# Update
# Canadian Space Agency Activities

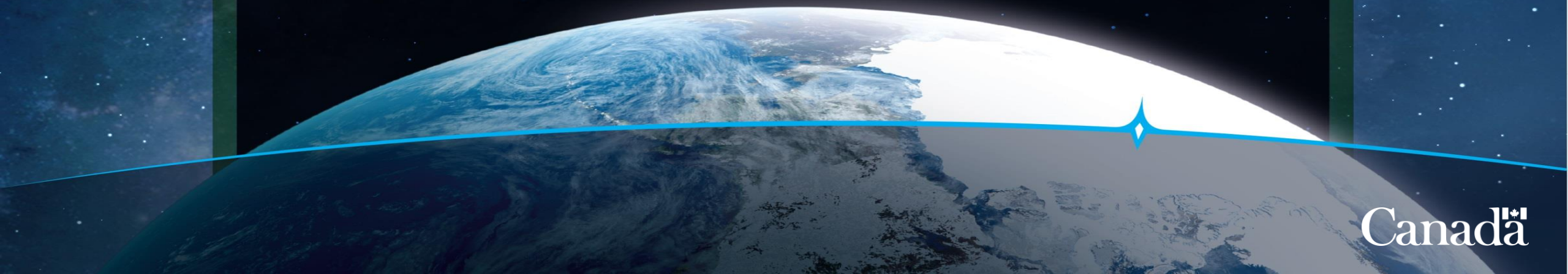

**David Haight**
Director
Economic Analysis, International and Regulatory Affairs

**Eric Laliberté**
Director General
Space Utilisation

**Isabelle Tremblay**
Director
Astronauts, Life Sciences and Space Medecine

**Eric Vachon**
Director General
Space Science and Technologies

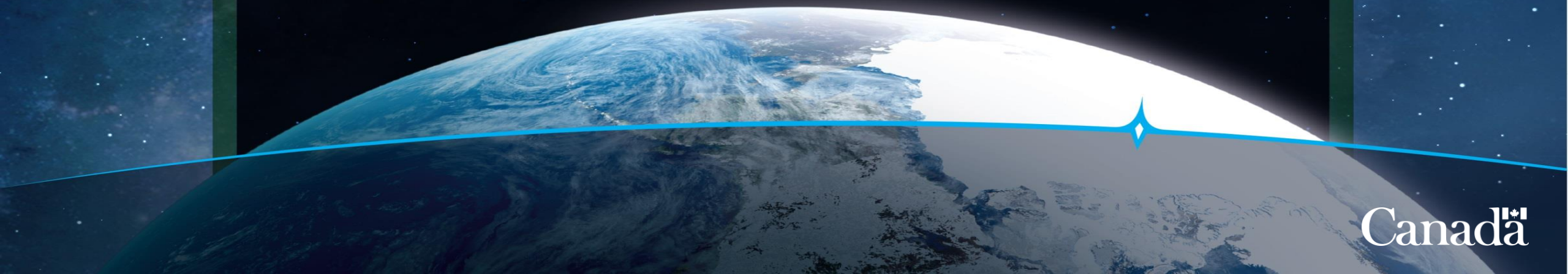

