

The National Research Council of Canada

Research excellence • Fall 2024





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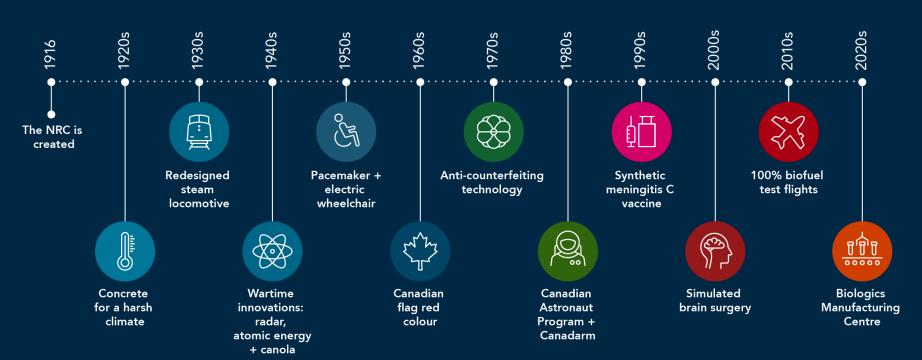
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Why choose the NRC

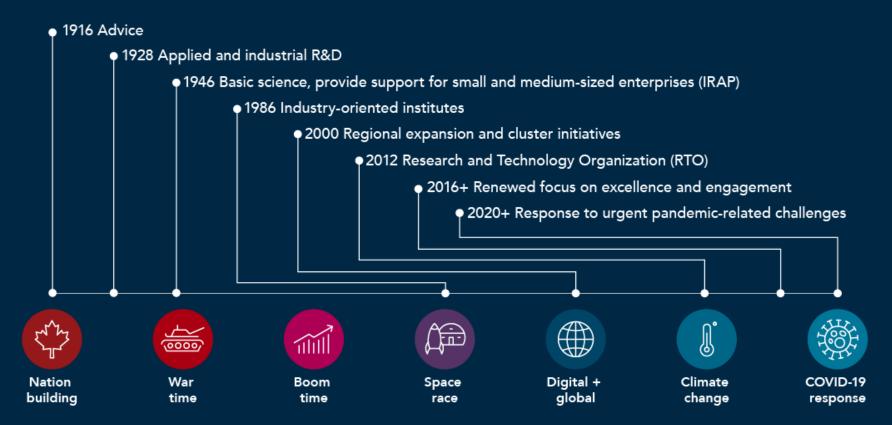


About the NRC

A century of innovation



The evolving strategic role of the NRC



We deliver value to Canada in 3 ways

We advance scientific and technical knowledge

We support government policy objectives

We support business innovation

Two primary streams of activity

Research performer (national labs)



12 research centres



24 laboratory sites



126 major R&D facilities



\$1,526M total expenditures



1,277 peer-reviewed publications



175.9M total revenues



956 R&D clients



15 collaborative programs



1,971 active patents (462 patent families)

Advice and funding to SME innovation projects

Industrial Research Assistance Program (NRC IRAP)

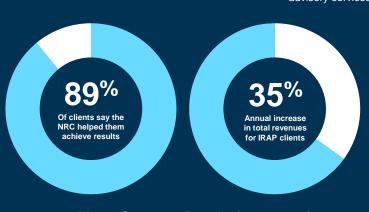
273 ITAs

113 locations \$468M

Gs &Cs funding invested in SMEs

3,262 total firms funded

6,148
Unfunded firms receiving advisory services



Macro Summary Results (2023-2024)

