

NATIONAL RESEARCH COUNCIL OF CANADA

Lessons from COVID-19 and
innovating for the future

Presentation Outline

A decorative graphic in the top right corner consisting of a grid of circles. The top row has four circles, with the second one from the left being red. The middle row has five circles, with the second one from the left being teal and the fifth one being pink. The bottom row has two circles, both in teal.

- ❖ **NRC Overview**
- ❖ **COVID-19: strategic pivot to meet Canada's needs**
- ❖ **Strategic pillars going forward**
- ❖ **Investments in facilities and talent**
- ❖ **Discussion**

WHAT WE DO



**WE ADVANCE
SCIENTIFIC
AND TECHNICAL
KNOWLEDGE**

**WE SUPPORT
GOVERNMENT
POLICY
OBJECTIVES**

**WE SUPPORT
BUSINESS
INNOVATION**

NRC – Science Innovation from Coast to Coast



- NRC IRAP OFFICES
- RESEARCH FACILITIES AND NRC IRAP OFFICES

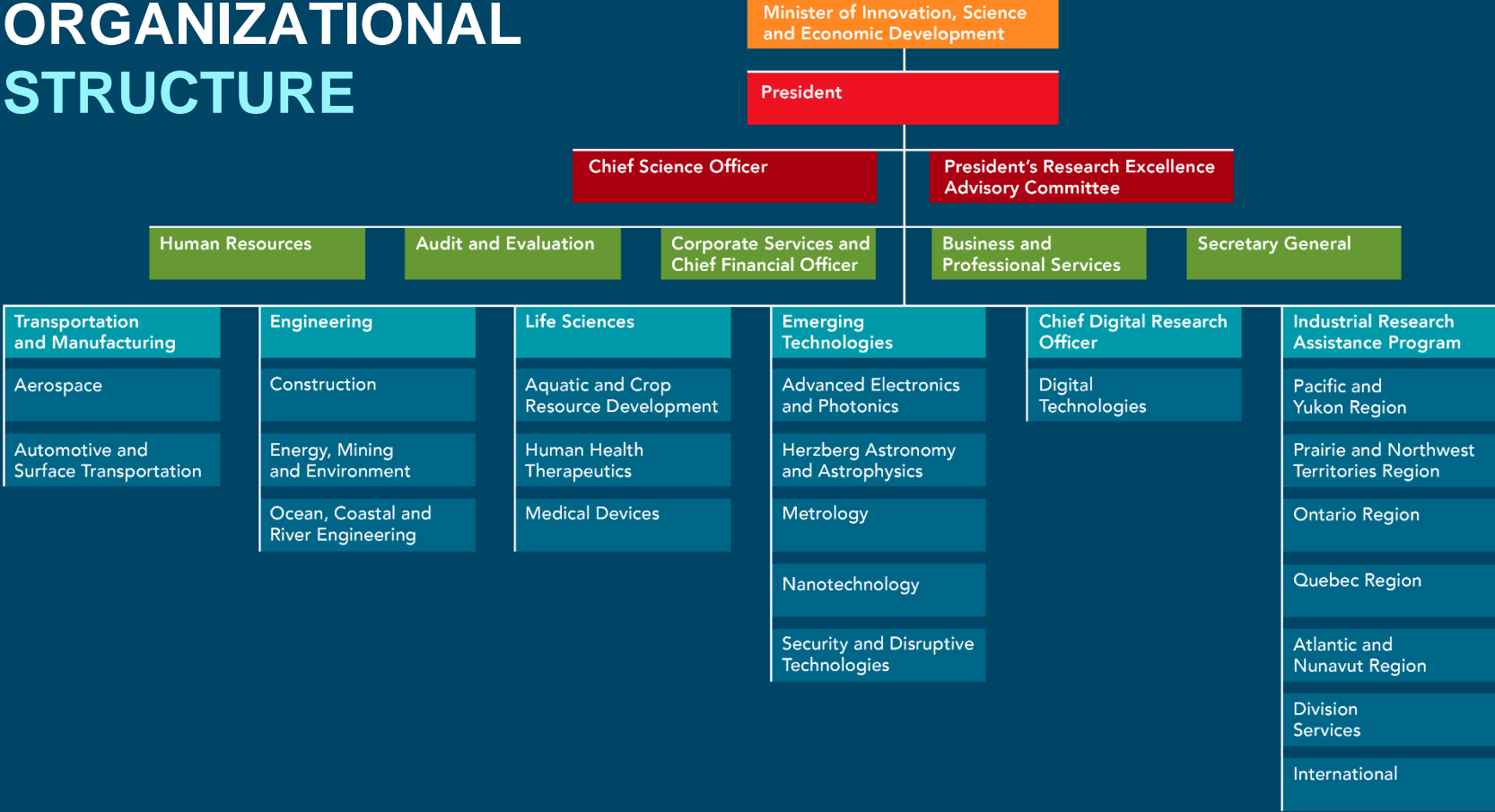


Industrial Research Assistance Program (IRAP) delivers national funding program and advisory support



14 NRC Research Centres across Canada conduct research and technical services with partners

ORGANIZATIONAL STRUCTURE



Industrial Research Assistance Program • NRC IRAP



**PROVIDE ADVICE,
CONNECTIONS,
AND FUNDING**
to help Canadian
small and medium-sized
businesses increase their
innovation capacity and
take ideas to market



**SERVE OVER 8,000
CLIENTS ANNUALLY**
(advisory services + funding)
across all industry sectors
and fund over 3,000 clients