**CASI ASTRO**
**November 1, 2022**



Canada

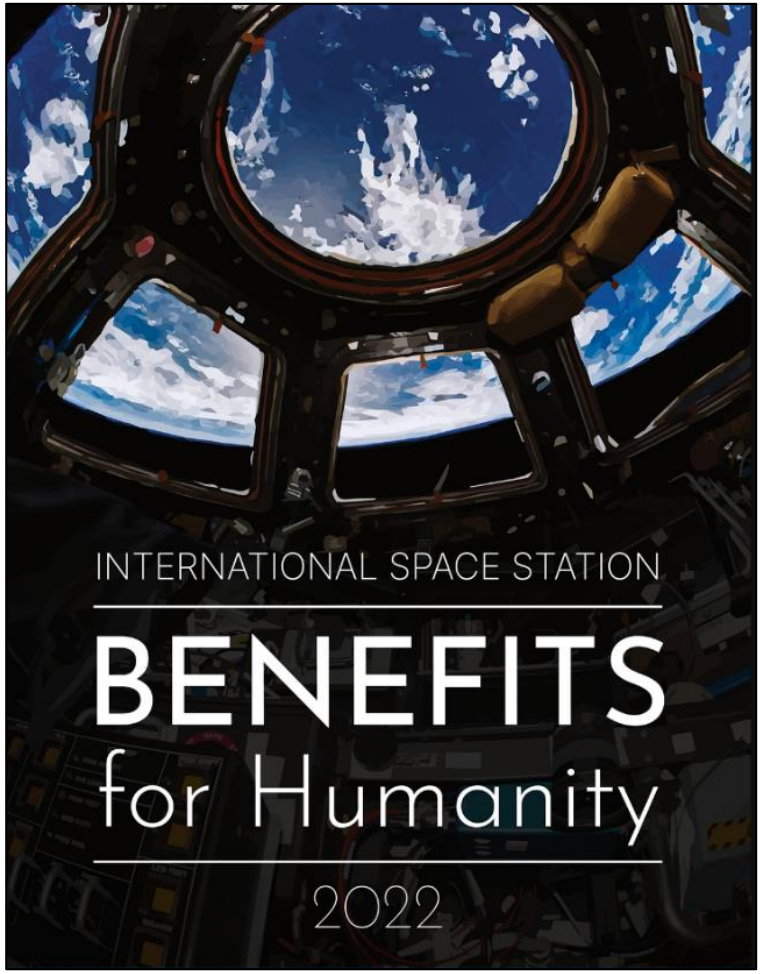
# Space Policy

**David Haight**
Director
Economic,
International and
Regulatory Affairs

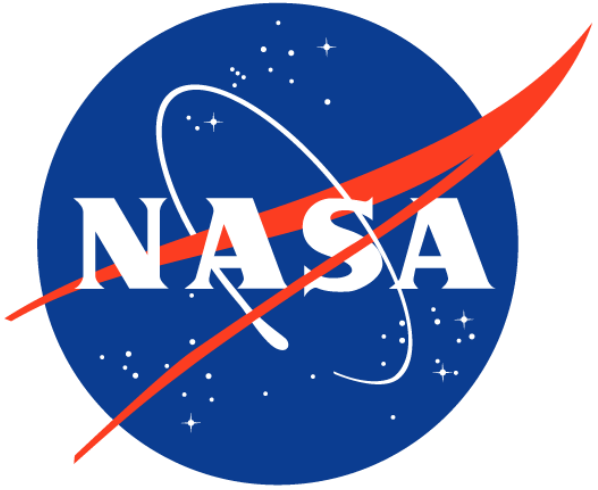


Canada

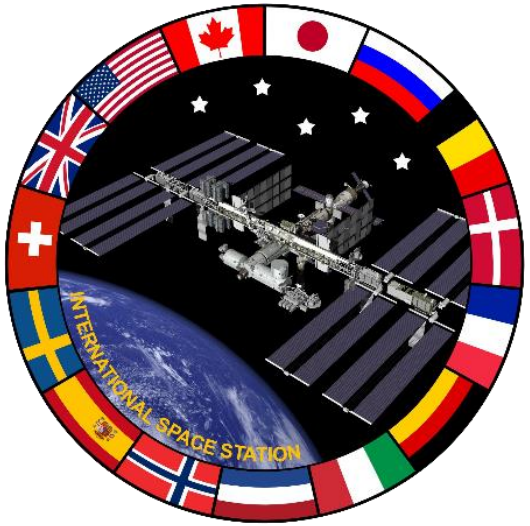
# Benefits of Space


# International Collaboration








# Space Sustainability

UNITED NATIONS
Committee on the Peaceful Uses of Outer Space



UNITED NATIONS

