwest Atlantic Ocean to understand how different species of this organism fare in the warmer water conditions brought by climate change. Because phytoplankton adapt and react more rapidly to environmental changes than other oceanic lifeforms, such as fish, they can serve as an early indicator of ocean health that helps predict the broader impacts of climate change on marine ecosystems.

Digital simulations to make hydrogen storage safer on vehicles

If hydrogen-powered vehicles are to become commercially available, manufacturers need a way to store hydrogen safely. The NRC is at the forefront of solving the related engineering challenges, including how to make hydrogen reservoirs that are stronger and more resistant to the extremely high pressure under which hydrogen is stored. The NRC's world-leading blow-molding simulation software, BlowView, allows manufacturers to run digital simulations of hydrogen permeation during vehicle design and development, reducing the time, cost and waste associated with physical testing of different liner thicknesses and other variables.

Experts from our Automotive and Surface Transportation and Clean Energy Innovation research centres are also working with Transport Canada to explore the potential of hydrogen- and battery-powered locomotives. The project involves developing a risk management framework for these locomotives and educating regulators about the technology, steps that will support Canada's decarbonization of rail transportation.

A promising development for hydrogen propulsion and power systems

Both the aviation and energy sectors need clean technologies to limit carbon emissions and reduce climate impact. Hydrogen is one of several alternative energy sources that holds great promise, but its high reactivity presents significant challenges. In partnership with Siemens Energy Canada Limited and several Canadian universities, in 2024–2025, we completed the first large-scale, high-pressure combustion test of novel fuel flexible injectors that can power gas turbines with up to 100% hydrogen in a safe, stable and efficient manner. The test, which took place in the NRC's Propulsion and Power Laboratory, explored the potential of this innovative design for real-world deployment, furthering our commitment to advancing hydrogen technology and creating value for Canada's industry.

Eco-friendly breakwaters that double as habitats for marine life

While concrete structures help protect shorelines against erosion, they also leach acidic chemicals into the water. In partnership with marine technology company ECOncrete, experts at our Ocean, Coastal and River Engineering Research Centre advanced an eco-friendly alternative to traditional concrete structures called Coastalock. Made from an ecologically sensitive concrete mix, the structures are also shaped and textured to create habitats for aquatic life. We lent our expertise and world-class large wave flume facility to physically test the units against varying water levels, wave heights and other conditions. The results helped determine the optimal spacing of the units, structure height and other details that will inform real-world deployments along coasts across the globe.

Software for decreasing small boat emissions

The transition to green energy sources is not limited to land vehicles like cars and buses. Efforts are also underway to make seafaring vessels more sustainable. Halifax-based Glas Ocean Electric is contributing to that transformation by focusing on small boats, which are often overlooked in research and development. Experts from our Ocean, Coastal and River Engineering Research Centre helped the company study the relationship between small boat emissions and meteorological and operational data to set a baseline that can be used to quantify emissions reductions.

Based on that research, Glas Ocean Electric built software that provides data on emissions and costs based on a variety of factors, including the number of people on board a vessel. This tool could help small boat operators reduce fuel consumption and emissions, potentially having a major impact given the number of such vessels in Canadian waters.

Leading-edge capabilities for advanced materials research

The $77-million expansion of the TerraCanada advanced materials research facility in Mississauga, Ontario, was completed in April 2024. Two new floors add more than 6,000 square metres of lab space to support the development and commercialization of advanced materials technologies. Bringing together scientists from the NRC and Natural Resources Canada, the facility supports the discovery and development of materials that are critical to clean technologies, which will help Canada meet its emission reduction targets while growing the country's clean energy sector.

New insights into flood-resilient construction

As floods and severe storms become more prevalent, it is vital to understand how homes and other buildings can be made more resilient to damage and loss. In partnership with Architecture Sans Frontières Québec and the Canada Mortgage and Housing Corporation, our Ocean, Coastal and River Engineering and Construction research centres have built a full-scale home to National Model Codes standards in the NRC's multidirectional wave basin. The purpose: to simulate various flood conditions and measure water infiltration through various elements.

The results will inform and strengthen residential flood resilience measures, flood protection equipment and architectural designs, helping protect people in Canada from the growing effects of climate change.