**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

NRC's Intramural Research Footprint



VANCOUVER, BC

- Batteries, fuel cells and industrial tribology



VICTORIA AND PENTICTON, BC

- Optical and radio telescopes
- Adaptive optics



EDMONTON, AB

- Nanotechnology, electron microscopy



SASKATOON, SK

- Plant biotechnologies and plant-growth facilities



MISSISSAUGA, ON

- Advanced materials for digital manufacturing, printed electronics, smart objects, devices, sensors



LONDON, ON

- Additive manufacturing, product development, laser consolidation, micro-machining



OTTAWA, ON

- Aerospace, vaccines, construction, quantum, photonics, machine vision, big data analytics, metrology, materials characterization and testing



SAGUENAY, QC

- Aluminium and multi-materials assembly
- Hybrid manufacturing (extrusions, forgings, castings)



MONTREAL/BOUCHERVILLE/ ROYALMOUNT, QC

- Advanced manufacturing, intelligent machining, robotics, process modeling/ simulation
- Medical devices, advanced biologics analytics, biomanufacturing pilot plant



HALIFAX, NS

- Photobioreactors, bioprocessing
- Natural product chemistry, bioactive characterization



CHARLOTTETOWN, PE

- Natural product and functional ingredient development



ST. JOHN'S, NL

- Ocean engineering
- Ice and vessel management



THE NRC DELIVERS VALUE TO CANADA IN TWO WAYS

1. National network of research centres performing research and technical services with partners
2. National funding program • the Industrial Research Assistance Program