ARTEMIS

# ARTEMIS ACCORDS

Australia 

Bahrain 

Brazil 

Canada 

Colombia 

France 

Israel 

Italy 

Japan 

Luxembourg 

Mexico 

New Zealand 

Poland 

Republic of Korea 

Romania 

Saudi Arabia 

Singapore 

Ukraine 

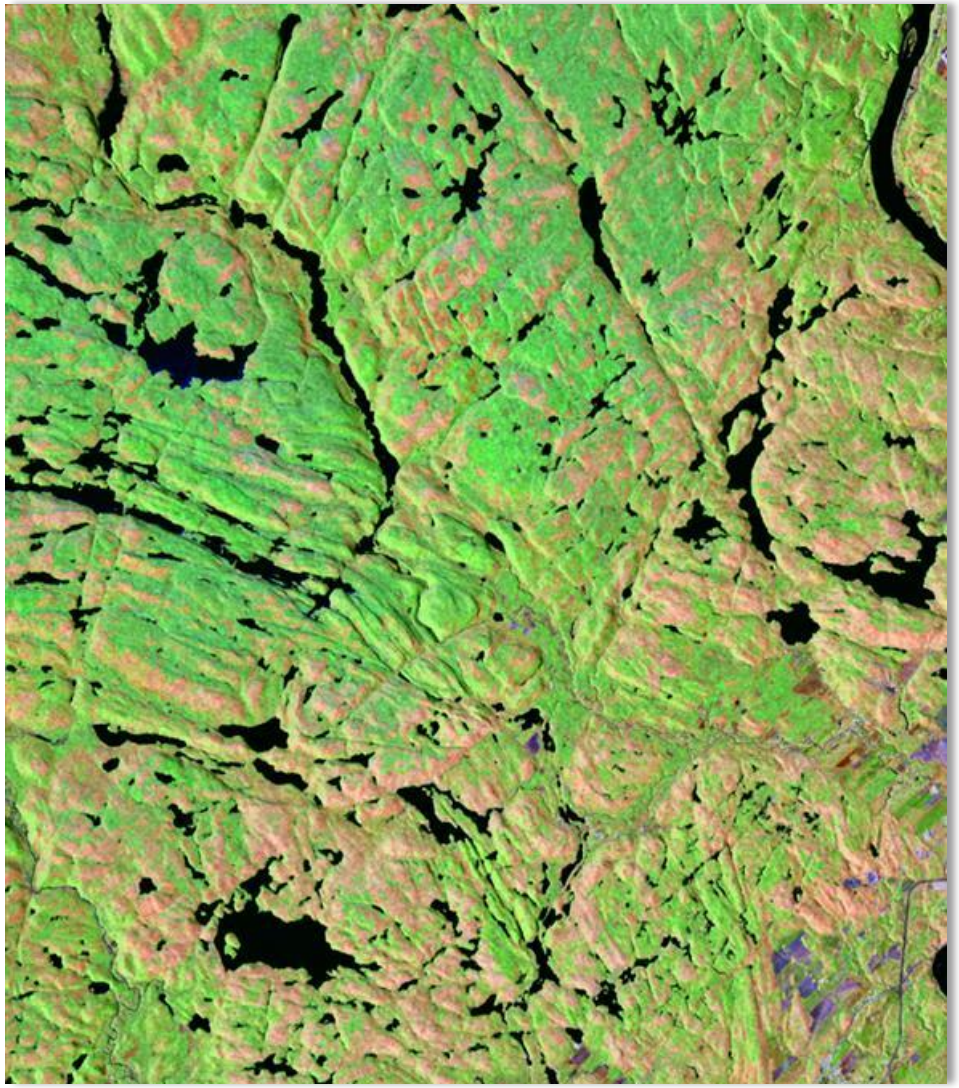
United Arab Emirates 

United Kingdom 

The United States of America 

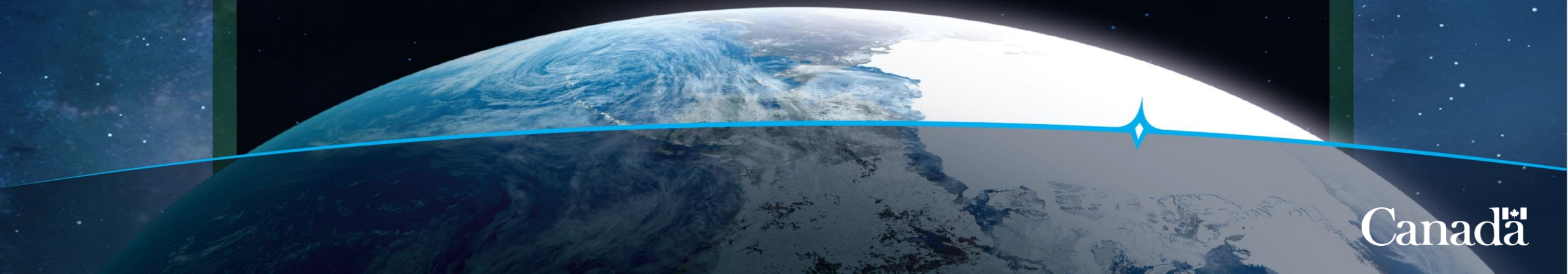
United for Peaceful Exploration of Deep Space

