

Ocean Program

Ocean Health. Ocean Wealth.

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Program Director

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- 1. The NRC**
- 2. The Ocean Program**
- 3. Call for Expression of Interest**
- 4. Canadian Forum for Maritime Autonomous Surface Ships**

The NRC Canada's National Research and Technology Organization

Vision, Mission, Values

VISION: Creating a better Canada through science and innovation.

VALUES: Excellence, respect, integrity, collaboration, impact, creativity.

MISSION: Collaborating across the global innovation system to generate and transform ideas into innovation that benefit Canadian society, the economy and the environment.



The NRC at a glance

Three key roles:

Business innovation

Federal policy mandates

Advancing knowledge

- 4,000 scientists, engineers, technicians, and other specialists, including 255 SME technology advisors.
- Manages 178 buildings in 72 locations.
- \$1.1 B annual budget including \$271M in funding for SMEs.



We work with

- **8,000** SMEs (advice & funding)
- **1,000** companies (R&D)
- **150** hospitals
- **70** colleges and universities
- **35** federal departments
- **36** countries



NRC Activities



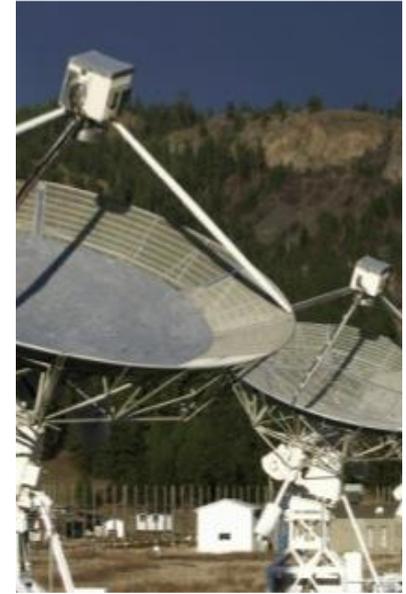
**Strategic
Research &
Development**



**Technical
Services**



**Industrial Research
Assistance Program
IRAP**



**Science
Infrastructure**



The NRC at work

Expertise in 14 areas of S&T

- Aerospace
- Automotive and Surface Transportation
- Construction
- Energy, Mining and Environment
- Ocean, Coastal and River Engineering
- Aquatic and Crop Resource Development
- Human Health Therapeutics
- Medical Devices
- Nanotechnology
- Digital Technologies
- Advanced Electronics and Photonics
- Metrology
- Astronomy and Astrophysics
- Security and Disruptive Technologies



2. The Ocean Program

Canada's Federal Blue Economy Priorities

2020 Speech from the Throne Commitments³

- Protect a quarter of Canada's oceans in five years.
- Grow Canada's ocean economy to create opportunities for fishers and coastal communities, while advancing reconciliation and conservation objectives.
- Invest in the Blue Economy to help Canada prosper.

In 2018, Canada launched the Supercluster Initiative

- \$150 million over 5 years to increase Canada's ocean economy, leveraged by \$150 million by private industry

Canada's Blue Economy a Federal Priority

"A blue economy is about harnessing the potential of our oceans, seas, lakes, and rivers – resources that Canada is privileged to have in abundance – to make life better for all, particularly women, young people, Indigenous peoples, and people living in developing countries. It means tapping into the latest innovations, scientific advances, and best practices while building prosperity and conserving our waters for future generations."

Statement by the Prime Minister on the Sustainable Blue Economy Conference¹

"We cannot have a strong ocean economy without healthy oceans. With three oceans and the longest coastline in the world, Canada has a real opportunity to both grow our economy and become a global leader in ocean conservation. That's why our government will be moving forward to protect 25 per cent of Canada's oceans by 2025 and 30 per cent by 2030 and will work to advance a blue economy strategy.... and Innovation Fund in efforts that will protect and restore our oceans and coastlines. Together we will ensure that more Canadians can sustainably continue to make a living on, and from, the water for generations to come."

The Honourable Bernadette Jordan, Minister of Fisheries, Oceans and the Canadian Coast Guard²

Canada and the World

UN Decade of Ocean Science for Sustainability 2021-2030

- Generate the scientific knowledge and underpinning infrastructures and partnerships needed for sustainable development of the ocean.
- Provide ocean science, data and information to inform policies for a well functioning ocean in support of all sustainable development goals of 2030 Agenda.