1916

CANADA EVOLVES · THE NRC RESPONDS

TODAY

NATION BUILDING

WAR TIME

BOOM TIME

SPACE RACE

DIGITAL + GLOBAL

CLIMATE CHANGE

Advice

1928 Conduct applied and industrial R&D

1946 Conduct basic science, provide support for small and medium-sized enterprises (IRAP)

1986 Industry-oriented institutes

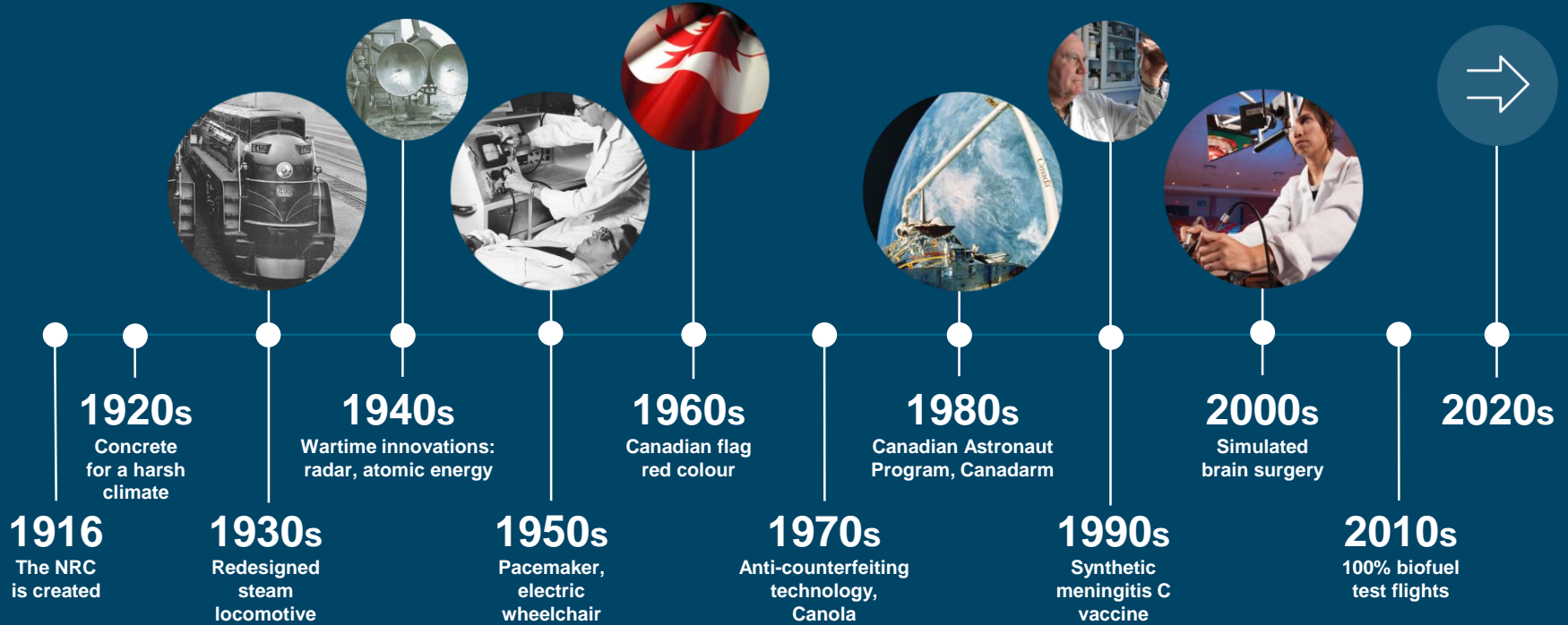
2000 Regional expansion and cluster initiatives

2012 Research and Technology Organization (RTO)

2016 + Renewed focus on excellence and engagement

EVOLVING NRC ROLE

A CENTURY OF INNOVATION



NRC strategic platforms deliver on finding solutions to Canada's priorities

Research and technical talent

- Over 2,200 NRC researchers have the expertise, skills and tools needed to undertake impactful research in collaboration with government, universities and industry

Technology Platforms

- NRC operates 126 large-scale, secure, technology platforms for industry, government and academe (e.g., research aircraft, metrology, telescopes)

Innovation-based SMEs

- Over 270 IRAP advisors in 110 locations across the country support thousands of innovation and high-value growth firms annually with their technology projects

Mission-oriented research

- NRC collaborative programs build teams of government, academic and industry researchers to address challenges (including Clean Fuels, AI, Quantum, Aging in Place)



These tools allowed the NRC to pivot and focus quickly in support of COVID-19 pandemic response

They also can help find solutions for new national challenges, such as growing climate change adaptation needs, biomanufacturing to support readiness for the next pandemic, and digital / communications security



COVID-19: STRATEGIC PIVOT TO MEET PANDEMIC NEEDS

NRC's Priorities During COVID

1

Protecting
our people



2

Supporting
our clients



3

Protecting
the health of
Canadians



Protecting our Clients

Support for Vaccine and Therapeutics Development

IRAP was entrusted with \$150M over three years to support projects of merit in stages too early to qualify for Strategic Innovation Fund (SIF) support

7

Vaccine firms supported

7

Therapeutics firms supported

Approved support

\$72.3M

As of November 9 2021

Innovative Solutions Canada (ISC)

IRAP collaboration with ISED and ISC COVID-19 Challenge Program to provide SMEs with financial support for their near-to-market solutions that meet a COVID-19-related need

