



NRC-CNRC

Laying the foundations for tomorrow's innovations

2022-2023 annual report



National Research
Council Canada

Conseil national de
recherches Canada

Canada



Government
of Canada

Gouvernement
du Canada

Laying the foundations for tomorrow's innovations: 2022–2023 annual report

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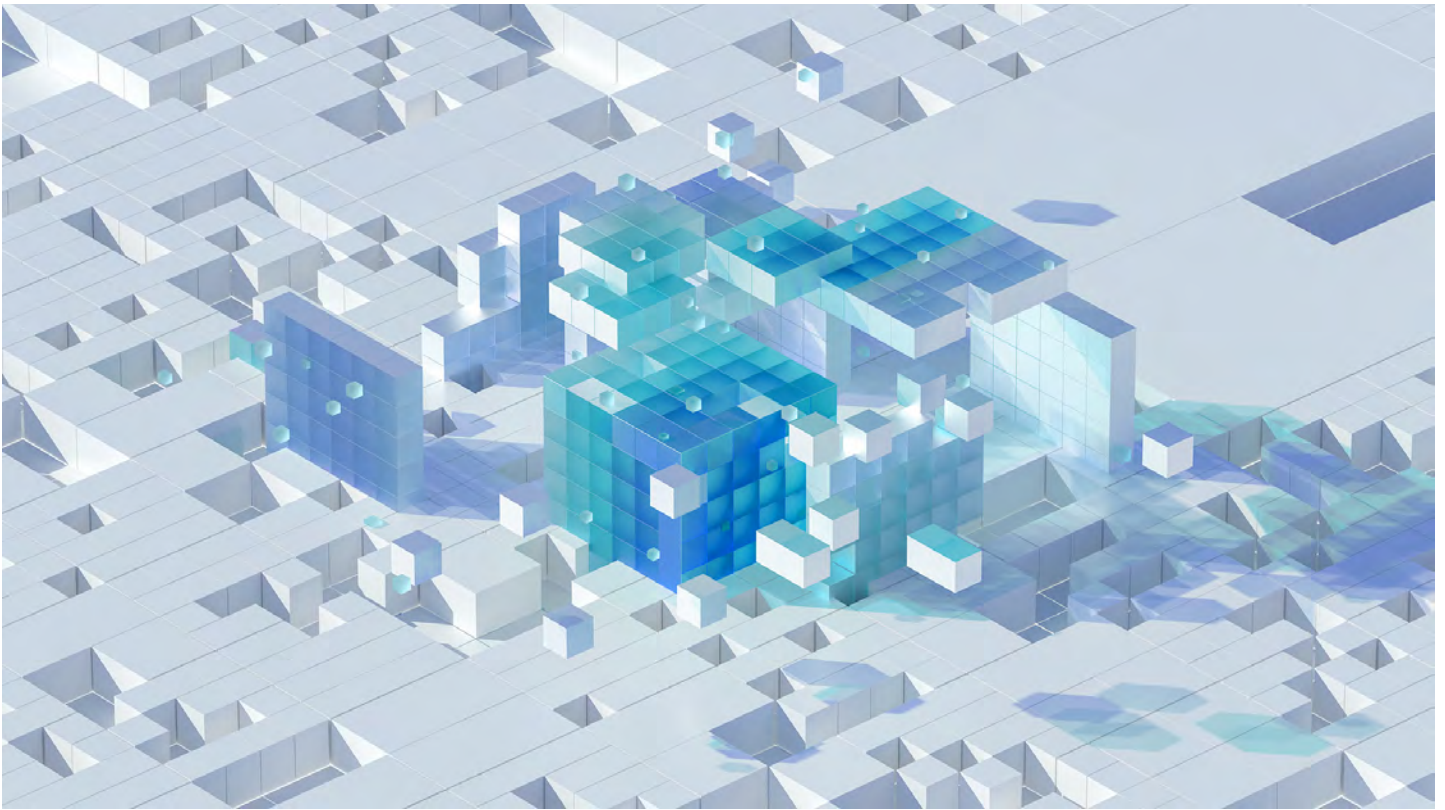
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For more than 100 years, the National Research Council of Canada (NRC) has been delivering research and innovations that improve the lives of people across Canada and around the world. With advances happening ever more rapidly, it is more important than ever to keep renewing our capabilities and expertise to ensure we are ready for whatever tomorrow brings.

This annual report reflects on what it means to renew the NRC—both literally, as we update many of our most critical facilities with a once-in-a-generation investment, and figuratively, as we plan for our future.



Message from the President

Reflections on the past year
from NRC President Iain Stewart



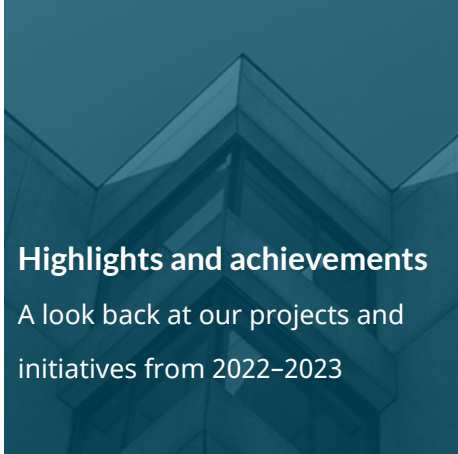
NRC at a glance

Facts and stats on the NRC's
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Revitalizing key facilities

An overview of the first phase of
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Toward inclusivity in research

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Awards and honours

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NRC leadership

An introduction to the
NRC leadership team

Message from the President



The NRC has a long history of conducting and supporting ground-breaking research that has led to innovations in areas from sustainable construction to radio telescope collaboration to biomanufacturing. Much of this work depends on highly specialized equipment and buildings, which is why the federal government's announcement of nearly \$1 billion to renew our facilities was so exciting for us.

An investment of this size has given us a unique opportunity to think strategically about the long term and make upgrades that will not only ensure our people have access to the latest equipment for the research they're doing today, but will set us up for future projects that haven't even been conceived yet.

But renewal was top of mind for us even before that announcement, because we had already started working on the next iteration of our strategic plan to take us to 2029. We built in extended time for employee engagement—in research centres, corporate services and the NRC Industrial Research Assistance Program (NRC IRAP)—for them to set out what they see as key opportunities and challenges, and to provide their ideas for how the NRC should address them.

In combination with our 3 strategic priorities of climate action, quantum and digital, and health, our intention is to create a strategic plan that will help us move at the speed of business with greater agility and responsiveness to emerging needs. The next few years will also see

governance changes to some of our research centres to enable them to better meet the needs of Canadian and international researchers.

One of the biggest changes will be the transition of NRC IRAP to the new Canada Innovation Corporation (CIC), which will take effect approximately 24 months after its announcement in February 2023. The CIC will be a Crown corporation that will focus on supporting the R&D needs of businesses across all sectors of the economy.

While this will change some of the ways we work together, this evolution will enable us both to grow and focus on what we do best. I'm very proud of this step, as NRC IRAP joins a long line of agencies that originated as part of the NRC and have since grown into vital independent organizations: the Canadian Space Agency, Defence Research and Development Canada, and Atomic Energy of Canada Limited, just to name a few.

With all the global efforts made to combat the COVID-19 pandemic, the world is in a better place today than it was one year ago. While many of our employees worked on-site throughout the pandemic, many others transitioned to doing some or all of their work remotely. Now that most public health restrictions have been lifted, these employees have returned to the office. We're renewing our understanding of what that looks like and finding ways to balance organizational needs with the personal needs of our people.

Ensuring a safe work environment for all has always been a priority, and our record is testament to the time and effort we invest in keeping our people safe. However, this year we were tragically reminded of the consequences when things go wrong. In February 2023, we lost one of our own, Philippe Tremblay, in a fatal workplace accident. As colleagues and friends, we mourn his loss. As an organization, we recommit ourselves to upholding the NRC's health and safety practices as our top priority.

In closing, I would like to welcome Digvir Jayas, Ali Tehrani and David Berthiaume to our Council, and thank Neil Bose, Carolyn Cross, Aled Edwards and Mohamed Lachemi for their excellent contributions. I'm also pleased to welcome Alain Beaudoin to our senior executive team, and I would like to thank the entire NRC staff for their ongoing dedication and passion for advancing Canada's research priorities.

Iain Stewart
President

NRC at a glance



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.

Our values

Excellence:

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

Our values

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.

Our values

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.

Our research centres

Our research spans **14** research centres across **5** divisions, with facilities in **24** locations across Canada.