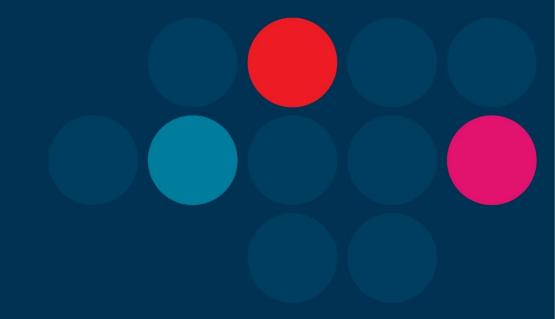
Organizational structure

Minister of Innovation, Science and Industry

President

Chief Digital Research Officer, Chief Science Officer and Departmental Science Advisor	President's Research Excellence Advisory Committee	President's Science Advisor and Secretary, PREAC	Special Advisor to the President	Strategic Initiatives	Human Resources	Audit and Evaluation	Office of Facilities Renewal Management
Digital Technologies							
Transportation and Manufacturing	Engineering	Life Sciences	Emerging Technologies	Industrial Research Assistance Program	Business and Professional Services	Corporate Services and Chief Financial Officer	Secretary General
Aerospace	Construction	Aquatic and Crop Resource Development	Herzberg Astronomy and Astrophysics	Pacific Region	Design and Fabrication Services	Finance and Procurement Services	Communications
Automotive and Surface Transportation	Clean Energy Innovations	Human Health Therapeutics	Metrology	Prairie Region	Knowledge, Information and Technology	Real Property Planning and Management	Corporate Secretariat and Senior Ethics Office
	Ocean, Coastal and River Engineering	Medical Devices	Quantum and Nanotechnologies	Ontario Region	National Programs and Business Services/ Intl. Innovation Office	Health, Safety and Environment	Policy, Strategy and Performance
		Clinical Trial Material Facility Project	Canadian Photonics Fabrication Centre	Quebec Region		Security	Ombud Office
				Atlantic and Nunavut Region		Client Service Centre	
				Division Services			

Client Enablement



The NRC in communities across Canada



2,248 scientists, engineers, technicians, other specialists and 273 NRC IRAP ITAs



182 buildings 24 laboratory sites



9,410 total clients 12,719 jobs supported

Research facilities across Canada

Vancouver, Victoria and Penticton, BC

Optical and radio telescopes, adaptive optics, Canadian Astronomy Data Centre, batteries, fuel cells and industrial tribology

Edmonton, AB

Nanotechnology

Saskatoon, SK

Plant biotechnologies and plant-growth facilities

Winnipeg, MB

Additive manufacturing, including digital twinning and machine learning, sustainable food packaging

London and Mississauga ON

Additive manufacturing, product development, laser consolidation, micro-machining, next-generation materials discovery and development for clean energy conversion and digital manufacturing

Ottawa, ON

Aerospace, vaccines, construction, quantum, photonics, machine vision, big data analytics, metrology, materials characterization and testing, ice and coastal engineering and water resources

Montréal, Boucherville, Royalmount and Saguenay, QC

Intelligent machining, robotics, medical devices, advanced biologics analytics, biologics manufacturing, aluminium and multi-materials assembly, hybrid manufacturing (extrusions, forgings, castings)

Halifax, NS

Photobioreactors, bioprocessing, natural product chemistry, bioactive characterization, biotoxin metrology

Charlottetown, PE

Natural product and functional ingredient development

St. John's, NL

Ocean engineering, ice and vessel management



Research and organizational priorities were identified for particular emphasis in CBI plans and the NRC plan







Ou 200



Health & biomanufacturing Quantum & digital

Foundational research



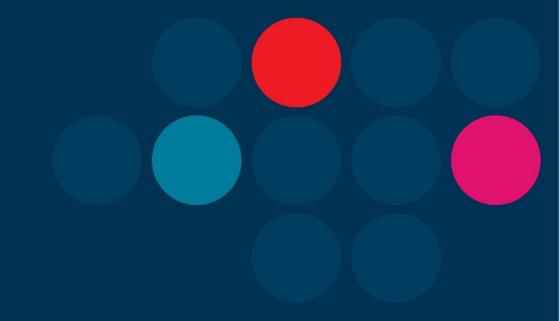
Health and Safety



Inclusive Innovation



Research excellence | Organizational excellence



NRC IRAP

Industrial Research Assistance Program



Provide advice, connections, and funding

to help Canadian small and medium-sized businesses increase their innovation capacity and take ideas to market