# Modern Regulatory Framework for Space



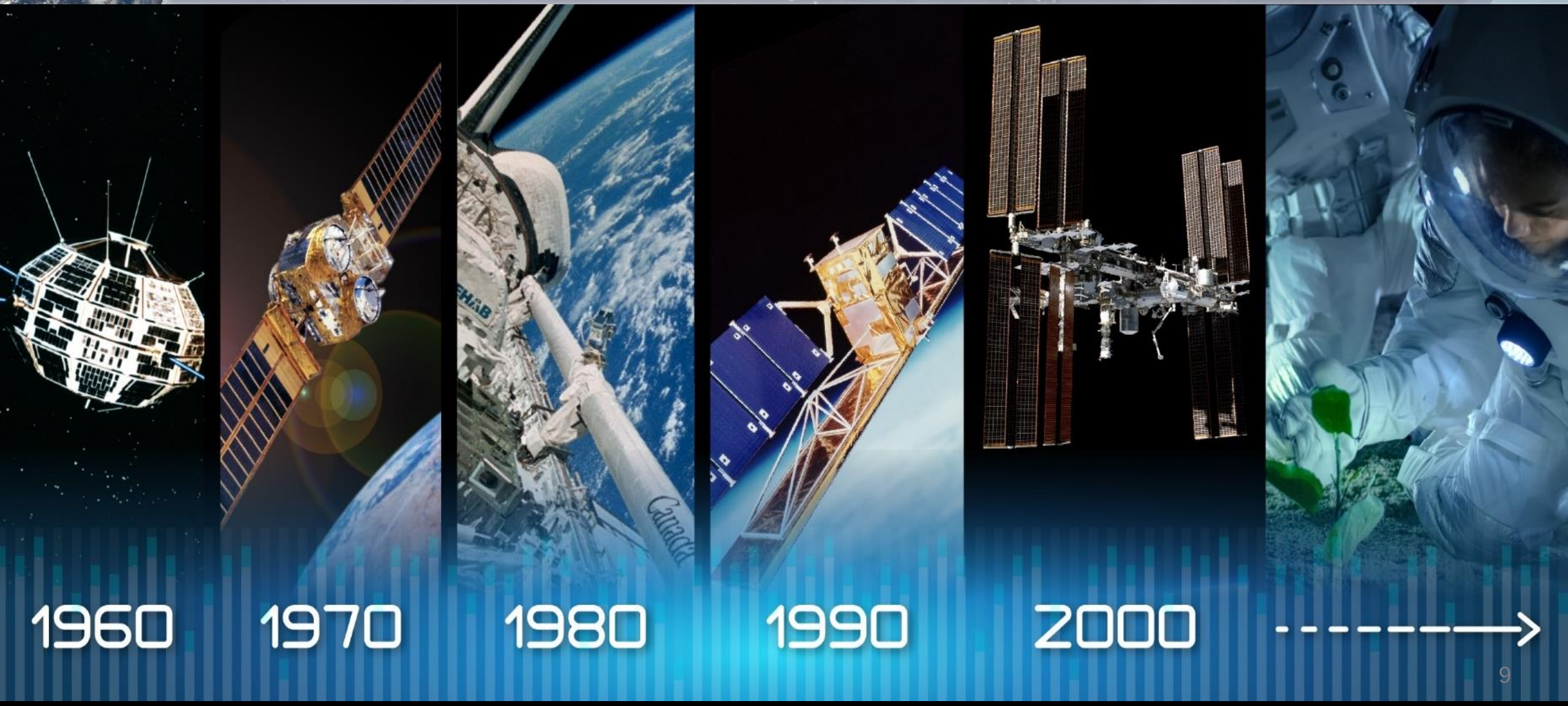
# Space Exploration Program

**Isabelle Tremblay**
Director
Astronauts, Life Sciences
and Space Medicine

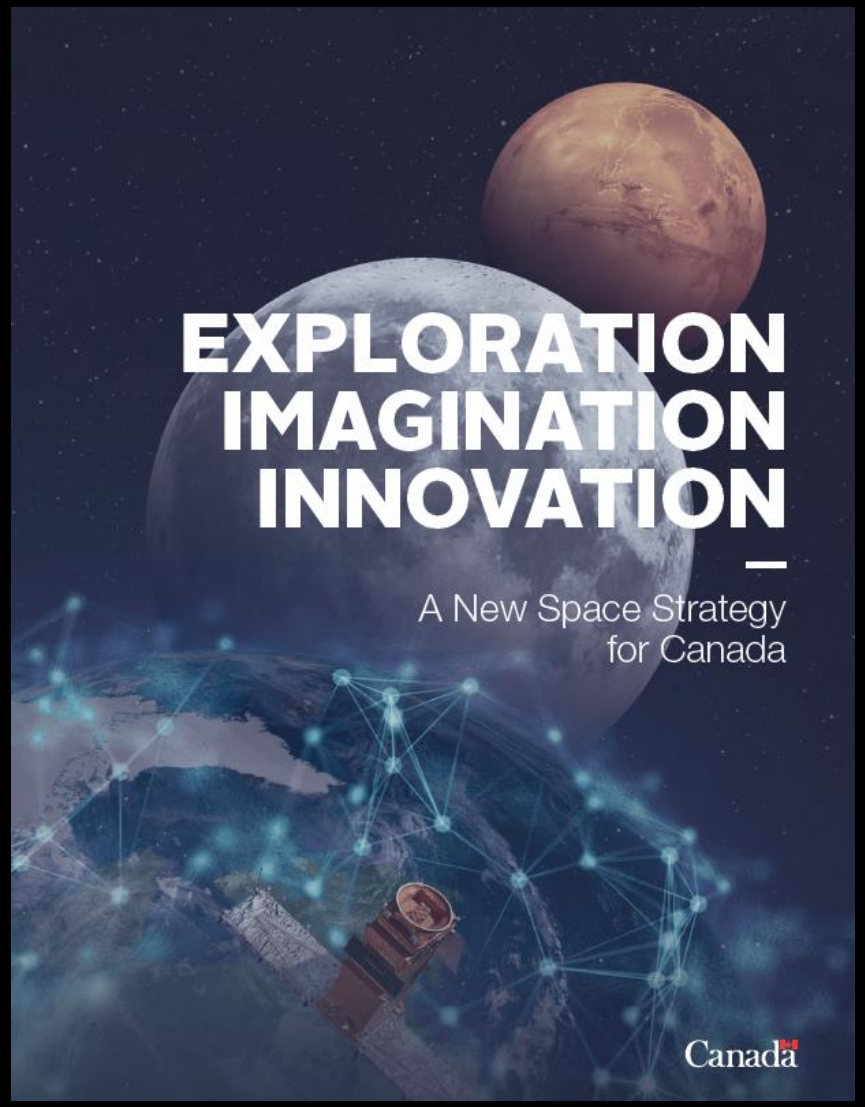


Canada

# CANADA IN SPACE: PAST, PRESENT AND FUTURE



# SPACE EXPLORATION STRATEGIC OBJECTIVES




## Ensure Canada remains a leading spacefaring nation by joining the Lunar Gateway

- Build the next-generation AI-enabled deep-space robotic system
- Enable scientific opportunities and global partnerships
- Guarantee the future of our astronaut program

## Harness space to solve everyday challenges for Canadians

- Improving remote medicine and health care
- Enhancing access to nutritious food