Life Sciences



Aquatic and Crop Resource Development

Life Sciences



Human Health Therapeutics

Life Sciences



Medical Devices

Emerging Technologies



Advanced Electronics and Photonics¹

Emerging Technologies



Nanotechnology.¹

Emerging Technologies



Security and Disruptive Technologies¹

Emerging Technologies



[Herzberg Astronomy and Astrophysics](#)

Emerging Technologies



Metrology.

Digital Technologies



Digital Technologies

Transportation and Manufacturing



Aerospace

Transportation and Manufacturing



Automotive and Surface Transportation

Engineering



Construction

Engineering



Energy, Mining and Environment

Engineering



Ocean, Coastal and River Engineering

People

4,263

full-time equivalent staff

2,293 scientists, engineers and technicians

269 NRC IRAP ITAs

87

nationalities in our workforce

39.5%

women in our workforce

(relative to Canadian market availability: 38.2%)

542

students, postdoctoral fellowships and research associates (hires)

24

laboratory sites

106

NRC IRAP points of service

Scientific achievements

1,222

peer-reviewed publications ²

53 publications per 100 scientists/engineers/technicians

1.19

citation score relative to world average ³

83%

co-authorship rate with external partners ²

10.9% with United Kingdom

8.5% with Germany

5.2% with Japan

267

patent applications in 2022–2023

1,951 active patents (**461** patent families)

606 active patents currently licensed

R&D clients and collaborators

89%

clients say the NRC helped them achieve results ⁴

1,005

R&D projects for clients

(969 R&D clients)

379

active collaborative R&D projects
(116 funded collaborators)

Industrial Research Assistance Program (NRC IRAP)

9,690

total clients

3,486 funded firms

6,204 firms received advisory services only

13,973

total jobs supported

35%

total revenue growth of client firms ⁵

21%

employee growth of client firms ⁵

NRC IRAP to transition to the Canada Innovation Corporation

The Government of Canada is launching the Canada Innovation Corporation (CIC), which will be a Crown corporation dedicated to supporting business R&D across all sectors. After more than 75 years of providing innovation assistance to small and medium-sized businesses in

Canada as part of the NRC, NRC IRAP will leave the NRC to become part of the new CIC.

This move will enhance NRC IRAP's capacity to serve its clients, while continuing to work closely with the NRC on key projects. This transition will take place approximately 24 months after its announcement in February 2023. Until the transition is complete, NRC IRAP's business will continue as usual, as part of the NRC, with steadfast delivery to its clients.

Financial⁶

\$1,470.8M

total expenditures

(operating, capital, and grants and contributions)

\$875.5M research centres

\$595.3M NRC IRAP

\$179M

total revenues

47% industry

8% other (i.e., academia, non-profits, etc.)

45% other government departments

\$612.3M

funding programs

(grants and contributions expenditures)

\$489.4M NRC IRAP

\$59.3M TRIUMF

\$34.8M collaborative science, technology and innovation

\$26.6M telescopes

\$2.2M other G&Cs

- 1 The Advanced Electronics and Photonics, Nanotechnology, and Security and Disruptive Technologies research centres are preparing to merge into one, in support of their jointly developed strategic plan leading up to 2024–2025.
- 2 Calendar year 2022
- 3 3-year average (2020–2022 calendar years)
- 4 Increased jobs, sales, R&D capacity and other benefits (Client Satisfaction Survey)
- 5 Average compound annual growth rate (2019 to 2021)
- 6 Unaudited results

Revitalizing key facilities



In the 2022 Fall Economic Statement, the federal government announced nearly \$1 billion over 8 years to support the modernization of our facilities and operations. This funding recognizes our essential role as a partner to Canadian businesses and innovators—and will enable us to continue to offer the cutting-edge facilities required to advance research in critical areas such as climate action and digital transformation.

In particular, much of the investment will go to projects directly involved in supporting Canada's 2050 net-zero emissions goals, advancing R&D in areas such as decarbonization, sustainable manufacturing and construction practices, critical minerals, energy storage systems, and more.

An investment of this size is an opportunity for Canada to maintain its leading role in key research areas and to become a larger player in other emerging areas expected to see substantial global growth in the near future. To administer this investment, we created the Office of Facility Renewal Management (OFRM), which will oversee the upgrades and modernization projects to be completed over the next several years.

In early 2023, work began on the project charters (which outline project scope, timelines and other key details) that will guide the first wave of facility upgrades. By creating this dedicated team, we are enabling our research centres to continue to focus on what they do best and setting ourselves up for long-term success.

Projects to be completed in the first phase of work include:

[Expand/Collapse all](#)

Construction acoustics laboratory—Ottawa, ON



Supports Canada's construction sector with research, regulations and construction solutions related to sound quality in buildings. The funding will improve the facilities' scientific capabilities by replacing outdated equipment, decommissioning 1 building and consolidating 4 facilities into 1 modern facility.

[Learn more](#)

Alternative fuel and engine technology—Ottawa, ON



Supports the development of clean energy technology, focusing on low-carbon fuel development and high-efficiency fuel use. The funding will enable the purchase of new equipment to expand research capabilities related to hydrogen, plastics and carbon

emissions.

Aluminum technology centre—Saguenay, QC



Supports the automotive and transportation sectors with specialized materials research and testing. The funding will enable the renovation of several labs and the purchase of modern equipment to support Industry 4.0 and increase the productivity of aluminum transformation in Canada.

Bioanalytical micro-nano devices facility—Boucherville, QC



Nurtures pilot-scale prototyping, from design to certification, to support Canada's biomanufacturing supply chain. The funding will enable the purchase of state-of-the-art equipment to keep the facility at the leading edge of a rapidly evolving industry.

Biomanufacturing facility—Montréal, QC



Supports research on novel biologics. The funding will modernize the biomanufacturing research and development laboratories and introduce new equipment required to complete the domestic research and development cycle of biological pharmaceutical products.

[Learn more](#)

Clear water tow tank—St. John's, NL



Provides simulations for a wide range of vessels, including submarines, ice breakers, yachts and high-speed warships. The funding will be used for equipment replacement and upgrades, and the implementation of a digital twinning facility to enhance modelling and simulation.

Convair 580 aircraft replacement—Ottawa, ON



Supports research and testing related to aerospace, satellites, air quality, defence, green aviation and climate resilience. The new aircraft—a multi-purpose flying laboratory—will be able to support a broader range of research initiatives and help Canada fulfill international commitments and collaborations.

[Learn more](#)

Advanced materials research facility—Mississauga, ON



Supports materials development and commercialization. The funding will establish 2 materials acceleration platforms that use AI, robotics and advanced computing to autonomously and rapidly design and test new materials, enabling research on critical minerals that will help develop next-generation, high-performance batteries.

Energy storage integration and battery testing facilities—Boucherville, QC, and Ottawa, ON



Supports research and development in battery cell production, battery cell assembly and battery testing. The funding will enable the purchase of new equipment and the installation of specialized suites for battery fabrication and assembly.

Fire safety testing facility—Ottawa, ON



Supports research on the fire performance of innovative products and fire protection systems. The funding will upgrade the facility to install a new smoke abatement system that will expand testing capabilities to include a wide range of full-scale experiments, while also mitigating the environmental effects of burning non-wood materials such as plastics, diesel fuel and insulation.

Hydrogen-safe laboratories—Vancouver, BC



Enables safe research and testing of hydrogen and fuel cell technology. The funding will support the replacement of outdated technology and equipment and the enhancement of lab safety systems, enabling greater diversity in research capabilities to support Canada's hydrogen strategy.

[Learn more](#)

Large ice tank upgrade—St. John's, NL



Simulates arctic and northern marine conditions to evaluate vessel and structural performance in marine ice conditions. The funding will extend the tank's lifespan by 25 or more years and add new research capabilities, including frazil ice and heavy impact testing.

[Learn more](#)

Photonics facilities—Ottawa, ON



Supports research in quantum sensing, computing and communications. The funding will be used to upgrade the facilities' cryogenic and ultrafast laser systems, enabling state-of-the-art research in light-matter interactions at the quantum limit. This will help build on Canada's position as a global leader in quantum science.

[Learn more](#)

Research altitude test facility—Ottawa, ON



Simulates flight-realistic temperatures, velocities and pressures to enable aircraft engine testing at altitude and icing conditions. The funding will be used for upgrades that include a new hybrid engine chamber to support the development of electric and hydrogen-based aircraft.

Sustainable manufacturing facilities—Boucherville, QC



Conducts research in key areas to support government priorities related to advanced manufacturing, greenhouse gas mitigation and sustainable plastics. The funding will support the purchase of new equipment, enabling new high-temperature barrier coating for low-emission jet engines, sustainable polymer technologies for packaging, mass manufacturing of composites for automotive lightweighting, and more.