Better data to improve wildfire management

The rising temperatures and increasing droughts brought by climate change have made wildfires more frequent and dangerous. To help wildfire management efforts, our Construction and Aerospace research centres continued investigations into the impacts of wildfires on structures and communities. This included research into the contents of wildfire-produced smoke, which contain harmful gases and fine particles that can travel thousands of kilometres, as well as tests on air filters designed to prevent such particles from entering structures.

Additional research studied the chances of embers from wildfires igniting different kinds of construction materials. Data from these investigations will be used to train AI and machine learning models, and also to assist municipalities with wildfire monitoring and containment that could help prevent devastation like that seen in Jasper National Park and other parts of the country in 2024.

A smarter approach to bridge safety monitoring

Bridges are vital linkages for communities across Canada. This is especially true in rural and Northern regions of the country, where bridges face increased structural risks from the impacts of climate change. Advancements in drone, sensor and AI technology are making it easier to keep these bridges safe for users.

In 2024–2025, NRC researchers advanced a new, data-driven approach to bridge safety monitoring in collaboration with Esri Canada; the University of Manitoba; l'Université du Québec en Outaouais; and Housing, Infrastructure and Communities Canada. This includes using drones equipped with AI and augmented reality technology to assess bridge conditions safely from afar, along with satellite and on-site sensors to remotely monitor bridge health through indicators like strain, acceleration and temperature.

Data from these projects will feed into a database of knowledge on the effects of traffic and environmental patterns on bridges and other infrastructure, which will inform government decisions related to bridge maintenance, renewal and replacement.

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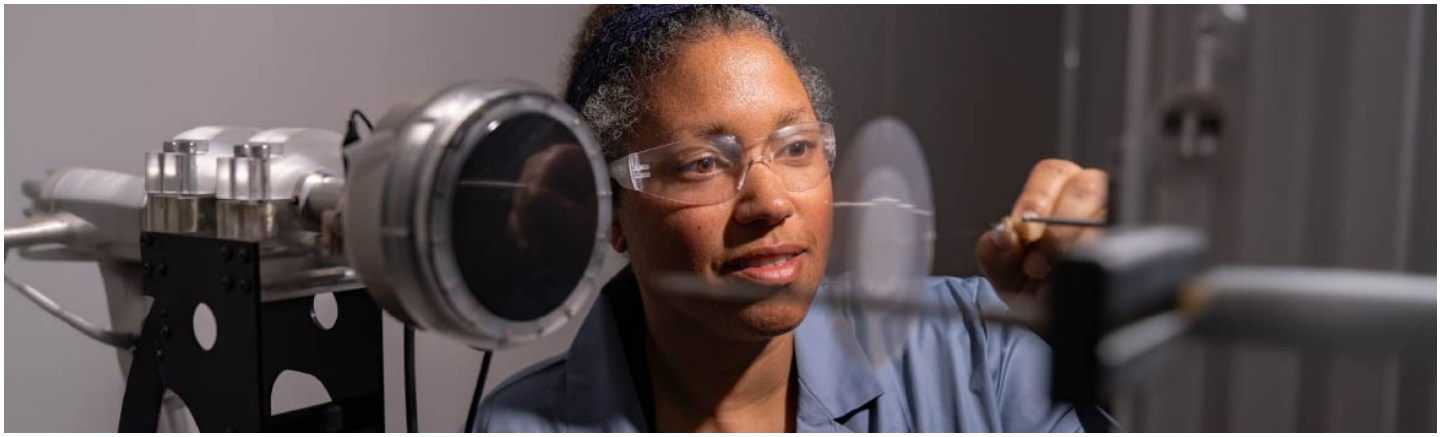


Furthering Canada's leadership in foundational research

It is foundational research—the scientific explorations in areas like astronomy and measurement science—that often paves the way for breakthroughs in other fields. We undertook many such explorations in 2024–2025, contributing to discoveries with implications for research within Canada and around the world.

A rare update to the Periodic Table of Elements, informed by NRC metrologists

Every element in the periodic table has a defined atomic weight. Those weights have important implications for research in areas like physics, chemistry and materials science—and as measurement science improves, they are also subject to change.