Serve over 9,000 clients annually

(advisory services + funding) across all industry sectors



Link innovative Canadian SMEs to global value chains

and support their growth by providing access to current technology and business market intelligence on priority industry sectors



Support youth

with employment programs

75+ years

Proven track record (since 1947)

\$468M

Annual contribution funding invested in SMEs

9,410

Firms receiving advisory services, funding or referrals

12,719

Jobs supported in SMEs

649
Youth internships supported

2,571
Assessments completed for other government departments

15

Fiscal year 2023-2024

IRAP transition to CIC

- In February 2023, the Government of Canada announced the transition of IRAP to the Canadian Innovation Corporation (CIC).
- The CIC will be a new, operationally independent organization solely dedicated to supporting business R&D across all regions and all sectors of the economy.
- The transition will happen after an approximate 24-month transition period, during which time IRAP will remain part of the NRC.
- During this period, it will be business as usual for IRAP employees and clients to ensure a seamless transition.



OFRM

Office of Facilities Renewal Management

Modernizing the NRC

Government of Canada investing \$962.2M over 8 years and \$121.1M ongoing to renew the NRC's facilities and real property.

Goal of modernization: to better invent, innovate and prosper.

Revitalization is an opportunity to:

- advance research excellence
- better partner with universities and industry
- increase the impact of NRC's work in support of Canada's science, technology and innovation goals.



Research centres

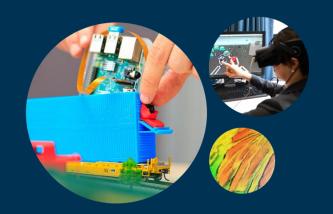
Research centres

Digital Technologies	Digital Technologies			
Emerging Technologies	Canadian Photonics Fabrication Centre Herzberg Astronomy and Astrophysics Metrology Quantum and Nanotechnologies Research Centre			
Engineering	Construction Clean Energy Innovations Ocean, Coastal and River Engineering			
Transportation and Manufacturing	Aerospace Automotive and Surface Transportation			
Life Sciences	Aquatic and Crop Resource Development Human Health Therapeutics Medical Devices			



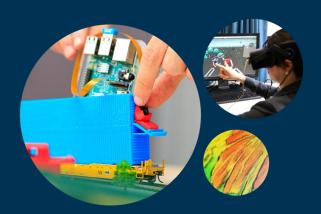
Making digital technologies smarter and more intuitive by exploring uses of data and information in innovative and meaningful ways to solve real problems

Key research areas • Artificial intelligence • Bioinformatics • Computer vision and graphics • Cybersecurity • Data analysis and modelling • Human-computer interaction • Internet of things • Natural language processing • Quantum computing



Why work with us

- Over 30 years of research experience in digital technologies
- New Applied Quantum Computing Challenge program to discover transformative algorithms and software
- Two research programs to support the Artificial Intelligence-Powered Supply Chains (SCALE AI) and Canada's Digital Technology Cluster
- Al for Design Challenge program to create a foundation of Al research tools
- Advanced digital expertise to support older adults and Northern peoples, through the Aging in Place and Arctic and Northern Challenge programs
- Collaboration with Indigenous communities and language experts to develop technologies that support language revitalization
- Four collaboration centres with universities and institutes
- Valued partner for other government departments
- Thought leadership and advice about ethics and accessibility of digital technologies





Emerging Technologies



North America's only pure play commercial compound semiconductor foundry

Semiconductor photonic components • Design • Fabrication • Testing • Integration



Why work with us

- Engineering and manufacturing services
- Commercial-grade prototyping
- Pilot-run production facilities
- 40,000 square foot facility
- 11,000 square feet of class 100/1000 clean room space





Government of Canada's foremost authority on astronomy and astrophysics, maintaining the country's largest observatories and representing the country in some of the world's leading astronomy initiatives

Key research areas • Astronomy technology • Optical and radio astronomy • Advanced data archiving and processing