Trisonic wind tunnel—Ottawa, ON



Supports world-leading aerospace research, including into novel green technologies. The funding will improve the reliability, safety and capabilities of the tunnel by replacing and upgrading outdated equipment and systems.

Starting in 2025, every 2 years, OFRM will run an internal call for research equipment, facilities and related capital projects, with a special interest in projects involving co-investment or facilities sharing with universities, colleges, other government departments and private sector collaborators. Stakeholders can learn more by visiting the NRC website.

Highlights and achievements



We advanced research and deepened our knowledge across many key areas in 2022–2023, making possible ground-breaking new science and innovation. Discover the NRC's major highlights and achievements of the past year.



Climate action and sustainability

Adapting to climate change with research on land and at sea



Quantum and digital transformation

Supporting Canada's digital evolution with innovative technologies



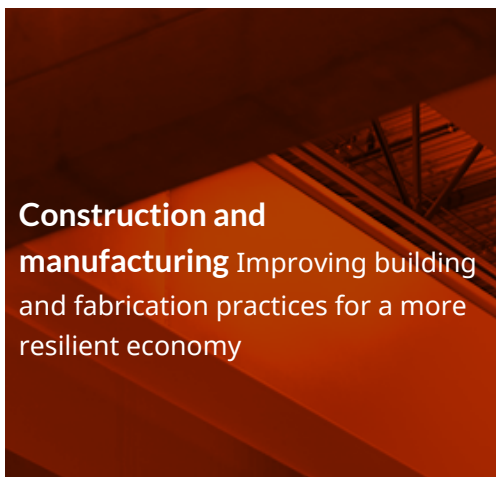
Health and biomanufacturing

Advancing the innovation of Canadian health products and technologies, and expanding biomanufacturing capacity



Aerospace and astronomy

Enhancing our ability to research the skies and stars



Construction and manufacturing

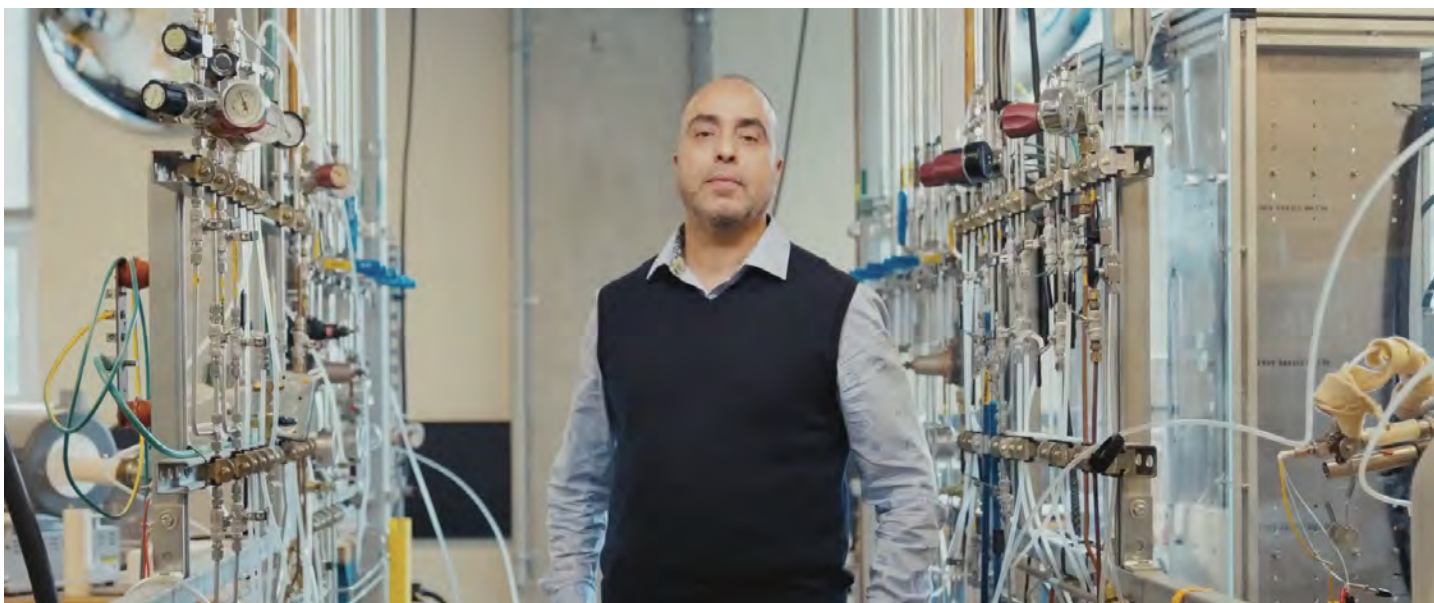
Improving building and fabrication practices for a more resilient economy

Supporting climate action and sustainability



Climate change is a critical issue for Canada and the world. In 2022–2023, we continued to support innovative research into clean energy sources, efficient construction practices, the health of marine ecosystems and more—with many of these projects working to help Canada achieve its goal of net-zero emissions by 2050.

Safer hydrogen research



▼ Khalid Fatih, Senior Research Officer, Energy, Mining and Environment Research Centre
Short video of Khalid Fatih posing in front of hydrogen production and compression testing stations.

Clean hydrogen is poised to play a major role in decarbonizing the world's energy systems. But because of its unique properties, a safe testing environment is essential. **Khalid Fatih** is a senior research officer who leads a team at the NRC's [Hydrogen-Safe Laboratories](#) in Vancouver, British Columbia, looking at hydrogen production and compression technologies.

"Our facility offers unique capabilities in Canada, with highly specialized equipment for hydrogen production and fuel cell and stack testing, including electrochemical performance evaluation, failure mode analysis and reactants contamination testing. We now have 8 NRC-designed and built test stations and test cells for proton-exchange membrane water electrolysis and anion-exchange membrane water electrolysis that serve Canadian industry clients and international partners. And it's all conducted in an environment that's specially designed for strict compliance with all Canadian hydrogen safety codes and standards.

I'm looking forward to the upgrades, which will not only further enhance safety with state-of-the-art equipment, but will also expand our testing capacity. Right now, for hydrogen production via electrolysis, we can test small cells and stacks up to 500 watts. With the upgrades, we'll be able to work with systems rated up to 5 kilowatts, which will help de-risk solutions farther along the technology readiness level scale. A lab-scale hydrogen embrittlement facility—which we'll ultimately expand to industrial scale—will also enable us to support hydrogen distribution, storage and export."



"We'll be able to work with systems rated up to 5 kilowatts, which will help de-risk solutions farther along the technology readiness scale."

Deeper insights on sea ice



▼ Jungyong Wang, Senior Research Officer, Ocean, Coastal and River Engineering Research Centre

Short video of Jungyong Wang posing in front of an ice tank carriage.

The large ice tank in St. John's, Newfoundland and Labrador, is one of the biggest facilities of its kind in the world, offering testing services for icebreakers and other vessels and offshore structures that may have to deal with various types of sea ice. As climate change alters the nature of that ice, the large ice tank helps make those vessels and structures more resilient and able to adapt to evolving conditions. Senior research officer **Jungyong Wang** of the Ocean, Coastal and River Engineering Research Centre designs and oversees the tests happening at the ice tank, providing critical insights into vessel performance and requirements for the Canadian Coast Guard, Royal Canadian Navy and others.

"For vessels operating in Canadian waters, running into ice is inevitable. The consequences can range from inconvenience to extremely costly damage. That's where my work at the St. John's large ice tank comes in. We use ice-formation techniques inspired by the natural processes that create ice in ocean waters to generate all types of full-scale ice conditions so we can get a better understanding of how different types of ice affect different vessels.

We look at issues like ship resistance and self-propulsion, the effects of ice on maneuverability, and the impacts of ice forces on moored and fixed structures. With that knowledge, we can advise on engine power, operational envelope and more, so we can make sure vessels will be ready for whatever they encounter when they're put into service.

In the last 5 years, we conducted extensive model testing for heavy and medium icebreakers to be used by the Canadian or U.S. Coast Guards. One heavy polar icebreaker typically costs \$1 billion or more, so it's important to get it right to make sure they can do their jobs

protecting our waters. Based on the results of our tests, we recommended several design changes to enhance performance and improve the ships' fuel efficiency—a key consideration as we strive to reduce emissions across the country.

I'm really excited about the renewal funding, because it will enable us to fully separate our underwater carriage system from our main carriage, which will substantially expand our underwater testing capabilities. With that new system, we'll be able to do underwater mooring tests (which we can't do right now) and our micro air bubble system for controlling ice density will be much more reliable and accessible. Currently, routine maintenance and repairs can take several days, but with the new system, we can do it in a couple of a hours. The new underwater carriage will also give us more viewing angles and allow us to better monitor and measure the ice without breaking it first."