\$14.4M

Funding awarded

21

Firms supported

8

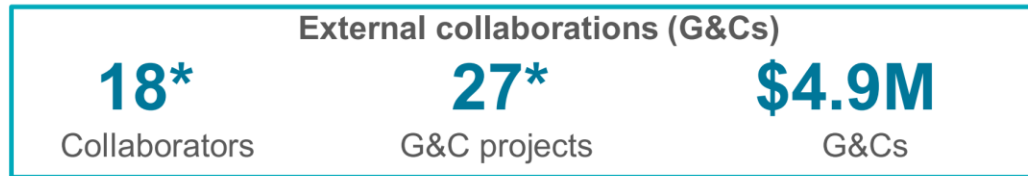
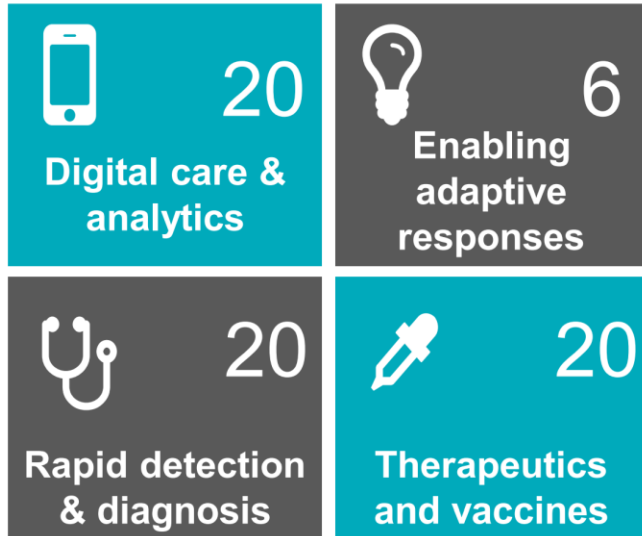
Challenges sponsored

IRAP has worked to support testing and diagnostics firms over the course of the COVID-19 pandemic. IRAP continues to support SMEs, including those firms with short-term antigen test solutions in an effort to provide Canadian sovereign testing and diagnostic solutions

Protecting the Health of Canadians

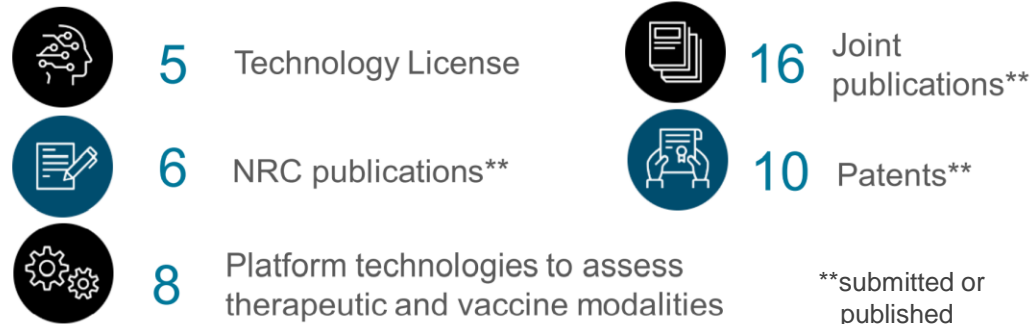
Pandemic Response Challenge Program

4 program pillars / 66 projects / \$15M



*Planned, ongoing and closed

Key Outputs



NRC contribution to the Pandemic response



Healthcare

- Vaccines R&D & Enabling Biomanufacturing
- Reference Standards for Testing reagents
- N95 mask testing



Innovation

- Pandemic Response Challenge Program
- Solutions for sterilization, diagnostics, filtration



Business support

- Domestic vaccines/therapeutics
- Innovation Assistance Program
- Targeting more than 3,000 youth job placements over 2 years

Themes of the NRC Strategic Plan



**ENABLING A
MORE SUSTAINABLE
ECONOMY**



**SUPPORTING
A HEALTHIER
FUTURE**



**INNOVATING
THE EVERYDAY**



**CREATING
CANADIAN
WEALTH**



**UNDERSTANDING
OUR WORLD**

Emerging Priorities: Post-Pandemic

Priorities and themes are aligned with the Minister's mandate letter and the five key themes from the NRC Strategic Plan.