Why work with us

- Offer extensive data management and analysis tools in our Canadian Astronomy Data Centre, supporting research at the Canada-France-Hawaii Telescope, Gemini Observatory, James Webb Space Telescope and more
- Support research and development activities at Canada's national and international observatories
- Develop advanced astronomical instruments for national and international observatories with university and industrial partners





Canada's National Measurement laboratory, developing and disseminating accurate measurement standards and services

Providing trusted metrological advice to government and industrial clients to advance innovation and improve quality of life

Key research areas • Chemical and physical measurement standards • Novel measurement methods and technologies • Realization of the international system of units (SI); such as the second, the kilogram and the mole



Why work with us

- High-performance laboratories and facilities, complemented by top minds in the field, tackling a broad range of measurement challenges, driving innovation and providing high-quality metrology capabilities
- Accurate, traceable measurements that define the national standard and are trusted and recognized internationally
- Primary measurement services that address established as well as emerging metrology areas, including 1) instrument calibration,
 2) chemical purity analysis, and 3) certified reference materials





Collaborating with Canadian and international labs, industry, and academia to advance science, accelerate and de-risk innovation to sustain Canada's industrial competitiveness well into the future

Key research areas • Attosecond science • Quantum science, advanced electronics, photonic devices, nanomaterials • Ultrafast quantum optics



- Scientific and engineering expertise in nanomaterials synthesis, printed electronics (2D-3D printing), nanocomposites, electronics and fibre photonic sensors, quantum information and security, quantum theory, and ultrafast quantum photonics and Attosecond Science
- Access to unique prototyping facilities and simulation, materials, fabrication, integration and full-scale testing
- Full suite of infrastructure for biological, physical and chemical characterizations of nanomaterials





Engineering



Providing an integrated innovation and business environment sustained by research and technical expertise

Bringing together national services, such as the Canadian Construction Materials Centre, the Canadian National Master Construction Specification, and Codes Canada, pre-eminent laboratories, and focused strategic research and development

Key research areas • Building envelopes and materials • Civil engineering infrastructure • Fire safety • Intelligent building operations



- Unparalleled expertise in building, structural and materials engineering, analytics, and human factors for smart construction solutions
- Access to unique, large-scale facilities and field testing expertise to validate even the most innovative building solutions
- Compliance expertise and testing capabilities for Canadian and international standards to ensure greater market access
- Unique, recognized impartial technology performance validation to optimize technology deployment





Creating the latest innovations in clean energy, clean tech minerals extraction, and environmental protection for Canadian industry

Key research areas • Bioenergy from waste streams • Bioprocesses and electrochemistry • Clean energy materials and processes • Energy storage • Net-zero emissions energy systems and life cycle analysis • Sensor technology • Sustainable minerals extraction technologies



- Support for the entire technology readiness scale, from fundamental research, to technology development and scale-up, to prototyping and field testing
- Access to one-of-a-kind, large-scale facilities and testing expertise to validate innovative energy, mining, and environmental solutions
- World-leading and unbiased technology performance validation
- Collaboration to address emerging technology requirements as the energy and mining sectors tackle climate change challenges





Developing safe, efficient and sustainable solutions to engineering challenges in harsh ocean and freshwater environments, in a changing climate

Key research areas • Arctic and Northern research • Coastal resilience • Digital waterways • Flood mitigation • Ice engineering • Intelligent marine assets • Marine and coastal infrastructure • Marine renewable energy • Marine safety • Pollution remediation • Shipping and marine transportation



- Unique facilities, technical experts, and digital capabilities to enable and advance sustainable intelligent marine assets, and improve the performance and safety of marine operations in harsh ocean and freshwater environments
- Canada's Centre of Excellence in field work and physical and numerical modelling to improve coastal resilience and protect infrastructure, property, and people from severe weather events and other environmental risks
- Sustainable solutions to protect our environment and ocean through marine renewable energy and pollution remediation, including microplastics and underwater noise
- Collaborative approach with partners, aiming to advance science and develop the most credible and reliable data for Canadians





Transportation and Manufacturing



Creating a stronger Canadian and global aerospace sector through research, innovation, and collaboration