Expand/Collapse all

Securing critical minerals to reduce emissions



Expanding electrification is one of the key ways Canada is working toward achieving its net-zero emissions goals—but that depends on securing a robust supply chain of the critical minerals needed to develop battery and energy storage technologies.

In Budget 2022, the federal government committed \$40 million over 4 years to the NRC to work with Natural Resources Canada on research, development and deployment of technologies to support critical mineral value chains.

This work will also help Canada achieve the goals set out in its [Critical Minerals Strategy](#).

Advances in climate-resilient trains



The Automotive and Surface Transportation Research Centre has been working to make train travel in Canada safer and more environmentally friendly.

In 2022, the first phase of the Clean and Energy-Efficient Transportation program was completed. Working with partners at Transport Canada, the University of British Columbia and Southern Railway of British Columbia, NRC researchers investigated the potential risks and hazards of hydrogen and battery-powered trains.

The next phase involves developing a regulatory framework for the operation of such trains. And as part of the Resilient Ground Transportation program, researchers are testing the performance of train air brakes in cold weather conditions.

This work will help make air brakes more robust and reduce the risk of failure in cold weather.

Creating a more climate-resilient built environment



The NRC is leading the new [Climate Resilient Built Environment Initiative](#), funded by Infrastructure Canada, which was announced in June 2022.

Under this initiative, teams from our Construction Research Centre, as well as our Ocean, Coastal and River Engineering Research Centre will be continuing efforts to increase the climate-resilience of buildings and infrastructure.

Work underway includes considering snow, wind and other future climate loads in structural design; developing guidelines for flood-resistant buildings; and investigating nature-based solutions for addressing flooding and urban heat islands.

We are also conducting research to support updates to existing standards and the development of new ones, including working with the Standards Council of Canada on a new standard based on our National Guide for Wildland-Urban Interface Fires.

Demystifying blue-green algae



The NRC's Biotxin Metrology team in Halifax is using cutting-edge technology to research the cyanobacteria that produce blue-green algae. This algae is toxic, posing risks to humans and animals, and its spread can damage aquatic ecosystems in lakes and rivers across Canada.

In addition to improving understanding of how cyanobacteria spreads and how to control it, this work will also help raise public awareness of how individuals can recognize and avoid associated risks.

Protection for a vital observatory



Throughout 2022, we worked with forest management specialists, including the Penticton Indian Band and the Sylix Okanagan People, to implement a wildfire protection plan to reduce the risk of fires at the [Dominion Radio Astrophysical Observatory](#) and surrounding area.

This project involved members from the Herzberg Astronomy and Astrophysics Research Centre, as well as our Health, Safety and Environment team; and Real Property Planning and Management team.

This protection plan is similar to the Other Effective area-based Conservation Measures taken at places such as the Ketch Harbour Marine Research Station in Nova Scotia, which aim to preserve biodiversity in areas not officially protected.

Plastic removal strategies to decontaminate waterways

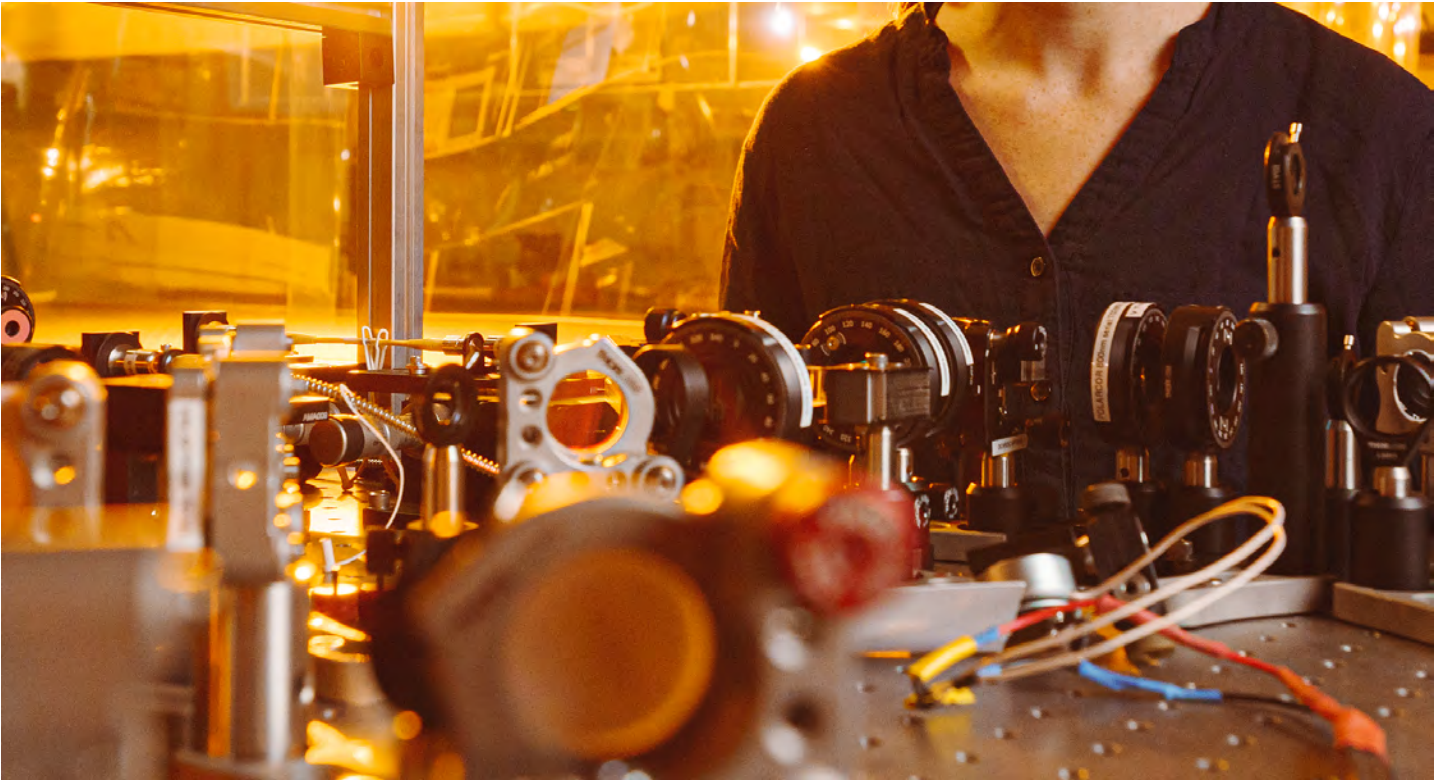


Using numerical models and machine learning technology, scientists in the Ocean, Coastal and River Engineering Research Centre, supported by colleagues in several other NRC research centres, are developing strategies to predict the sources of microplastics and the pathways they take to reach waterways and oceans.

Experts from the Aquatic and Crop Resource Development Research Centre are also developing a high-throughput toxicological testing platform to test microplastics and potentially associated chemicals that affect aquatic food resources.

This information will inform approaches to prevent new plastic contamination and help isolate and remove existing microplastics from water before they degrade past the point of retrievability.

Advancing quantum and digital transformation



As digital and quantum technologies take on larger roles in our society, we are providing critical innovations to advance the development of these technologies and position Canada as a quantum leader.

Research at the speed of light



▼ Kate Fenwick, PhD student and Ben Sussman, Senior Research Officer, Joint Centre for Extreme Photonics

Short video of Kate Fenwick and Ben Sussman standing in front of a new quantum walk experiment in the ultrafast quantum photonics facility.

The NRC's photonics facilities in Ottawa, Ontario, enable research in a variety of areas, including the foundations of quantum optics to applications in quantum sensing, quantum computing, quantum communications, ultrafast laser optics, material characterization and more. These technologies serve a vital function by underpinning our most critical communications networks. PhD student **Kate Fenwick** and group leader **Ben Sussman** are studying the interaction between light and matter at the quantum limit in the Ultrafast Quantum Photonics facility.

KF: "My PhD work is looking to use optical Kerr shutters to carve ultrafast pulses of light out of a continuous laser beam to enable applications like single-photon metrology, time-stretch spectroscopy and quantum walks.

This research gives us a better understanding of quantum mechanics, which underpin the foundations of our world, and that paves the way for new technologies that haven't been possible with a classical understanding of physics."

BS: "Through a collaboration with the University of Ottawa, called the Joint Centre for Extreme Photonics, graduate students like Kate have access to our state-of-the-art labs, and we benefit from working with an outstanding group of students. And although we're already working in one of the best facilities in the country, this technology evolves fast.