UN Sustainable Development Goals – Life Below Water

- Prevent and significantly reduce marine pollution of all kinds
- Sustainably manage and protect marine and coastal ecosystems
- Minimize and address the impacts of ocean acidification
- Increase scientific knowledge, develop research capacity and transfer marine technology to improve ocean health and enhance the contribution of marine biodiversity

High Level Panel for a Sustainable Ocean Economy

- Ocean Health:
 - Reduce GHG emissions
 - Protect and restore marine and coastal ecosystems
 - Reduce ocean pollution
- Ocean Wealth:
 - Sustainable ocean food
 - Sustainable ocean energy
 - Sustainable ocean-based tourism
 - Sustainable ocean transport
 - Sustainable new ocean industries



NRC's Response to Canada's Blue Economy Growth: NRC's Ocean Program

- **Program Goal**

- To support the Ocean Supercluster community by increasing the amount of sustainable technologies for Canada's blue economy growth
- To increase Canada's research and technology capacity that balance the health of the ocean and the economy

- **Ocean health. Ocean wealth.**

- The ocean is an asset, to restore its health will lead to economic, social and environmental prosperity



NRC Ocean Program - Commitment

- **Seven year duration (FY 2020/21 – 2026/27)**
- NRC will invest ~\$50 million over life of the Program
 - Access to over 40 researchers and world class facilities on a cost recoverable basis
 - Research services considered an eligible, unfunded cost within supercluster projects
 - Approximately \$10 million in Grants and Contributions for collaborative research projects aligned with Ocean Program research objectives

**Collaboration is essential
to meet Ocean Program
goals
funds supplement NRC's
own internal research**

NRC Capacity

- Algae (maintain database, can grow and harvest for replenishment, as a sensor, and as energy)
- Fish nutrition (mostly from algae)
- Mining, prospecting and producing value added products from water sampling and/or waste streams
- Microbial research
- Zebrafish lab (only one in Canada)
- Ship/ice collisions
- Ship performance and optimization
- Ice behaviour, management and prediction
- Numerical modelling (CFD, agent-based modeling, hydrodynamics, etc.)
- Metocean prediction
- Sensors
- Testing (physical and numerical) of coastal and deep ocean infrastructure
- Digital technologies

THE NRC OCEAN PROGRAM

Ocean Health. Ocean Wealth.

Supporting technology development to advance Canada's blue economy within four research themes:



COASTAL RESILIENCE

Flood prediction and forecasting systems

Nature-based solutions for flood and erosion risk reduction

Climate change impact assessment and adaptation

More resilient and sustainable marine infrastructure



INTELLIGENT MARINE ASSETS

Improved operational performance of marine assets

Autonomous asset operation in harsh environments

Long-range environmental prediction and digitalized seaways

Marine renewables in harsh environments



POLLUTION REMEDIATION

Impact and detection of pollutants

Transport and fate of pollutants

Extraction of pollutants for use as feedstock



BIO ASSETS

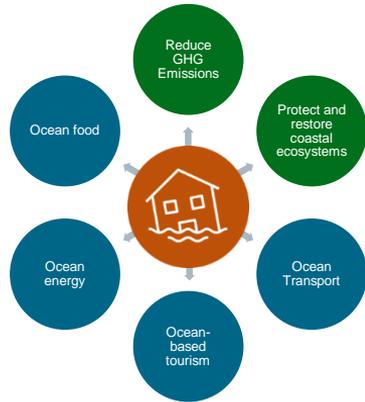
Bio-sensing solutions for monitoring ocean health near industrial sites

Value-added products from marine bio-resources: mining; prospecting; and, economical, sustainable production processes

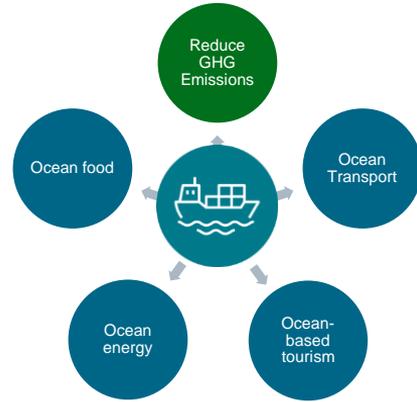
Alternative source of proteins for food and feed applications (i.e. aquaculture)