Key research areas • Advanced digital manufacturing • Air travel research • Atmospheric and aircraft icing • Autonomous air mobility • Defense technologies and sustainment • Digital twin/virtual testing • Sustainable aviation



- Unparalleled access to scientists and engineers with deep expertise in multiple specialized disciplines to collaborate on research from design and concept development, technology maturation, testing and certification, as well as sustainment
- Access to unique testing facilities nationally and internationally
- Strong track record of developing advanced civil and military aircraft technologies to ensure that aviation is safer, more efficient, more eco-friendly, and more comfortable
- Customizable research, testing, validation, and advisory service options





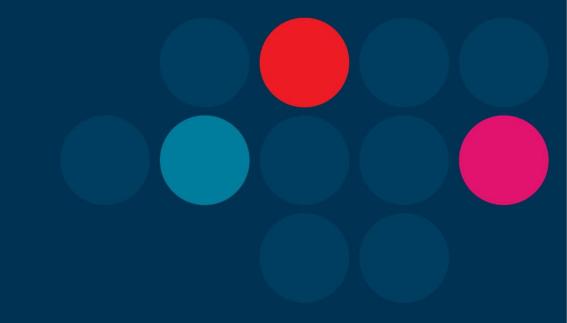
Leading-edge research, technical, and engineering services, and innovative technology solutions to help Canada be more competitive through innovations in mobility and manufacturing excellence

Key research areas • Additive manufacturing • Connected/autonomous vehicles technologies integrating testing and validation • Defence and security vehicle technologies • Digital manufacturing • Heavy-duty vehicle testing and evaluation • Intelligent transportation system and fleet management • Metallic polymer and composite manufacturing • Rail vehicle-infrastructure technologies • Surface engineering • Vehicle electrification • Vehicle light weighting



- Assist manufacturing industry in increasing its productivity and agility, decreasing product time-to-market, and advancing sustainable development strategies to better face Industry 4.0 challenges
- Broad range of experts to provide smart manufacturing processes and digital capabilities for increased operational efficiencies for metallic, polymer, and composite products
- Contribute to the development, optimization and evaluation of technology solutions that are aimed at improving ground transportation sustainability, efficiency, safety and connectivity
- Provide customer-driven end-to-end solutions, with expertise spanning design, prototype, simulation, lab and field testing for automotive, heavy-duty vehicles and including over 50 years in rail R&D





Life Sciences



Providing scientific research, services, and technology development focused on the sustainable transformation of Canadian bio-based resources into higher-value products

Key research areas • Improved crops, production practices, and processing innovations • Ocean health, aquaculture and algal technologies • Sustainable marine, agricultural and industrial biotechnologies • Value added products, bioprocessing, and atypical fermentation



- Collaborative approach with industry, academic, and government partners to develop and transform agricultural and marine bioresources into food, feed and ingredients, and other high-value bioproducts
- Cutting edge facilities including a marine research station housing algal cultivation and feed production facilities, plant growth facilities coupled with plant cell culture and transformation technologies, bioprocessing, natural products and analytical technologies
- Multi-disciplinary expertise spanning analytical and natural product chemistry, genomics and microbial profiling, agriculture and plant biotechnologies, bioprocessing and bioproduction, and algal and marine biotechnologies





Transforming human health outcomes for the benefit of society, in collaboration with public and private sector organizations, by accelerating the discovery and development of innovative biologic medicines in Canada

Key research areas • Antibody-based therapies against cancer and neurodegenerative diseases • Biomanufacturing platforms • Disruptive technology solutions for cell and gene therapy • Vaccines and emerging infections readiness



- Largest research and development team dedicated to biologics development in Canada
- Preclinical expertise spanning all stages from target selection to manufacturing-scale bioprocesses for technology transfer
- Global reputation for scientific leadership in the research of therapeutics for cancer, neurodegenerative diseases, emerging infections, immunobiology, vaccines, bioprocess engineering, and advanced analytics





Supporting the Canadian ecosystem in the development, translation and implementation of medical device innovations by relying on scientific fundamentals, biomedical engineering expertise, and a deep understanding of the research path from idea to market