The renewal funding will allow us to expand our capabilities in sources and detectors to make sure we stay at the forefront of quantum photonics research. I'm looking forward to being able to generate unique photon states—different wavelengths, durations and photon numbers—and to detect new types of quantum mechanical states of light and matter."



"This research gives us a better understanding of quantum mechanics, paving the way for new technologies that haven't been possible with a classical understanding of physics."

An evolution for better client service

The NRC's Canadian Photonics Fabrication Centre (CPFC) is the only compound semiconductor foundry in North America that is publicly operated and available to all. It offers foundry services, end-to-end fabrication of photonic devices and the development of process

technologies. In 2022, it was announced that the CPFC would be operated as its own NRC business unit. This will give the CPFC the agility to better serve the needs of its clients, while still allowing the NRC to continue to conduct vital research in photonic technology.

Expand/Collapse all

An innovative partnership



Building on our long-term relationship with the University of Waterloo, in 2022, we opened a new collaborative space on campus where students and faculty can come together with teams from our Digital Technologies Research Centre to work on projects related to AI, the Internet of Things and cybersecurity.

In another collaborative project, our Nanotechnology Research Centre partnered with the Waterloo Institute for Nanotechnology to fund interdisciplinary research for high-risk, high-reward, "blue sky" discoveries.

Throughout 2022–2023, 9 projects were launched under this initiative, looking at theranostic nanomedicine, printed nanomaterials for flexible near-infrared sensors, nanoplastic identification and classification, and more.

Stretching the boundaries of wearable electronics



A partnership between the NRC's Advanced Electronics and Photonics Research Centre and the Taiwan Textile Research Institute has culminated in the successful prototyping of stretchable conductive inks.

These inks, which can be stretched, twisted and washed, represent a major milestone in the development of wearable electronics and could support applications ranging from motion capture to health monitoring.

The project was awarded a 2022 gold-level Edison Award in the "breakthrough materials" category and has already been licensed by the world's largest global supplier of flexible film.

Enhanced guidance for laser systems



Lasers are expected to play an important role in space-based communications, but the mirrors traditionally used to guide their beams are bulky and lack the accuracy and speed needed for precision applications.

Working with researchers at Carleton University and the University of Málaga in Spain, the nanophotonics team at the Advanced Electronics and Photonics Research Centre has developed a new way to guide lasers using photonic chips, which are more cost-effective than mirrors, weigh less than a gram and offer much more precise targeting over longer distances.

The next phase of the project involves building a functional beam-steering system, which could be used to help bring high-speed internet to Northern and rural communities.

Moving forward with quantum initiatives



In January 2023, the federal government released the [National Quantum Strategy](#) (NQS) to support Canada's quantum sector and solidify the country's position among international leaders in this field.

The NRC plays a key role in advancing the NQS, particularly through our Challenge programs. The Internet of Things: Quantum Sensors Challenge program has funded 42 projects looking into ultrafast sensing of entangled photon pairs, quantum photonics standards development, wavefront sensing and more.

The Applied Quantum Computing Challenge program, launched in September 2022, is currently accepting applications for projects that will enable efficient quantum simulation of complex physical systems to support the development of new technologies for human health, climate change and other far-reaching benefits.

Both programs have engaged with industry to support the commercialization of the NQS. The Quantum Research and Development Initiative is another NRC-led program established under the NQS to coordinate federal research across government to de-risk quantum technology development.

This initiative will also help grow quantum capacity and expertise in support of key national priorities such as mining, defence and security, communications, natural resources, environmental management, and climate change monitoring.

AI for safer, more resilient logistics



The NRC's Artificial Intelligence for Logistics program is working with the University of Calgary to develop AI models that will help reduce the costs and carbon footprint of transportation and logistics.

Using data from 2 of Canada's largest transportation companies, the AI tools being developed will optimize routes and scheduling, increase road safety, and protect the industry from the hazards of extreme weather.

Expanding Canada's biomanufacturing capacity



We are supporting the Government of Canada's commitment to increasing domestic biomanufacturing capacity along the entire production continuum: from research and development to the production of material for clinical trials.

Homegrown vaccines and other biologics



▼ Helene Mauboussin, Quality Assurance Team Lead, Human Health Therapeutics Research Centre

Short video of Helene Mauboussin posing in front of pharmaceutical manufacturing machinery in a clinical trial biological drug manufacturing facility.

The biomanufacturing research and development laboratories of the NRC's Human Health Therapeutics (HHT) Research Centre play a vital role in scaling up the manufacturing process, enabling vaccines and other biologics-based therapeutics to advance from research to clinical trials. **Helene Mauboussin** leads HHT's Quality Assurance team, which ensures all elements of the complex production process meet precise quality requirements every step of the way.

"My team reviews and approves all procedures and documentation related to the production that happens in our facilities. We investigate and correct every deviation, so we can be confident in the safety, identity, strength, purity and quality of every product, every time. This is required to meet regulations and, more importantly, to keep people safe.

Although the NRC has been working in vaccine research and development for decades, the past few years have been really exciting for us, given the increased global interest in biomanufacturing. Most notable this year was the substantial completion of the clinical trial material facility, which is just down the hall from the R&D labs. My team is currently working on the commissioning, qualification and validation process for the new facility, and we hope to be able to produce our first product in the facility in 2024. With the new facility, the goal is to enable drugs researched and developed in Canada to move through clinical trials here as well.

We're also looking forward to some critical upgrades in our R&D labs, which will bring us more in line with the new facility. In addition to modernizing our space, the new funding will also allow us to update much of our equipment so it matches what's in the clinical trial material facility. This alignment will make the technology transfer from the R&D lab to the clinical trial material facility much faster and easier."



"Our work ensures we can be confident in the safety, identity, strength, purity and quality of every product, every time."

Contributing to the Canadian biomanufacturing continuum

In 2020, we were tasked, on behalf of the Government of Canada, to create something unique in Canada: a biomanufacturing facility intended specifically to undertake full-scale production in support of a public good mandate. In August 2022, the Biologics Manufacturing Centre received its drug establishment licence, granting it formal authorization for production of drugs for use in Canada. In parallel, we were setting in motion the process of transferring the governance and operations of the Biologics Manufacturing Centre to a not-for-profit corporation.

This was done to enable the facility to function independently of the government, as a contract manufacturing organization, while continuing to deliver on its mandate to respond to pandemic and other health emergency preparedness needs, support public-interest projects, and contribute to the growth and resilience of Canada's life sciences sector. CCRM, a leader in developing and commercializing regenerative medicine-based technologies and cell and gene therapies, was selected as co-founder of this new not-for-profit, which was incorporated in December 2022. On April 1, 2023, Biologics Manufacturing Centre (BMC) Inc. officially assumed responsibility for the operations of the Biologics Manufacturing Centre.

With the upgrades to the HHT research and development labs, the construction of the clinical trial material facility and the completion of the Biologics Manufacturing Centre, the biomanufacturing triad—R&D process development, clinical lot production and full-scale manufacturing—will all soon be available at the NRC's Royalmount site. The 3 biomanufacturing facilities can be used separately or collectively to support public good projects or individual client needs. By existing side-by-side on a single campus, they are working together to support Canada's Biomanufacturing and Life Sciences Strategy goal of building a robust, end-to-end continuum of public-enabling biomanufacturing capacity in Canada.

Expand/Collapse all

Accelerating the journey from discovery to therapy



In early 2022, we partnered with Concordia University and Kyoto University's Center for iPS Cell Research and Application (CiRA) to accelerate research on the therapeutic use of iPS (induced pluripotent stem) cells. iPS cells are stem cells produced from adult skin cells and can be used to produce any type of cell in the body, making them highly promising for treating cancer, heart disease and other hard-to-treat conditions—without the usual risk of rejection. Bridging the gap between scientific breakthrough and practical application often takes years, but the NRC-Concordia-CiRA team, under the Cell and Gene Therapy Challenge program, has already started developing the tools needed to bring this ground-breaking cell therapy to the mainstream.

Hyper-precise calibration for new radiation therapies



Advances in cancer treatment have the potential to offer improved outcomes with fewer side effects.

Correct dosage is required to deliver these therapies safely and effectively, but that depends on the ability to precisely measure new modalities of radiation treatment.

Teams at the Metrology Research Centre are working with proton therapy, synchrotron X-ray beams and ultra-high dose radiation therapy to ensure these therapies can be measured and calibrated to deliver maximum benefit and improve cancer outcomes.

Early pandemic warning through wastewater monitoring



The NRC Industrial Research Assistance Program (NRC IRAP) provided funding for a 2022 pilot project with the Greater Toronto Airports Authority looking at how inbound wastewater monitoring could help detect strains of COVID-19 and other infectious diseases sooner and less invasively than through individual testing.