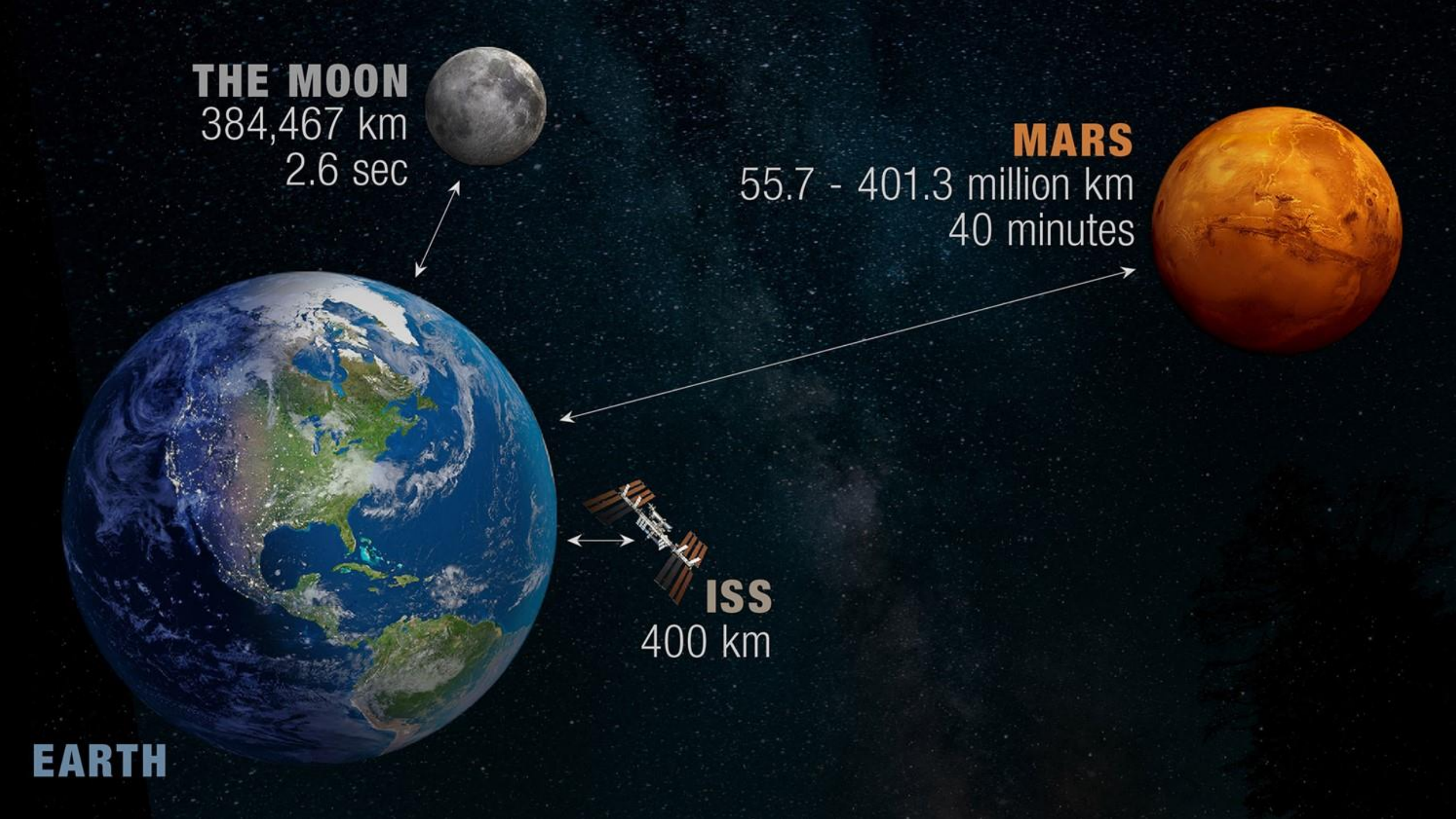
## Position Canada's commercial space

- Cement and expand our international partnerships
- Help our space firms start up and scale up

## Support science excellence & innovation

- Supporting space science to study Earth and beyond


James Webb Space Telescope
(NASA, ESA, CSA)
AstroSat (ISRO)
Trace Gas Orbiter
(ESA, Roscosmos)
Rosalind Franklin rover
(ESA)
Mars Science Laboratory
(NASA)
Lunar Gateway
(NASA, ESA, CSA, JAXA)
Canadian lunar rover (CSA)
OSIRIS-REx (NASA)
International
Space Station
(NASA, ESA, CSA, Roscosmos, JAXA)
Launched
To be launched
Canadian Space Agency
Agence spatiale canadienne
Canada


THE MOON
384,467 km
2.6 sec
MARS
55.7 - 401.3 million km
40 minutes
ISS
400 km
EARTH

# CANADA’S ROLE IN MOON EXPLORATION

The Moon is a crucial stepping stone in humanity's quest to travel onwards to Mars

Canada’s contributions:

1. Advanced robotic system known as Canadarm3 for the Lunar Gateway
2. LEAP: A program for innovative Canadian science and technology, including a Canadian rover designed for the Moon

Studies on major contributions to human lunar surface exploration

# LUNAR SURFACE EXPLORATION INITIATIVE (LSEI)

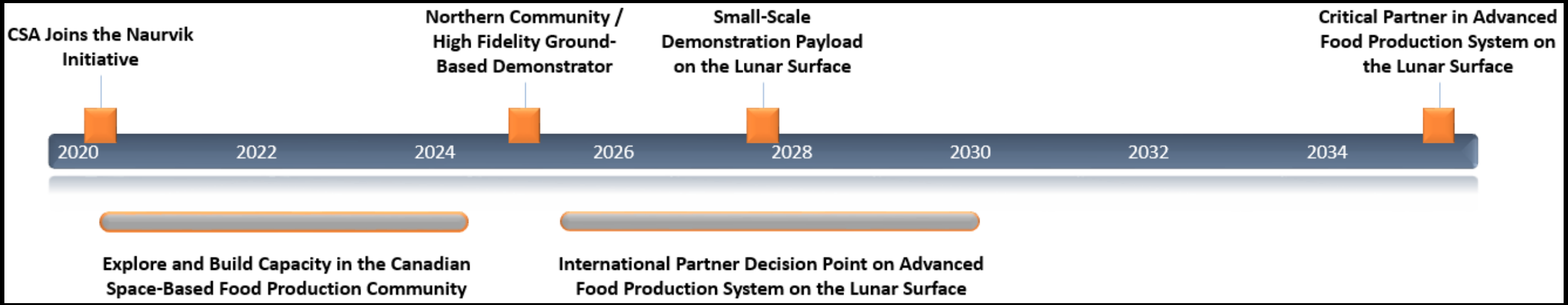
- Preparatory activities to define viable options for Canada to provide **early, visible and critical infrastructure contributions** driven by Canada's **commercial interests** and complemented by the **high-class science** necessary to **enable** these contributions.
- Contributions should enable **Canadian astronauts on the Moon**
- Contribution areas to be explored:
  - Autonomous and Intelligent Robots & Rovers
  - Agriculture & Food Production Module
  - Healthcare*
  - Mining and In-Situ Resource Utilization
  - Power Generation & Distribution
  - Avionics & Communication
- Seven concept study contracts currently in place, with a down-select to five phase 2 prototyping contracts forthcoming