Key research areas • Lab-on-a-chip development and fabrication • Virtual therapeutics



- Deep biomedical acumen, commitment to research excellence and translation to clinical use
- Strong connectivity with clinicians, industry, academia and government
- Track record of ideation-to-market, with the ability to skillfully navigate at any point of the translation
- Access to one-of-a-kind, large-scale facilities to de-risk even the most innovative diagnostics, and digital health technologies, including the Centre for Research and Applications in Fluidic Technologies (CRAFT), a collaborative venture between the NRC and the University of Toronto





Supporting growth of Canada's biomanufacturing production capacity for the future, ensuring vaccines and other biologics can be safely manufactured here at home

June 2021: Construction completed

August 2022: Drug establishment licence received

April 2023: Not-for-profit corporation, Biologics Manufacturing Centre (BMC) Inc., assumed responsibility for operations





Brings NRC researchers and facilities together with collaborators from industry, academia, and governments to work on game-changing scientific discoveries and technological breakthroughs



Focus on mission-oriented program and project design



Advance projects spanning innovation continuum



Enable strategic partnerships and funding



Support capacity building to enable sustained impact



Leverage IRAP business expertise to take ideas to market



Generate highly-dynamic multi-disciplinary R&D program teams



Bring together researchers and facilities from across the NRC



Develop collaborative by design programs in consultation with stakeholders



Bring together global leaders on collaborative projects and joint funding

Up to \$43M/YR in G&C funding for

eligible collaborators

\$150M

in Gs&Cs provided to date

Over

700

projects funded

Fiscal year 2022-2023

Supporting Canada's Global Innovation Clusters

The NRC's Clusters Support programs foster collaboration with innovators in both industry and academia and bring our national network of researchers and facilities to work on pressing Cluster challenges and longer-term innovation goals







Advanced Manufacturing

Support Canada's Advanced Manufacturing Cluster with research to reduce costs applied to design, supply, processing and assembly costs related to light and heavy ground transportation (rain, mass transit, recreational transport)

13 collaborating institutions · 21 projects · over \$7.2M in grants and contributions



Digital Health + Geospatial Analytics

Support Canada's Digital Technology Cluster in the areas of improving healthcare delivery using artificial intelligence and digital geospatial technologies to solve challenges in areas such as agriculture, forestry, environmental monitoring, transportation and clean energy

4 collaborating institutions · 16 projects · over \$4.1M in grants



Ocean

Support Canada's Ocean Cluster with research on coastal resilience, intelligent marine assets, pollution remediation and bio assets

22 collaborating institutions · 53 projects · over \$8.7M in grants and contributions



Sustainable Protein Production

Support Canada's Protein Industries Cluster with R&D to develop high-quality Canadian plant protein and value-added co-products. Research is focused on advanced omics, phytobiome, protein processing, pulse starch utilization, quality and safety of crop products, inoculants, and precision agriculture

15 collaborating institutions · 24 projects · over \$5.8M in grants and contributions



Artificial Intelligence for Logistics

Support Canada's Al-Powered Supply Chains Cluster (Scale Al) by enabling and developing Al tools for next-generation transportation and warehousing, including road, rail, air, and water vehicle autonomy and related systems

17 collaborating institutions · 32 projects · over \$9.6M in grants and contributions

Challenge programs

Addressing current + emerging government priorities



Over \$104M in Gs&Cs provided by Challenge programs to 94 collaborating institutions, for a total of 307 projects



High-throughput and Secure Networks

Develop high-performance, rapid and secure communication for rural and remote communities



Disruptive Technology Solutions for Cell and Gene Therapy

17 collaborating institutions · 43 projects · over \$14M in grants and contributions

Develop disruptive technology solutions to improve access and affordability of cell and gene therapies

15 collaborating institutions · 30 projects · over \$17.1M in grants and contributions



Materials for Clean Fuels

Develop new materials for zero-emission transportation fuels and chemical feedstocks across the continuum from discovery to commercialization