The pilot project showed promise, and NRC IRAP is now in discussions about broader deployment of the technology to provide earlier warning and improve future pandemic response efforts.

Better control for centrifugal microfluidic testing



In 2023, a team in the Medical Devices Research Centre received a Canadian patent for its incorporation of pneumatic control into centrifugal microfluidic chips.

These chips can be used to automate several steps in biological testing by circulating various liquid buffers and reagents through specially designed miniature channels. The pneumatic technique helps fluids move as intended through the chips during testing, ensuring assays can be executed fully.

In addition to the Canadian patent, this technology has also received patent protection in Australia, Europe, Japan, South Korea and the United States.

A step toward treatment for Alzheimer's disease



Working with researchers at the University of Alberta, scientists in the Nanotechnology Research Centre have discovered a type of biodegradable nanoparticle that may disrupt the accumulation of a protein associated with some of the degenerative effects of Alzheimer's disease.

While the exact role of these proteins in the development of Alzheimer's disease still needs to be more fully understood before a therapy can be developed, this discovery marks an exciting step toward a treatment that could stop or even reverse the disease.

Atypical fermentation for non-human health products



In early 2022, we opened a new atypical fermentation facility on Prince Edward Island, where members of our Aquatic and Crop Resource Development Research Centre work on the sustainable transformation of Canadian bio-based resources into higher-value products.

This new facility offers customized fermentation research for personal care, specialty products, and food and feed applications

Launching new innovations to the sky and beyond



Canada has long been recognized as a leader in aerospace and astronomy research and technology, home to unique research, development, innovation and testing capabilities and incredible talent. NRC facilities across the country are supporting that role and helping deliver innovative solutions to global challenges.

A state-of-the-art airborne laboratory



▼ Mengistu Wolde, Principal Research Officer, Flight Research Lab, Aerospace Research Centre

Short video of Mengistu Wolde posing in front of an NRC aircraft inside of a hangar.

The Convair 580 is the largest aircraft in the NRC's fleet. A multi-purpose airborne laboratory, it houses the equipment needed to support research on atmospheric conditions, icing, cloud physics, smog and more.

While the aircraft will remain in high demand until its decommissioning in 2028, its age makes maintenance and repairs increasingly challenging. **Mengistu Wolde** is a principal research officer with the Aerospace Research Centre who was facility manager for the Convair 580 and is now the scientific research lead spearheading the launch of its replacement: the new Medium-range Aircraft Platform for Environmental Research (MAPLE).

"The Convair is a unique facility in Canada and has supported a wide range of research projects involving partners from all over the world. One of our biggest accomplishments from the past year was the completion of the High Spectral Resolution Airborne Microwave Sounder (HiSRAMS) project with McGill University, Omnisys of Sweden, Horizon Sciences and Technologies in Nova Scotia, and the European Space Agency (ESA).

The project started in 2018 as a proof of concept to develop 2 advanced airborne hyperspectral radiometers for future space missions requiring global observations of temperature and water vapour. The NRC and our collaborators successfully developed the radiometers, integrated them on the Convair, and conducted flight data collection and modelling.

We also deployed to the U.S. for 3 weeks to support a large international climate and weather study project called ESCAPE, and worked with European Union partners on advanced radar studies to inform the ESA's WIVERN satellite mission concept, aimed at providing global observation of winds from space.

Working with the Convair since I joined the NRC in 2000 has been a real privilege, and now I'm looking forward to working with the new MAPLE aircraft, which will be built with the federal renewal funding. The new plane will have a longer range so we can do more research in remote areas like in the North, and its capabilities will be developed with input from many stakeholders to make sure it's flexible and versatile enough to handle an even wider range of research needs. When MAPLE enters into service, it will be equipped to study climate change, air quality, cloud systems and severe weather, all of which will help prove out new solutions for green aviation, space-based observation and so much more."



"The new plane is being designed with input from many stakeholders to make sure it's flexible and versatile enough to handle an even wider range of research needs."

Expand/Collapse all

Made-in-Canada correlators to see farther into the cosmos



In January 2023, Canada announced its intention to become a full member of the Square Kilometre Array Observatory (SKAO), an international collaboration building 2 of the world's largest telescope arrays in Australia and South Africa.

Membership in SKAO will give access to the array for Canadian astronomers, and it provides an opportunity for several Canadian companies to contribute to building and assembling various parts of the array.

The Herzberg Astronomy and Astrophysics Research Centre played a lead role in developing the correlators, which help coordinate the many individual telescopes and enable data from across the array to be correlated and analyzed.

Seeking new insights into the formation of the universe



When the James Webb Space Telescope launched in December 2021, it included several Canadian-made components and instruments.

One of these, the near-infrared imager and slitless spectrograph (NIRISS), was the first of the telescope's 4 science instruments to be declared fully science-ready on June 22, 2022.

Since then, NRC teams have had the opportunity to study the history of distant galaxies, the formation of exoplanets, black holes and more.

A step toward autonomous flight



In early 2022, a team at the Aerospace Research Centre started the first phase of flight trials for a self-flying helicopter.

Later that year, the team achieved its very first completely autonomous flight, involving takeoff, flight manoeuvring around a planned circuit and landing—including avoiding several obstacles in the landing zone.

While there are still many steps before fully autonomous flight becomes feasible on a larger scale, this flight represents a significant milestone in support of that goal.

Adapting to flight conditions with integrated reality



In partnership with the Department of National Defence, the Aerospace Research Centre is using integrated reality to better understand helicopter piloting conditions when performing operations at sea.

The Integrated Reality In-Flight Simulation (IRIS) project uses the unique capability of the Bell 412 helicopter to be programmed to behave and react like different aircraft.

That allows test pilots to experience how wind, turbulence and other conditions would affect the types of aircraft actually used for offshore military operations.

This will provide a better understanding of pilot workload so flight simulators can be made more accurate, ship designs can be enhanced and crews can be kept safer.

New solutions for handling in-flight hazards



Our Aerospace Research Centre is working with the U.S. Federal Aviation Administration to learn more about in-flight icing conditions and to test innovative icing detection, forecasting and de-icing solutions.

Last year, using the Convair 580 aircraft equipped with more than 40 probes and sensors, our Airborne Facilities for Atmospheric Research and Reconnaissance team flew in hazardous icing conditions to collect data and demonstrate new weather forecasting capabilities.

This project will provide vital information to help pilots manage dangerous conditions that can impair aircraft operations.

Advancing space science with the Canadian Space Agency



The NRC has been working with the Canadian Space Agency (CSA) since the CSA's inception as a spin-off from the NRC.

In 2020, [we signed a memorandum of understanding](#) to create a collaboration framework for areas including earth observation, sensor development and testing, and space technology development.

Since then, our projects have spanned various research areas, including microgravity research, health technologies and data management through the Canadian Astronomy Data Centre.

The 2023 federal budget provided the CSA with \$76.5 million over 8 years to support Canadian science on the Lunar Gateway station, and we look forward to supporting this mission.

Making construction and manufacturing more sustainable



NRC-led research is helping make buildings more energy efficient and resilient to climate change, and supporting more sustainable manufacturing practices that reduce carbon emissions and energy consumption.

Quieter homes for healthier lives



▼ Markus Müller-Trapet, Research Officer, Construction Research Centre

Short video of Markus Müller-Trapet posing in front of acoustics equipment inside the flanking sound transmission laboratory.

Unwanted noise is more than just a nuisance. It can also put people at higher risk of health impacts, including cognitive impairment in children and cardiovascular issues. As population densification increases and more people live in multi-unit buildings, studying the effects of noise becomes more important.

The Construction Research Centre's acoustics labs enable research into how sound travels through walls and floors, particularly in multi-unit buildings. **Markus Müller-Trapet** is a research officer who leads the Building Acoustics team at the construction acoustics lab in Ottawa, Ontario. Among other things, his team is currently studying the effects of "impact noise" such as footsteps and dropped objects.

"The effects of noise are serious. Understanding how noise travels through buildings—and what techniques and materials can stop it—is what my team does. Our lab, which is unique in North America, enables us to build multi-room mock-ups to test sound transmission for the Canadian market. Our work helps manufacturers of innovative solutions that want to succeed in a competitive building product market, while also providing evidence-based recommendations for acoustical requirements for consideration by the committees that develop the National Building Code of Canada.

In the last year or so, we've been doing a lot of work to expand our capacity so we can meet the high demand for our facility. This year, we completed the commissioning of our new 4-room, 2-floor flanking sound transmission lab and finalized the design for a new floor testing

lab. Our existing floor testing lab is usually booked at least 6 months in advance, so the construction of the new lab, which will improve efficiency and enable us to test innovative high-performance floor systems, is crucial for serving our many industry clients.