**Healthcare is being studied as part of the Health Beyond Initiative.*

# FOOD PRODUCTION

## Vision:

By the mid-2030s, Canada will have developed food production capabilities for long-duration human spaceflight and provided one or more critical systems to an international lunar surface food system partnership, while contributing to improving food systems on Earth.

# FOOD PRODUCTION



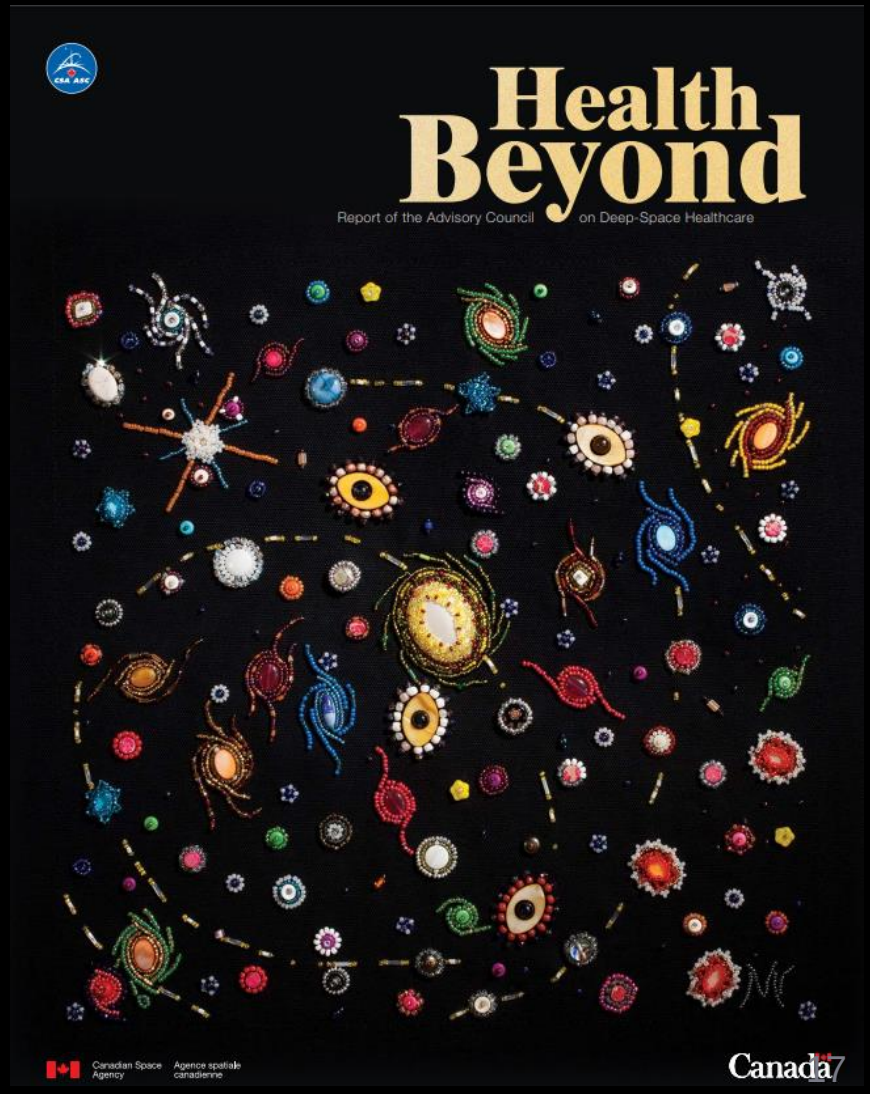

# ADVISORY COUNCIL ON DEEP SPACE HEALTHCARE

## Advisory Council Mandate

Assist the CSA as it endeavors to define in detail a potential deep-space healthcare program for Canada that is nationally critical, visible, scalable, affordable and socially beneficial