16 collaborating institutions · 25 projects · over \$12.5M in grants and contributions



Artificial Intelligence for Design

Develop a foundation of AI tools, technologies and capabilities to accelerate discovery, R&D, and innovation processes

22 collaborating institutions - 36 projects - over \$6.7M in grants and contributions



Aging in Place

Improve the quality of life of older adults and their personal caregivers through innovation that will support safe and healthy aging

9 collaborating institutions · 11 projects · over \$2.8M in grants



Internet of Things: Quantum Sensors

Develop a disruptive generation of quantum sensors that are orders of magnitude better than sensors that exist today

21 collaborating institutions · 35 projects · over \$18.1M in grants and contributions



Arctic and Northern (newly launched)

Address pressing issues confronting Northern peoples through technical expertise and applied research



Applied Quantum Computing (newly launched)

Support commercial and government innovations in quantum algorithms and applied quantum computing



Construction Sector Digitalization and Productivity (newly launched)

Support further modernization and digitalization of Canadian construction sector practices



Low Carbon Built Environment (newly launched)

Support the development of low-carbon construction tools, products and services

Ideation Fund

Supports exploratory research through the New Beginnings and Small Teams Initiatives

\$11M in grants delivered to 75 collaborating institutions for 223 projects



At least 14 invention disclosures anticipated from first round



Helps train highly-qualified personnel



Facilitates collaboration with external partners



Provides grant funding, dedicated time and resources



Fosters new or unexpected research results



Small-scale, exploratory research led by NRC employees working with collaborators

\$2M in annual funding (\$1M in grants) to projects of up to 18 months in duration

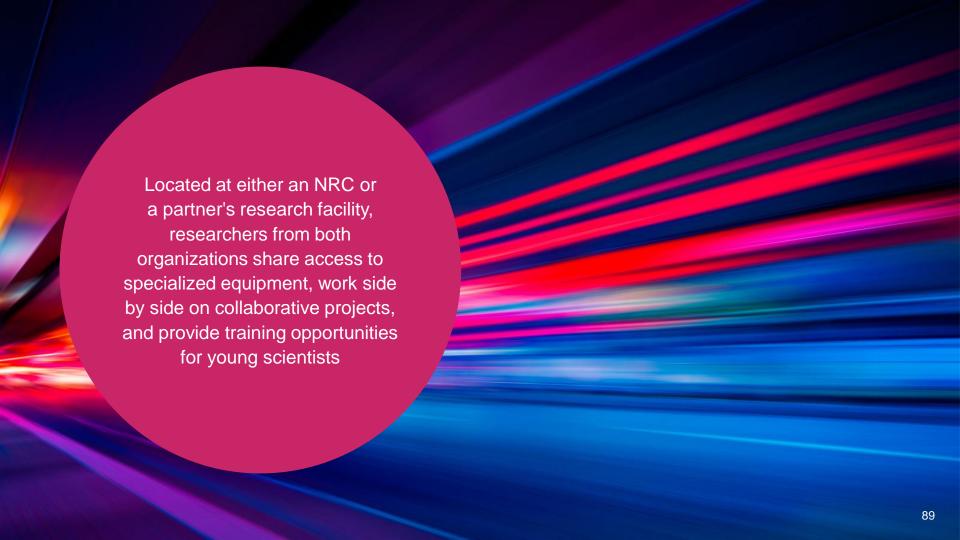


Explores transformative ideas by NRC teams working with collaborators

\$4M in annual funding (\$2M in grants) 3-year projects

Collaboration centres

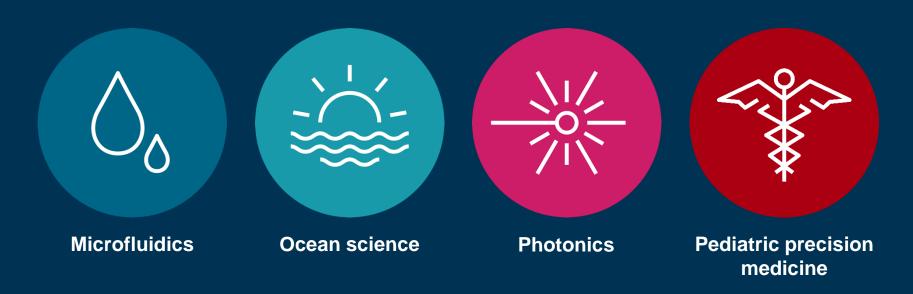
Co-locating researchers and equipment with university, industry, and other government organization partners to support research excellence in areas in which Canada can excel