The facility renewal funding will help us expand even further and offer even more testing options. We'll be building a wall testing lab, a horizontal 2-room flanking transmission lab and a new listening room. The upgrades are designed with current and future construction types and materials in mind that will ensure low-carbon floor and wall systems also meet requirements for sound insulation. The increased capabilities will allow us to test larger assembly types, such as multi-layer mass timber cassette floor assemblies. We're even turning our office space into a 'living lab' where we'll use sensors and other technologies to study the effects of various solutions on our own comfort and privacy while we work. All this will help us answer more practical questions and keep Canadians healthier and safer from the effects of excessive noise."



"We're even turning our own office space into a 'living lab' where we'll use sensors and other technologies to study the effects of various solutions on our own comfort and privacy while we work."

Expand/Collapse all

Supporting harmonized construction codes



The Construction Research Centre is providing technical, administrative and policy support to the new governance model for National Model Code development, announced in November 2022.

Under this model, the provinces and territories will be decision-makers in the construction code development process. This will help ensure their priorities are reflected in future code revisions, and also streamline the adoption of the codes by the provinces and territories so more Canadians can benefit from them sooner.

As a longstanding key player in supporting code development bodies, we contributed to the creation of the new governance model along with the provinces and territories. We will also represent the federal government as co-chair of the new Canadian Table for Harmonized Construction Codes Policy and the Canadian Board for Harmonized Construction Codes.

New Challenges for the Canadian construction industry



Our Challenge programs have facilitated partnerships within Canada and internationally to advance high-risk, high-reward transformative research.

In 2022–2023, we turned our sights to decarbonizing the construction industry, designing and planning 2 new Challenge programs to be launched in the coming year.

One will focus on the low-carbon built environment, and the other on increasing sector productivity through digitalization, performance-based codes and offsite construction.

A new facility to support advanced manufacturing



Our new advanced manufacturing research facility in Winnipeg opened its doors in summer 2022.

This facility was designed to meet the needs of local industries, businesses and academic communities, and will expand our research and development capacity in critical areas such as digital manufacturing and sustainable food packaging.

The facility has established a partnership with Red River College and is already working on key projects with several industry partners.

Toward inclusivity in research



An equitable, diverse and inclusive NRC supports better research and better outcomes for Canadians. With diverse voices at the table, we get more perspectives and fresh ideas. This year, we stepped up our efforts in equity, diversity and inclusion (EDI); expanded our work with Indigenous partners; and strengthened collaborations with research organizations around the world.

Championing EDI



For EDI initiatives to be successful, they have to be more than directives from the human resources department. This year, we appointed champions throughout our organization in the areas listed below. These volunteers have agreed to raise the profile of the needs and realities of employees and communities, and will be visible and vocal in support of related initiatives within the NRC and across the government. Backed by executive sponsorship for each area, the champion program will help build a sense of inclusion, integration and respect across our organization, with buy-in and ownership from everyone at the NRC.

Anti-racism: Dr. Jean-François Houle and Dr. Ibrahim Yimer

Accessibility and disability inclusion: Dale MacMillan and Dr. Julie Lefebvre

2SLGBTQ+ inclusion: Dr. Sue Twine and Amy Campbell

Wellness and mental health: Dr. Lakshmi Krishnan and Dr. Mouhab Meshreki

Official languages: Dr. Pascale Champagne and Donald Bourget

Indigenous engagement: Dr. Shannon Quinn and Jean-François Picard

Women: Dr. Geneviève Tanguay and Emily Harrison

Celebrating women in STEM



In November 2022, we launched our first call for proposals for the NRC Luise and Gerhard Herzberg Postdoctoral Fellowship, following the announcement of the new fellowship at last year's Celebrating the Success of Women in STEM Symposium. This fellowship offers a recent PhD graduate who identifies as a woman to undertake a 2-year research project of their design at the NRC.

In February 2023, we held our annual symposium on women in STEM, this year with the theme of celebrating 100 years of women's contributions to research. We had a total of approximately 1,800 registrants to the symposium, which included scientific discussions, an expert panel on women's leadership and more.

Expanding initiatives with Indigenous partners



We brought back our Indigenous student hiring pilot project for a second year, expanding it in 2022–2023 to involve more divisions and research centres across the NRC. We also provided more training to supervisors about supporting Indigenous students.

This year, we also started looking at how to facilitate the transition from pilot project to permanent initiative going forward—and at how the lessons learned from this project could inform future initiatives in support of other equity-deserving groups.

Our Arctic and Northern Challenge program works with Canadian and international partners from Northern communities, academia, industry, government and other interested parties to address pressing issues affecting the quality of life of Northern peoples, including housing, health, food and water.

In May 2022, in collaboration with our Canada-Inuit Nunangat-United Kingdom Arctic Research Programme ([CINUK](#)) partners, we selected 13 projects, based on Inuit and regional perspectives, to address key challenges in the North such as lung health, mitigation and adaptation to changing ground conditions, and renewable energy in off-grid cabins.

In collaboration with the Ocean, Coastal and River Engineering Research Centre, this Challenge program is also working with traditional craft producers from the North to find the best ways to keep people living and working in the North warm and safe. Using technologies such as a thermal mannequin, testing has so far demonstrated that natural materials such as seal skin, eider duck down and qiviut (muskox wool fibers) have better thermal performance than modern synthetic materials.

Our Indigenous Languages Technology project also continued throughout 2022–2023, with work on speech and text-based technologies related to more than 25 languages. [ReadAlong Studio](#), which is available for 22 Indigenous languages in Canada, was adapted this year into a

desktop app that does not depend on the cloud, making it more accessible to remote communities with limited online connectivity.

The open-source software can also be adapted to Indigenous languages outside Canada. Since the March 2022 International Conference on Language Documentation and Conservation, 614 unique visitors from across the world have visited the project website and 77 unique ReadAlong versions in various languages have been made on the site.

Making the Killam Program more equitable

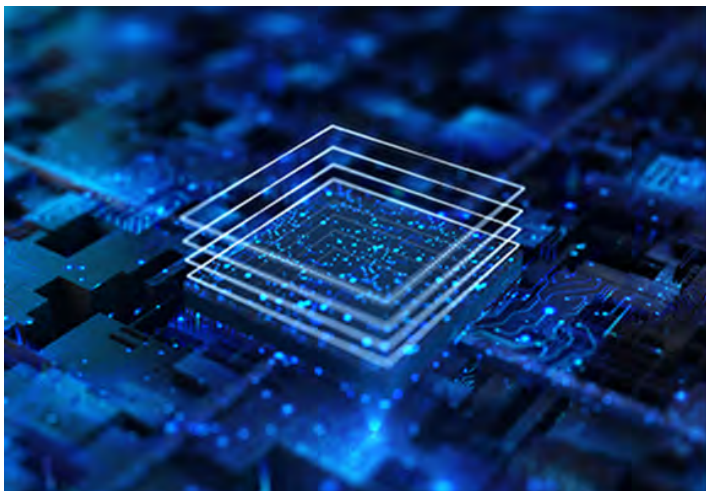


The National Killam Program is privately funded through the generous contribution of Dorothy J. Killam to build Canada's future by encouraging advanced study. In 2022, we took on the administration of the Killam Program on behalf of the Killam Trustees, who are charged with achieving the vision set out in the 1965 bequest of Dorothy Killam.

The program provides prizes and fellowships to scholars of exceptional ability who are making a difference in humanities, social sciences, natural sciences, health sciences and engineering. Dorothy Killam fellows are required to reflect at least one of the attributes of inclusive collaboration, barrier breaking and research leadership.

As the new administrator of the program, we are working to ensure all parts and processes incorporate equity, diversity and inclusion, and to encourage participation from equity-deserving groups.

Extending our partnerships around the world



In 2022–2023, we launched a joint call for industrial research and development proposals with partners in Germany and the United Kingdom, as well as several joint calls for research proposals with partners in Japan. Our work with Japan will include projects related to AI-based solutions for better living, co-innovations with Japanese corporations and proof-of-concept projects with Japanese multinational enterprises.

Following 10 years of associate membership in the Eureka network, Canada was officially invited to become a full member in summer 2022. Eureka brings together private enterprise, research institutions and other innovators to advance market-driven industrial research and development. Full membership will provide more opportunities for Canadian innovators and enable Canada to have a greater voice and make a larger contribution to Eureka's goals.

In November 2022, the Government of Canada formally launched its Indo-Pacific Strategy to deepen the country's engagement with the Indo-Pacific region, support regional peace and security, strengthen economic growth and resilience, and promote sustainable development.