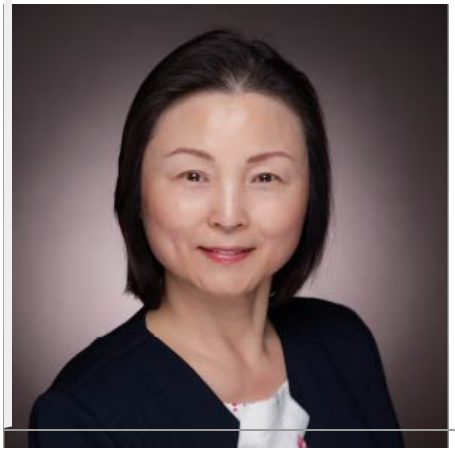
Revisions to the standard atomic weight of an element is a rare occurrence that happens, on average, every couple of decades as advancements in measurement science make more precise weighing possible. In 2024, work by experts in our Metrology Research Centre contributed to the revised standard atomic weights for 3 elements: lutetium, gadolinium and zirconium.

That work involved advanced isotope ratio measurements in our world-class glow discharge mass spectrometry facility—studies that were part of the literature review carried out by the International Union of Pure and Applied Chemistry Commission on Isotopic Abundances and Atomic Weights to determine the revised weights.

The 3 elements included in the most recent revision are vital to technologies that have applications in healthcare, aerospace and other sectors important to Canada's future. Gadolinium, for instance, is a vital component of MRI technology, where precision is important, but the measurements used to set its standard atomic weight previously dated back to the 1940s. Our high-precision measurements inform the periodic table, which supports international collaboration, trade and commerce, while also helping enable Canada's supply chain for critical minerals.

"What captivates me about this work is the mix of cutting-edge science and international diplomacy required to turn a scientific finding into a globally accepted standard. By aligning Canada with one of the most iconic symbols of science, the Periodic Table of the Elements, we reinforce our reputation as a trusted leader in science and technology, while research into the fundamental properties of lutetium, gadolinium and zirconium strengthens Canada's role in technology-critical mineral research."

— Dr. Juris Meija, Senior Research Officer, Metrology Research Centre



"The most exciting aspect of this work for me is solving longstanding challenges in isotope ratio measurements, and providing more precise and accurate measurements. It is incredibly rewarding to provide the scientific community with validated methodologies for isotopic analysis and high-quality isotopic certified reference materials, supporting research worldwide in this area."

— Dr. Lu Yang, Senior Research Officer, Metrology Research Centre

Canadian support for the SKA Observatory

Currently under construction, the SKA Observatory (SKAO) will operate the 2 largest radio telescope arrays in the world, located in South Africa and Australia. It aims to answer some of the biggest remaining mysteries in astrophysics.

Canada has been a key partner in the design and construction of this ambitious scientific facility. To ensure researchers across the country have full access to the SKA telescopes and their data, we launched the Canadian SKA Scientist Program in 2024–2025. The program funds early-career, postdoctoral researchers who will form a network across Canadian universities.

While carrying out independent cutting-edge research, the funded researchers will also support the Canadian astronomical community in developing world-class science programs centered on the SKAO.

Brown dwarf revealed to be twins

In 1995, scientists observed a brown dwarf, a celestial object that is larger than a planet but lighter than a star, for the first time. Known as Gliese 229B, this brown dwarf puzzled astronomers due to its unexpected dimness. Nearly 30 years later, a team of international researchers made an observation that solved the decades long mystery: it was not 1 brown dwarf but 2 orbiting tightly around each other.

Dr. William Thompson, the Herzberg Instrument Science Fellow at our Herzberg Astronomy and Astrophysics Research Centre, was part of the international team that made the observation that proved the long-standing theory. This surprising discovery is further evidence of Canada's capacity to contribute new knowledge and helps maintain our position as a world leader in astronomy and astrophysics.

New optical technique to quantify harmful elements in wildfire smoke

NRC researchers are developing a technology that will allow the first in-field measurements of light absorption by aerosols, without the need for laboratory calibration.

Aerosols are made up of tiny nanoparticles less than one-hundredth of the width of a human hair. Black carbon aerosols are a major component of carcinogenic diesel exhaust, and major contributors to climate warming due to their strong light-absorbing ability. They are found in forest fire smoke, combustion-engine emissions and industrial emissions.

Detecting and measuring light absorption by these nanoparticles is difficult in real-world conditions and especially challenging while monitoring wildfire smoke due to a lack of appropriate reference techniques. The new optical technique developed by the NRC will address this measurement challenge. The ultimate goal is to commercialize a black carbon monitoring device that is more accurate than current devices and that can be integrated in networks of low-cost sensors.