Three key priority areas to advance R&D:

1. Pandemic response and building Canada's biomanufacturing capacity
2. Climate action
3. Digitalization and Quantum

1. Pandemic response and building Canada's biomanufacturing capacity

Continue to play a key role in Canada's Pandemic Response

- **Scale innovative SME**
- **Advance Vaccine Production Technologies**
- **Biomanufacturing Resilience:**
Operationalize the Biologics Manufacturing Centre and Clinical Trials Material Facility

Engage in R&D for a more Resilient Future

- **Vaccines & Therapeutics** (Emerging infections and Rare diseases)
- **Cell & Gene Therapy**
- **Technology Accelerators** (Virtual Care and Microfluidics platforms)
- **International & National Collaboration**

2. Climate Action

Help Achieve Net Zero Emissions

- R&D to develop the Low Carbon Built Environment
- Co-lead with Other Government Departments the National Battery Innovation Strategy
- Develop building and energy codes for climate resiliency

Green Transformation of Agriculture, Aerospace and Transportation

- Climate Resilient Crops
- Clean and Energy-efficient Transportation program
- Low-emission Aviation program
- High-efficiency Mining program

3. Digitalization and Quantum

New Challenge Programs in Quantum

- Applied Quantum Computing
- IoT Quantum Sensors:

Revitalizing Photonics

- A modernized Canadian Photonics Fabrication Centre (CPFC)

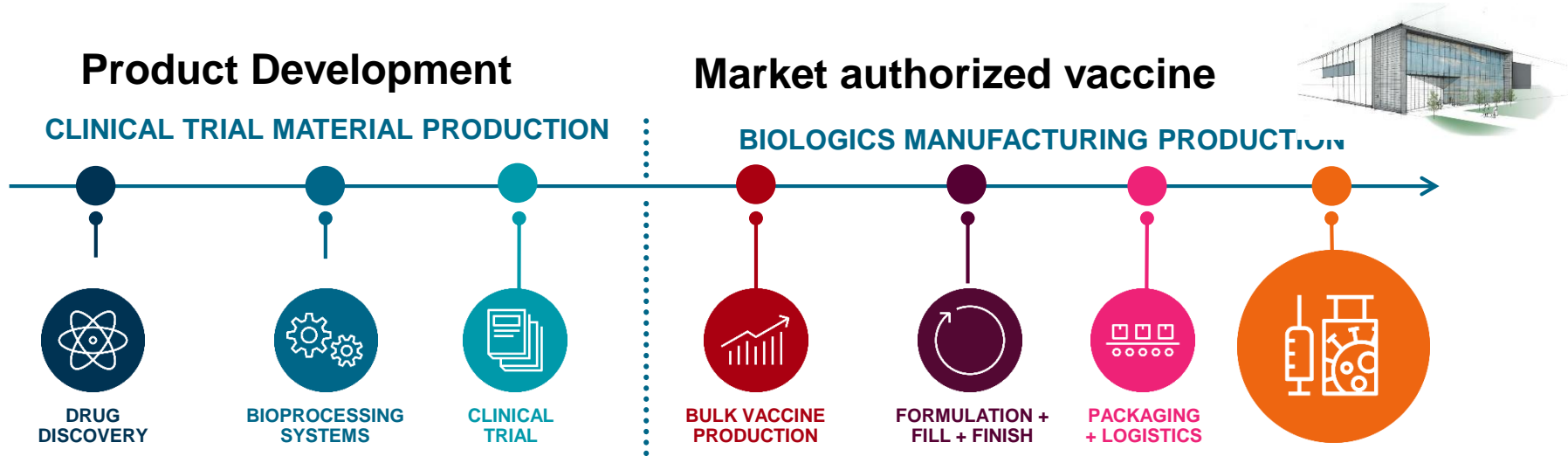
Advancing AI

- “Detect and Avoid” solutions for drones
- AI for maritime applications (sea-ice freeze-up, coast guard ships)

Cross-cutting & Disruptive R&D

- Digital Twinning
- Nano-enabled disruptive solutions
- Common framework for the System of Units (SI)

GMP Production at NRC Royalmount



GMP-compliant facility for manufacturing of vaccines and biologics for use in **clinical trials**.