Areas of research



Areas of research







CIC-NRC Cybersecurity Collaboration Consortium

Karluk Collaboration Space

NRC-University of Toronto Collaboration for Green Energy Materials

NRC-uOttawa Joint Centre for Extreme Photonics

NRC-Waterloo Collaboration on Artificial Intelligence, Internet of Things, and Cybersecurity

NRC-CHU Sainte-Justine Collaborative Unit for Translational Research (CUTR)

** NRC-Fields Mathematical Sciences Collaboration Centre

Canadian Centre for Advanced and Digital Manufacturing



Connecting globally

The NRC is recognized as a neutral connector and convenor internationally and within the Canadian innovation ecosystem

Connecting and convening

Using facilities and in-house expertise as platforms for R&D collaboration with SMEs, universities, and other organizations

Providing Canadian SMEs with access to established and long-standing international networks that enable them to penetrate foreign markets

Co-locating researchers and equipment with university partners through collaboration centres to accelerate research outcomes

Representing Canadian interests as Canada's affiliate on over 30 different international scientific organizations

Managing and providing access to some of Canada's specialized, large-scale scientific infrastructure (e.g. astronomical observatories)

International partnerships

The NRC is connecting Canadian and international R&D capabilities to solve global research challenges

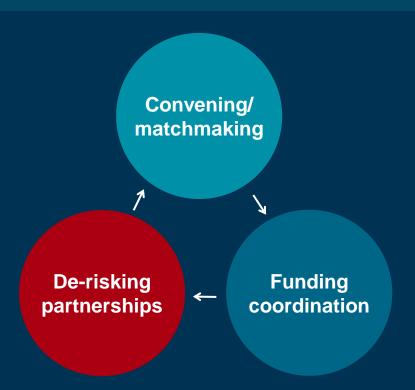


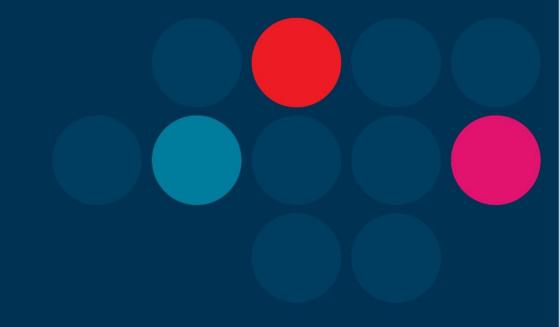


The NRC's international business model

Working with an extensive network of Canadian and foreign partners, we help SMEs and NRC research programs and their collaborators:

- Identify collaboration needs
- Identify and engage potential partners
- Secure preferred access to partners
- Access resources to carry out an exchange/ collaboration/co-innovation project





Supporting business innovation

Support business innovation by:

- working collaboratively with other researchers on R&D to solve problems and generate new IP
- providing research services to solve client challenges and generate new IP for clients
- offering technical services that test, evaluate and validate client technologies
- licensing NRC-generated technologies
- leading innovation assistance program for small and medium-sized businesses through our Industrial Research Assistance Program (IRAP)



Intellectual Property at the NRC

Our IP protection and commercialization strategies support the current and future needs of Canada and the NRC

We actively engage with licencees and collaborators to maximize the commercial development of our IP to drive benefit to Canada and Canadians

We offer a range of options for managing and licensing IP, depending on the research and commercialization goals, nature of the IP, and funding model for IP development



Why choose the NRC

The NRC works with partners to deliver a national platform for innovation









Thank you

First name Last name • Position • First.Last@nrc-cnrc.gc.ca