A digital impedance bridge for better metrology

In partnership with the Canadian company Measurements International Limited, experts at our Metrology Research Centre are developing a new digital system to measure impedance, a parameter that quantifies how much an electrical circuit element resists the flow of electricity.

Impedance is fundamental in many technologies, especially for the electronics industry. Compared to its analogue counterparts, this new digital and fully automated version will offer lower measurement uncertainties, shorter measurement times and a wider frequency range. It is an important tool when designing any modern electronics, like smartphones.

This NRC-invented system will be available on the market worldwide, offering highly accurate, reliable automated measurement capabilities and versatility to national metrology institutes or any industrial or research laboratory dealing with complex electrical measurement tasks.

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Helping Canadian businesses innovate and lead

The capacity of Canadian industries and businesses to innovate and compete internationally is key to Canada's economic prosperity and standard of living. Throughout 2024–2025, we worked with small and medium-sized enterprises (SMEs) across the country to build their innovation capacity, including through NRC IRAP.

Assistance for made-in-Canada AI technologies

NRC IRAP's new AI Assist program is helping Canadian SMEs develop and deploy new AI-based solutions, like generative AI and deep learning, in a safe and responsible manner. The goal is to maximize the quality and competitiveness of made-in-Canada AI technologies, and enable more SMEs to reap the productivity and efficiency benefits of AI.

Through this program, a cross-Canada network of NRC IRAP industrial technology advisors (ITAs) connects SMEs to the knowledge, computing resources and tools they need to integrate AI capabilities into their own service offerings and processes. ITAs also work with traditional industries, like manufacturing and mining, that might be unaware of the transformative potential of AI or lack experience using these technologies.

The program was announced in October 2024 as part of a $2.4 billion Government of Canada investment to encourage AI adoption across Canada's economy. In less than a year, more than 250 projects have already been defined and initiated. As one example, we are helping a healthcare firm pilot AI-enhanced software for assessing heart sounds. Trained on sounds captured by digital stethoscopes, the software aims to remove noise from recordings, such as the sounds of children as they shift or cry, so physicians can better differentiate the segments of the cardiac cycle.

As the AI Assist program continues, the funding and support we provide will accelerate AI adoption within SMEs and empower AI-driven innovation that promotes productivity, efficiency and well-being, all while solidifying Canada's place as a world leader in AI.

"The more I have learned about AI, the more convinced I am that it is a generationally transformative technology. The history of innovation is that new technologies change the way we think of work, enable entirely new kinds of jobs and create net improvements in productivity, which is both an increase in GDP as well as efficiency. Generative AI solutions are a chance for Canada to catch up and address our longstanding erosion of productivity. To be there to influence such a dramatic and transformative technology is an opportunity and a big responsibility."

— Godwin Liu, Industrial Technology Advisor,
NRC IRAP

> "Our product necessitated the capability to segment heart sounds and de-noise heart sound recordings. NRC IRAP recognized the significance of this aspect in ensuring our success and sustaining Kardio Diagnostix's leadership in the competitive artificial intelligence market. The valuable advisory services and financial support provided through the AI Assist program catalyzed the development of a groundbreaking deep learning segmentation solution that has never been accomplished before and will be patented."
>
> — Dr. Robert Chen, Co-founder, Kardio Diagnostix

Clean technology programming transitions to NRC IRAP

In June 2024, the Government of Canada announced that Sustainable Development Technology Canada (SDTC), including support to advance promising clean technologies toward commercialization, would transition to the NRC. Now part of NRC IRAP, the new IRAP Clean Technology program will continue to reinforce the growth and success of Canada's clean technology sector.

Fibre optic sensing and machine vision for safer railways

Industries across Canada depend on railways for the reliable transportation of materials and goods throughout the country. Experts at our Automotive and Surface Transportation Research Centre are exploring ways to enhance railcar safety with advanced technologies, efforts that will help keep people safe while also ensuring freight reaches its destination.

In partnership with Transport Canada and the University of Alberta, we evaluated the performance of a machine-vision inspection system that can identify cracks, wear and other defects as a train passes through a structure containing 35 infrared cameras that capture each railcar from every angle. The study results will help refine the system and ready it for broader deployment.

In April 2024, we also completed a project to develop a fibre optic sensor system to collect data on the conditions contributing to track failures—insights that will support research to make railways across Canada safer and more reliable.