Target Operation: 2024

Two-storey vaccine biomanufacturing **production** facility with **Drug Establishment License**

Target Operation: 2022

NRC Biologics Manufacturing Centre

An end-to-end GMP biomanufacturing facility



- 5 100 m² / 54 900 sq. ft. on 2 floors
- 1 160 m² / 12 500 sq. ft. of manufacturing space
- QC labs, Mechanical Area & Offices on the second floor

- Offices and Locker Room
- Production Area (Class D)
- Production Area (Class C)
- Filling Area (Class C)
- Secondary Packaging Area
- Warehouse
- Water System and Corridor



Facility Overview



The Building

- Full end-to-end manufacturing capabilities from scale-up to secondary packaging
- Two individual production suites (500L/2000L)
- QC Laboratory
- Warehouse
- Office and Common spaces



Production Equipment

- Bioreactors – single use technology
- Chromatography columns
- Tangential Flow Filtration
- Aseptic filling equipment
- Secondary packaging line (future)
- Autoclaves (Decontamination and sterilization)
- Part washer



Services

- Purified water
- Water for injection
- Pure steam
- Effluent treatment system
- 12 HVAC units
- Clean compressed air & gases
- Chilled water
- Seed storage

NRC Clinical Trial Material Facility

Provides the infrastructure and expertise necessary for the domestic production of vaccines and other biological therapeutic material for clinical trials, thereby establishing a vital product development bridge between R&D (e.g., current Human Health Therapeutics Research Centre) and commercial-scale capacity (e.g., Biologics Manufacturing Centre).



NRC Collaboration Tools

1. Collaboration Centres

Develop internationally recognized expertise in certain fields

NRC researchers and equipment co-located with university partners to collaborate on research themes of common interest

4. Challenge Programs

Focus on outcomes in specific areas of importance to Canada

Bring together the best minds from academia, industry and across government to deliver breakthroughs across the innovation continuum

2. Researcher Mobility

Cross-pollinate ideas with NRC researchers

Offer students and scientists access to world-class facilities and work on multidisciplinary teams of expert researchers and technicians on projects of critical importance

3. IRAP International Collaboration

Introduce innovative Canadian SMEs that can address the technology needs of large companies

Provide funding to Canadian SMEs for co-innovation projects with foreign companies to develop or adapt Canadian technologies/services



ENABLING PARTNERSHIP

NRC-NSTDA Joint Collaboration

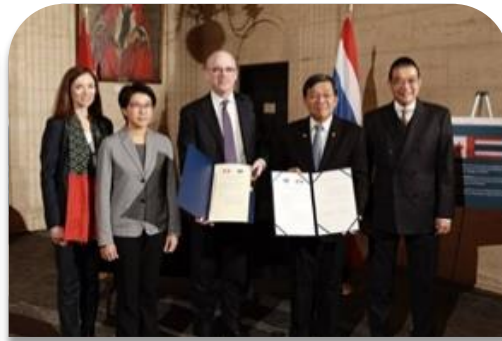
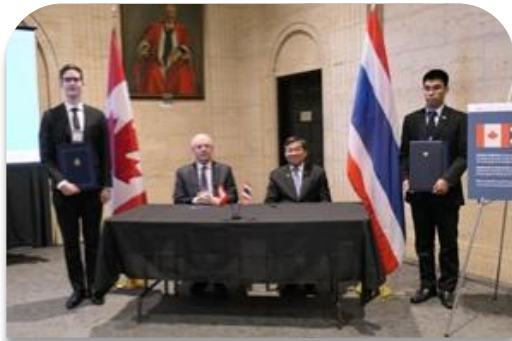
- Exchanged knowledge to assist in the formation of the successful **Industrial Technology Assistance Program (ITAP)**
- Coordinated **missions to Thailand** to discuss relations
- Jointly chaired a roundtable discussion during the **Funding Agency Presidents' Meeting (FAPM)**
- Identified area for collaboration in **Agrifood technologies**
- Active members of the **RTO International Network (RIN)**



National Research
Council Canada
Conseil national de
recherches Canada



ITAP



2,151

**SCIENTISTS, ENGINEERS,
TECHNICIANS, AND
OTHER SPECIALISTS**
including 255 SME industrial
technology advisors

179

BUILDINGS MANAGED
(equivalent to 354 NHL
hockey rinks) in 22 locations

\$1.1B

ANNUAL EXPENDITURE
including an IRAP contribution
budget of \$293M for SMEs

1,577

**R&D COLLABORATIONS
AND HELPED 8,000 SMEs**



THANK YOU