NRC IRAP will support the strategy in 2 ways: by expanding the Canadian International Innovation Program (which is delivered in collaboration with the Trade Commissioner Service on behalf of Global Affairs Canada) into new economies in the region, and by introducing dedicated funding to help Canadian businesses demonstrate clean technologies through deployment of pilots in the region.

Awards and honours



Several NRC researchers, scientists and other professionals were recognized throughout the year for the excellence of their work and career-long contributions to their respective fields.

Individual awards and recognitions

Devi Ayyagari

Best Student Poster

2022 Ocean Frontier Conference, Ocean Frontier Institute

Dr. Noureddine Bénichou

Sjölin Award

International Forum of Fire Research Directors

2022 Fire Researcher of the Year Award

Canadian Association of Fire Chiefs

Dr. Pascale Champagne

Fellow

Engineering Institute of Canada and Chemical Institute of Canada

Award of Excellence

School of Engineering Alumni, University of Guelph

Islam El Gamal

2022 Junior Investigator Award

Council on Ionizing Radiation Measurements and Standards

Dr. Alison Ferrie

Lifetime Achievement Award

Canadian Association for Plant Biotechnology

Frank Jefferies

Lifetime Achievement Award

Real Property Institute of Canada

Dr. Linda Johnston

Simon Holland Award

ISO Technical Committee 229 – Nanotechnologies

Dr. JJ Kavelaars

2022 Dunlap Award

Innovation in Astronomical Research Tools, Canadian Astronomical Society

Shahrzad Khajavi

Best Student Presentation

2022 European Optical Society Annual Meeting

Louis-Philippe Lefebvre

Additive Manufacturing Award of Excellence in Standardization

ASTM International

Dr. Prakash Patnaik

Distinguished Material Scientist Award

Metallurgy and Materials Society

Dr. Chantal Paquet

Women in Flexible and Hybrid Electronics STEM Award

Canadian Printed and Flexible Electronics Symposium

Adam Sherwood

First Prize

AIAA/IEEE Electric Aircraft Technologies Symposium Student Design Competition

Dr. Gregory Smallwood

Trailblazer Award

Science for Policy, Canadian Science Policy Centre

Dr. Danica Stanimirovic

Public Service Excellence Award and Fellow

Canadian Academy of Health Sciences

Rodi Sürensoy

2022 Junior Investigator Award

Council on Ionizing Radiation Measurements and Standards

Dr. Velko Tzolov

Fellow

Engineering Institute of Canada

Dr. Gaozhi (George) Xiao

Fellow

Engineering Institute of Canada

Shuo Yan (PhD Candidate)

Best Paper Presentation Award

California Climate and Energy Collaborative

Team awards and recognitions

Advanced Electronics and Photonics team

Gold Edison Award and R&D 100 Award

Aerospace team (Dr. Prakash Patnaik and Dr. Craig Davison)

2022 Panel Excellence Team Award, Applied Vehicles Technologies, NATO Science and Technology Organization

Automotive and Surface Transportation team (Dr. Alexandre Gariépy, Siyu Tu, Marc-Olivier Gagné and Dr. Ehab Samuel)

Paper of the Year, North American Die Casting Association

Canadian Hydrogen Intensity Mapping Experiment team

Brockhouse Canada Prize, Natural Sciences and Engineering Research Council of Canada

Construction team (Dr. Michael Lacasse, Dr. Abhishek Gaur and Travis Moore)

Best Paper Award, Buildings Journal

Digital Technologies team (Aidan Pine and Dr. Patrick Littell)

Best Special Theme Paper, Association for Computational Linguistics

Metrology team (Dr. Richard G. Green, Dr. Carlos Sanchez, Dr. Barry M. Wood)

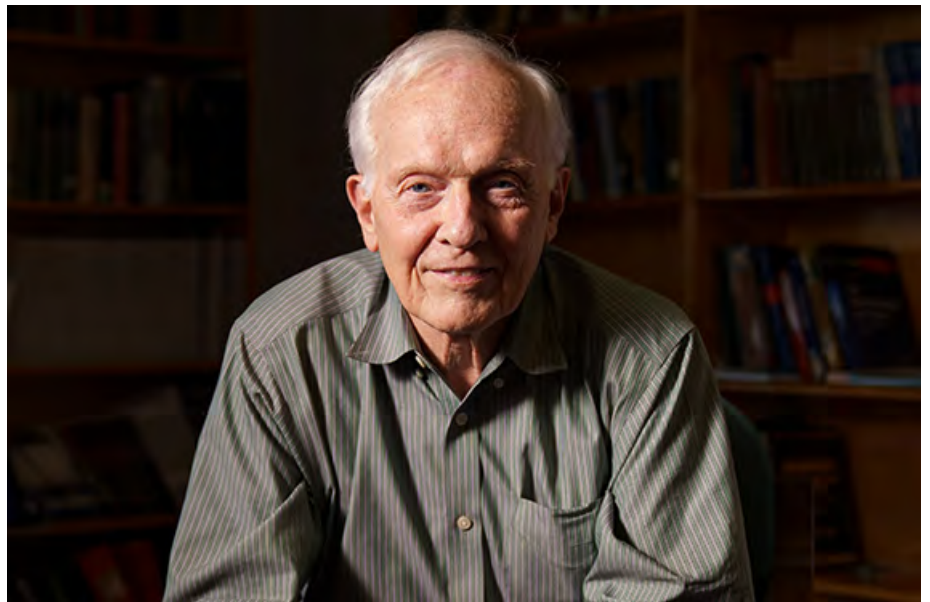
Joseph F. Keithley Award for Instrumentation and Measurement, Institute of Electrical and Electronics Engineers

Spacecraft reverberant acoustic chamber facility team (Shahruhk Alavi, Antal Prigli, Yong (Eric) Chen, Devon Downes, Christophe Legare, Dr. Sebastian Ghinet, Dr. Anant Grewal, Dr. Viresh Wickramasinghe, Brent Lawrie, Luc Hurtubise)

Alouette Award, Canadian Aeronautics and Space Institute

Dr. Paul Corkum named co-winner of Frontiers of Knowledge Award

Dr. Paul Corkum, Principal Research Officer at the NRC, is the co-recipient of the BBVA Foundation Frontiers of Knowledge Award in Basic Sciences for his groundbreaking work in ultrafast processes and attosecond physics. A pioneer in the development of attosecond science, he is best known for developing the tools for



producing the shortest human-made flashes of light to study the motion of electrons in molecules and atoms, and was a co-recipient of last year's prestigious Wolf Prize in Physics.

NRC leadership



Senior leadership

Composition in 2022–2023



Iain Stewart

President, National Research Council of Canada, Ottawa, ON

Line vice presidents



Dr. Jean-François Houle

VP Engineering



Dr. Lakshmi Krishnan

VP Life Sciences



David Lisk

VP Industrial Research Assistance Program (NRC IRAP)



Dr. Joel Martin

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



Dr. Geneviève Tanguay

VP Emerging Technologies



Dr. Ibrahim Yimer

VP Transportation and Manufacturing

Internal services



Alain Beaudoin

VP Business and Professional Services



Emily Harrison

VP Human Resources; Equity, Diversity and Inclusion Champion



Dale MacMillan

VP Corporate Services and Chief Financial Officer



Dr. Shannon Quinn

Secretary General

Special assignments and projects



Francois Cordeau

VP Office of Facilities Renewal Management



Dr. Michel Dumoulin

Special Advisor to the President



Christine Jodoin

VP Strategic Initiatives (acting as of December 2022)

Council Members

Composition in 2022–2023





Dr. Douglas W. Muzyka

Chair of the NRC Council; Former Senior Vice-President and Chief Science and Technology Officer, E.I. DuPont de Nemours and Company, Indian River, NS



Dr. Karen Bakker

Professor and Canada Research Chair, University of British Columbia, Vancouver, BC



Norma Beauchamp

Former President and Chief Executive Officer, Cystic Fibrosis Canada, Toronto, ON



David Berthiaume

Executive Director, Kemitek, Thetford Mines, QC



Dr. Susan Blum

Associate Vice-President, Applied Research and Innovation, Saskatchewan Polytechnic, Saskatoon, SK



Ray Hoemsen

President and Managing Director, Hoemsen & Associates, Winnipeg, MB



Dr. Digvir Jayas

Vice-President (Research and International), University of Manitoba, Winnipeg, MB



Dr. Steven Murphy

President and Vice-Chancellor, Ontario Tech University, Oshawa, ON



Dr. Pierre Rivard

Executive Chairman and Co-Founder, TUGLIQ Energy Corp., Toronto, ON



Dr. Ali Tehrani

Venture Partner, Amplitude VC, Vancouver, BC



Iain Stewart

President, National Research Council of Canada, Ottawa, ON

From: [National Research Council Canada](#)

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