Canadian leadership on the global stage as co-chair of Eureka

Canada served with Germany as co-chair of the global innovation network Eureka from July 2024 to July 2025—the first non-European member to take on that role. Alongside Germany's Federal Ministry of Education and Research, the NRC co-chaired Eureka meetings in late 2024 and early 2025, and led the planning and execution of the Eureka Global Innovation Summit in Hannover, Germany, which attracted innovators, entrepreneurs, investors and policymakers from around the world.

Together, Canada and Germany focused on achieving several strategic objectives during the co-chair period including transforming Eureka into an innovation think tank, increasing synergies with global ecosystems and expanding partnerships with countries like Brazil and Singapore, and developing long-term strategies for more effective governance and administration. We also initiated a pilot for the largest network call on circular value creation, highlighting Canada's dedication to global innovation and growth through partnerships.

Eureka is the world's largest innovation network, aiming to foster market integration and encourage international R&D cooperation among its 45 member countries. Canada's position in Eureka has been a valuable opportunity to deepen our connections with our international partners as we work toward shared prosperity.

A platform to decarbonize the construction sector at scale

Canada's construction industry faces a significant challenge: increase housing supply while supporting a low-carbon economy. In 2024–2025, we continued to advance research through our Platform to Decarbonize the Construction Sector at Scale initiative, which supports the development of tools and guidelines that can help the industry both accelerate productivity and decarbonize.

Activity areas include advancing the digitalization of construction sector practices, and supporting development of low-carbon construction tools, products and services. This work will also help the industry develop and deploy low-carbon construction solutions at scale, and make progress toward Canada's goal of net-zero emissions by 2050.

A technology adaptation to support the agriculture industry's sustainability goals

Laser-induced breakdown spectroscopy (LIBS) technology, which uses laser pulses to identify elements in matter, was designed for the mining and metallurgy industries. In partnership with Canadian agri-environmental firm Logiaq, we have adapted the technology for another use: measuring carbon stored in soil, which will help the agriculture industry take steps to reduce its climate impacts.

Compared to conventional techniques for soil analysis, LIBS simplifies the process while reducing analysis time from days to minutes and analysis costs from dollars to cents. Logiaq's LaserAQ Quantum instrument, which uses our LIBS technology, is already in use within commercial labs in Canada and Africa.

Full-scale demonstration of an autonomous flight simulation system

Our Flight Research Lab continues to develop its autonomous flight and simulation system for vertical takeoff and landing. In 2024–2025, the team demonstrated the system on a full-scale rotorcraft, including new features related to perception, trajectory planning, autonomous traffic monitoring and human-machine interfaces. The autonomous flight system is also now capable of communicating with a second autonomous vehicle, marking a key milestone in its progress. Another study sought to understand how long it would take a pilot to engage or disengage aircraft automation, and their ability to do so while doing another task.

Additionally, the team formed 4 new academic partnerships and 2 new industry partnerships, all of which will involve multi-year collaborations, and confirmed new use cases for the system with the Department of National Defence. In total, the autonomous flight system was flown 30 times in 2024–2025, with 40 hours of test time. More active flight tests are planned for 2025 to further evaluate the system's unique capabilities.

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To make progress in the areas that matter most to Canada, we must maintain our internal capacity to deliver excellence and that is through our outstanding employees. We develop, support and enable a diverse community of passionate and talented people dedicated to making a lasting impact on Canadians, and the world.

Sponsoring Indigenous and racialized employees to prepare for leadership roles

In 2023–2024, we launched a pilot sponsorship program to support high-potential Indigenous and racialized employees in preparing for leadership roles. As part of the sponsorship program, 26 employee protégés were paired with 12 senior leaders who learned about the employee's career aspirations, advocated for opportunities to further develop their leadership skills, and helped open doors and build new networks.

Following the conclusion of the successful pilot in fall 2024, we launched a call for interest for new protégés in winter 2025. The second cohort will run throughout 2025–2026.

"The sponsorship program has been an invaluable part of my growth within the NRC. It has allowed me to meet individuals from different research centres who I would have normally not crossed paths with. The exchange of ideas and good practices, and more importantly, gaining insights from my sponsor's years of experience, has been a profound learning experience for me. This opportunity has not only expanded my professional network, but has also significantly enriched my understanding of various aspects of our field."