Addressing the Challenges and the Opportunities

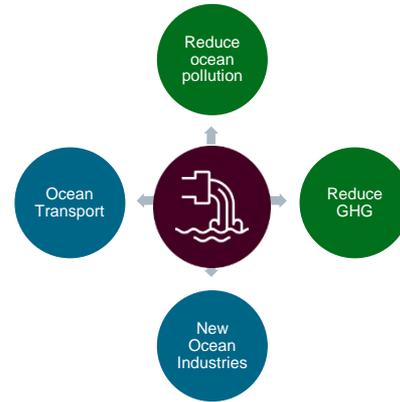
Technologies themes address technology and innovation across the blue economy spectrum



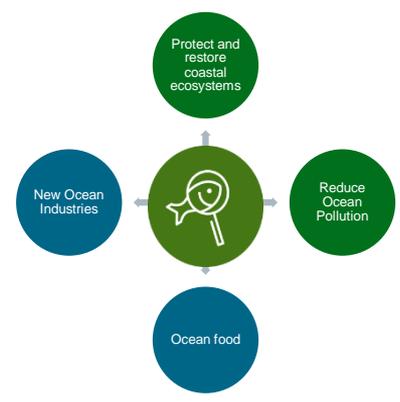
Coastal Resilience is necessary for the land-sea interface, no industry can thrive without a healthy and resilient coast



Intelligent Marine Assets are required for all marine industries, reducing their impact is necessary for maximum productivity



Pollution Remediation looks to remove plastic, oil, biofouling and noise; pollution to be used in circular economy



Bio Assets will create sensors out of algae, develop new value added products, and create alternative protein fish feed

NRC's Ocean Program

Responsible for MASS related activities

Ocean Program has Technology Theme dedicated to Intelligent Marine Assets

- Fraser Winsor, Research and Technology Lead (R&T Lead)
- Focus on Operational Performance in ice and harsh environments and longer term environmental prediction
- Primary Sector: Ships and Shipping to enable MASS



INTELLIGENT MARINE ASSETS

Improved operational performance of marine assets

Autonomous asset operation in harsh environments

Long-range environmental prediction and digitalized seaways

Marine renewables in harsh environments

Canadian Forum for Maritime Autonomous Surface Ships (CFMASS) Testing/Research and Development Sub-Committee

Transport Canada launched the Canadian Forum for Maritime Autonomous Surface Ships in 2019 supported by three sub-committees

- Test/Research and Development
- Domestic and International Frameworks Development
- Multilateral Cooperation
- NRC Chairs Subcommittee which has remained active throughout covid
 - Guided by federal Interdepartmental Working Group with participation from:
 - Transport Canada
 - Canadian Coast Guard
 - Department of Fisheries and Oceans, Blue Economy Strategy Secretariat
 - Canadian Hydrographic Service
 - Navy (TBD)

Canadian Forum for Maritime Autonomous Surface Ships (CFMASS) Testing/Research and Development Subcommittee

Testing Research and Development Sub-Committee Objectives:

- Create a Technology Roadmap for enabling MASS in Canadian waterways
- Coordinating all MASS related research activities under CiSMaRT (Research and Technology Theme Lead sits on Board)
- Develop multi-party projects to increase enabling MASS technologies created in Canada
- Long term vision to establish Canada as the global leader in testing and evaluation of MASS technology
 - Physical and numerical modeling across Canadian landscape
- Hold monthly webinars to keep national stakeholders informed and engaged
- Information stored on external collaboration site – permission based

Intelligent Marine Asset Projects

Use of Machine Learning for Identification and Characterization of Vessel Operational Best Practices

Digital Twin Technology for Autonomous Operation in Harsh Environment

Prediction of Ice in the St. Lawrence Waterway Using Artificial Intelligence

Ship Situational Awareness in Ice

St. Lawrence Seaway Autonomous Marine Testbed

Extension of Driving Automation Research Activities at NRC to the Marine Use Case



Expression of Interest: Enabling MASS

NRC will be looking for Expressions of Interest to supplement its research in MASS related activities

Call will be launched through CISMART's Network

- Commitment through CFMASS Testing/Research and Development Subcommittee

Important Dates:

December 15th : Call will be out before

January 15th : Expressions of interest due COB

February 15th : Selected proponents will be asked to submit a full proposal by.

April 1st : Funding envelope begins

Thank you

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