— Sanjana Rawat, Project Manager, Herzberg Astronomy and Astrophysics Research Centre

"This program has been a truly eye-opening experience, enhancing my understanding of the challenges and aspirations of our diverse workforce. Working with 2 exceptional individuals, I discovered remarkable talent and had the privilege of opening doors for them to explore and identify opportunities for professional growth, which was both rewarding and inspiring. The program underscored the importance of fostering opportunities for learning and development."

— Maria Aubrey, Vice-President, Business and Professional Services

Discover the possible!

Each day at the NRC, we explore new ideas through innovative research and help companies discover new possibilities that will affect Canada's future and the world. Our commitment to empowering our own people to also discover the possible within themselves is reflected in our new employee value proposition (EVP).

Developed through consultations with employees and leaders, the EVP reflects our commitment to fostering a workplace that supports new ideas, collaborative excellence, career development and work–life harmony, while offering competitive benefits for our people.

In 2025, the NRC was named one of Canada's top employers for young people, was on the National Capital Region's list of top employers and was named a Forbes Canada best employer.

Fostering a culture of safety

Ensuring the safety and security of our people, contractors and visitors is our top priority, which we are pursuing through our Hazard Prevention Program and our ongoing "Make it safe!" campaign. The campaign promotes safety-consciousness whether working on or off site, and encourages employees to raise health and safety concerns with management. As a result, we have seen an increase in hazard reporting, indicating a high degree of safety consciousness and engagement among our teams.

Empowering our employees' success

A diverse workforce and a workplace where everyone can reach their full potential are key to achieving our vision of a stronger Canada and a better world through excellence in research and innovation. Our 2024–2027 Equity, Diversity and Inclusion (EDI) Strategy supports this vision by promoting a diverse and barrier-free workplace for equity-deserving groups. The strategy will guide recruitment and career development, strengthen access to employee communities and resources that promote belonging, and drive inclusive innovation in research and program delivery.

To support the career success of all NRC employees, we also made available a career development toolkit for employees and supervisors. The employee toolkit includes a worksheet that helps employees define their career aspirations and identify the steps to achieving them, in collaboration with their supervisor. There is also a tool that helps document existing skills and strengths, as well as guidance on the 70-20-10 model of learning, which recommends

development plans be made up of 70% experiential learning, 20% social learning and 10% formal learning. The supervisor toolkit provides access to several tools and templates that assist with career development conversations, coaching and planning.

Upgrading Canada's research infrastructure

Modernization of our research infrastructure, made possible by funding from the Government of Canada that began 2 years ago, continued throughout 2024–2025. This included a significant milestone: $100 million in procurement dedicated to supporting our facility renewal projects.

This year, we completed over 70% of the upgrades to our photonics facilities, installing nearly 30 new pieces of unique equipment that will enhance our capacity to develop and manufacture semiconductors for AI, quantum and defence applications. We initiated construction of a new acoustic facility in Ottawa that will house several specialized labs and support Canadian industries in developing quieter, healthier environments. In Saguenay, Quebec, we added new equipment to our Aluminum Technology Centre, including a hydrogen concentration measurement device, a vertical digital milling machine and an ion beam polisher.

We also opened the call for proposals for the second wave of major capital investments, with the selection of projects to be done in 2025–2026. Collaboration will be an important part of the renewal projects, including with industry and university partners. The projects will help further enhance Canada's scientific infrastructure and capabilities in key research areas.

Evolving our procurement process for greater research agility

Being able to respond quickly to the needs of partners in industry and academia is key to our success. An amendment to the *National Research Council Act* enhances our agility by granting us increased authority in the procurement of goods and services. The Act also established a Procurement Oversight Board to oversee and govern procurement within the NRC. With this increased authority and associated oversight, we are in a stronger position to work hand-in-hand with industry and renew Canada's research infrastructure at the NRC.

Recognizing the contributions of women in STEM

In February 2025, the NRC and the Office of the Chief Science Advisor co-hosted the annual Celebrating the Success of Women in STEM Symposium. More than 1,800 people registered for the 2-day virtual event, which included expert panels and networking sessions reflecting on

and celebrating the pivotal role of women and inclusion in transforming research into innovation.

In 2024–2025, we also selected the second recipient of the NRC Luise and Gerhard Herzberg Postdoctoral Fellowship, which is awarded each year to a PhD graduate who identifies as a woman and has demonstrated research excellence. As the new Herzberg postdoctoral fellow, Dr. Kate Fenwick of Calgary, Alberta, will continue her explorations into ultrafast photonics, a research pathway that could one day be key to quantum computer development.

Celebrating the first recipients of the Killam NRC Paul Corkum Fellowship

The first 2 recipients of the Killam NRC Paul Corkum Fellowship were awarded in March 2025. Working with the Quantum and Nanotechnologies Research Centre, Andrew Tanentzap of Trent University will study the use of disruptive environmental monitoring technology to transform water-quality monitoring. Linda Nazar of the University of Waterloo, in collaboration with the Clean Energy Innovation Research Centre, will explore the use of nickel in lithium-ion battery technology to reduce the costs of battery production.

A collaboration between the NRC and Killam Trusts, the fellowship creates opportunities for mid- to late-career scholars to advance research aligned with NRC Challenge programs. Along with an annual grant paid to the institution of each fellow, recipients get the opportunity to partner with NRC researchers, use NRC facilities and resources, and share knowledge through new collaborations. The name of the fellowship recognizes the contributions of Dr. Paul Corkum to Canadian research on attosecond molecular imaging.

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Individual awards and recognitions

Isabelle Amen

Education and Training Award, NCSL International

Jenny Atwood

Women in Optics Notebook, SPIE

Dr. Noureddine Bénichou

Fellow, Canadian Academy of Engineering; Public Service Award of Excellence, Treasury Board of Canada Secretariat

Dr. Frédéric Bouchard

2025 Early Career Achievement Award (Industry/Government), SPIE

Dr. Pavel Cheben

2024 Engineering Achievement Award, IEEE Photonics Society;
2025 Maria Goeppert Mayer Award in Photonics, SPIE

Dr. Joel Corbin

Member, College of New Scholars, Artists and Scientists, Royal Society of Canada

Dr. Paul Corkum

Medal for Exceptional Achievement in Research, American Physical Society

Dr. Nafiseh Ebrahimi

Elaine Bowman Distinguished Service Award, Association for Materials Protection and Performance

Victoria Howard

J.R. Cunningham Young Investigators Award, Canadian Organization of Medical Physicists

Dr. Eric Irissou

Fellow of the Society, ASM International

Dr. Samira Lotfi

Award for Contributions to the RO/RCO Community, Professional Institute of the Public Service of Canada

Dr. Zoubir Lounis

Fellow, Canadian Academy of Engineering

Dr. Christian Marois

Fellow, Royal Society of Canada

Dr. Alan McConnachie

Peter G. Martin Award, Canadian Astronomical Society

Dr. Elizabeth Mudge

Method of the Year Award, AOAC International

Dr. David Murrin

Fellow, Canadian Academy of Engineering

Amanj Rahman

Award for Promoting Health and Safety in the Workplace, Professional Institute of the Public Service of Canada

Dr. Homin Shin

Minister's Award, Korean Ministry of Science, Information and Communication Technology

Dr. Li-Lin Tay

Ricardo Aroca Award, Chemical Institute of Canada

Dr. William Thompson

J.S. Plaskett Medal, Royal Astronomical Society of Canada and Canadian Astronomical Society

Dr. Jennifer Veitch

Fellow, Royal Society of Canada

Dr. Gaozhi Xiao

Fellow, Canadian Academy of Engineering

Lydia Zamlynny

Inés Cereijo Technical Division of Reference Materials Student Award, AOAC International

Team awards and recognitions

Automotive and Surface Transportation team

2024 Think Ottawa Sector Excellence Award

Dr. Deborah Lokhorst as member of the Dragonfly team led by Dr. Roberto Abraham (University of Toronto)

2024 Dunlap Award for Innovation in Astronomical Research Tools, Canadian Astronomical Society

Dr. Guy Austing as member of the NRC–University of Ottawa team

2024 Think Ottawa Leader Award in Information Communications and Technology

Dr. Andrew Todd et al.

Winner, 2024–2025 Best poster competition on Quantum Technologies: prospects for new thermometric and radiometric sensor development, Royal Society meeting

King Charles III Coronation Medal recipients

The King Charles III Coronation Medal recognizes deserving individuals, including public service employees, who have made a significant contribution to Canada or to a particular province, territory, region or community of Canada, or have made an outstanding achievement abroad that brings credit to Canada.

The NRC was allocated 13 medals which were awarded to the following individuals:

Christine Aquino

Clément Giraneza

Bruce Hardy

Daniel Hewitt

Dr. Michael Lacasse

Dr. Malcolm McEwen

Annapurni Narayanan

Kory Phillips

Emery Rutagonya

Dr. Danica Stanimirovic (posthumously)

Dr. Joseph Su

Dr. Teodor Veres

Dr. Ali Yousefpour

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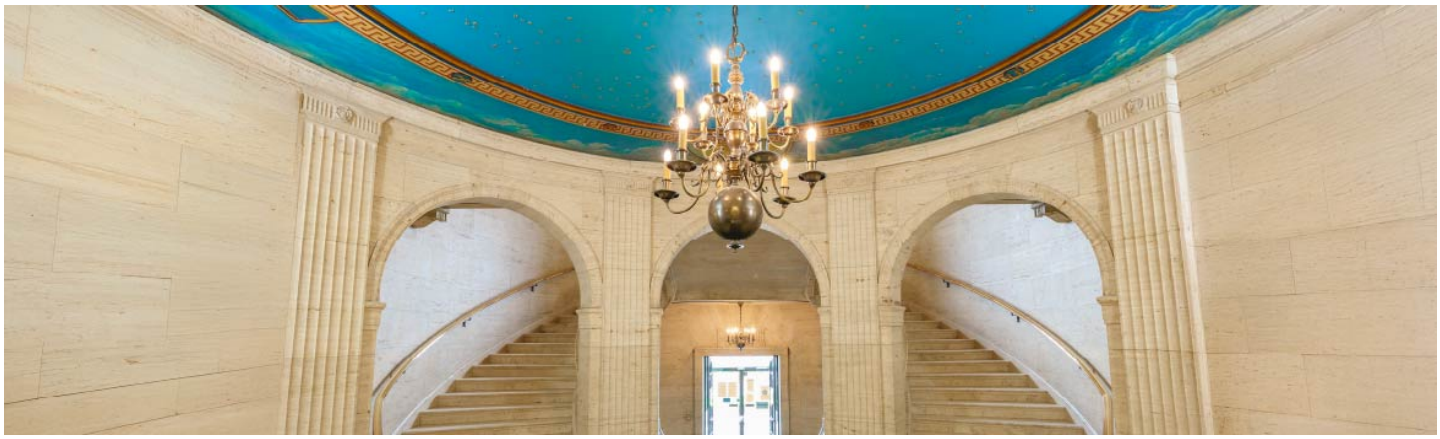

Senior leadership

Composition on March 31, 2025:

Mitch Davies

President

Maria Aubrey

Vice-President, Business and Professional Services

Karen Cahill

Vice-President, Corporate Services and Chief Financial Officer

François Cordeau

Vice-President, Office of Facilities Renewal Management and Special Advisor

Emily Harrison

Vice-President, Human Resources

Dr. Jean-François Houle

Vice-President, Engineering

Dr. Lakshmi Krishnan

Vice-President, Life Sciences

Dr. Julie Lefebvre

Vice-President, Emerging Technologies

David Lisk

Vice-President, Industrial Research Assistance Program (NRC IRAP)

Dr. Joel Martin

Chief Digital Research Officer, Chief Science Officer and Departmental Science Advisor

Dr. Shannon Quinn

Secretary General

Dr. Ibrahim Yimer

Vice-President, Transportation and Manufacturing

Special assignments and projects

Dr. Doug Johnstone

President's Science Advisor and Secretary to the

President's Research Excellence Advisory Committee

Council members

Composition on March 31, 2025:

Dr. Douglas W. Muzyka

Chair of the NRC Council

Norma Beauchamp

David Berthiaume

Dr. Joël Blit

Dr. Susan Blum

Ray Hoemsen

Dr. Digvir Jayas

Dr. Steven Murphy

Dr. Pierre Rivard

Norman JD Sawyer

Dr. Ali Tehrani (on leave)

Mitch Davies

Procurement Oversight Board members

Composition on March 31, 2025:

Dr. Munir Sheikh (Chair)

Johanne Bélisle

Heidi Francis

Joëlle Paquette (non-voting member)

Departmental Audit Committee members

Composition on March 31, 2025:

Kevin Lindsey (Chair)

Dana Ades-Landy

Gayle Gorrill

Dr. Pierre Rivard (NRC Council member)

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