A CSA-led partnership should pursue an audacious goal — **a leadership role** in deep-space astronaut healthcare

We need to work with of **national collaborators** that have the relevant expertise, and also have mandates that are **aligned with our mission**



# HEALTH BEYOND

The Health Beyond Initiative is developing sustainable medical technologies for future deep-space missions, that also promise to help tackle health challenges in remote communities on Earth

Vision and Mobilization

Capacity Building

Demonstration and Deployment

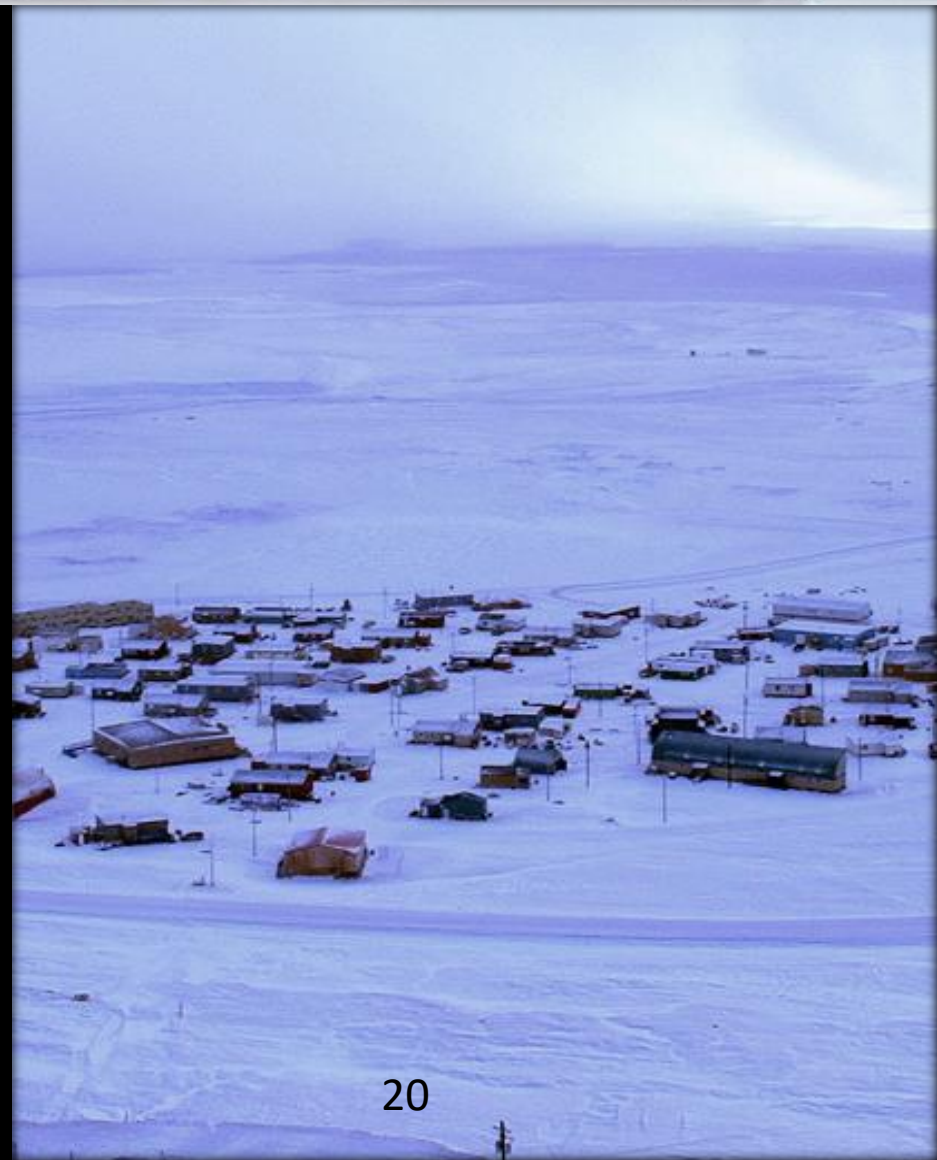
# CONNECTED CARE MEDICAL MODULE ($C^2M^2$)

## A Flexible Framework for a Canadian Flagship Contribution to Human Space Exploration Infrastructure

- A scalable integrated system of state-of-the-art medical technologies and methodologies.
- Leverage and rally the expertise, experience and vision of health stakeholders

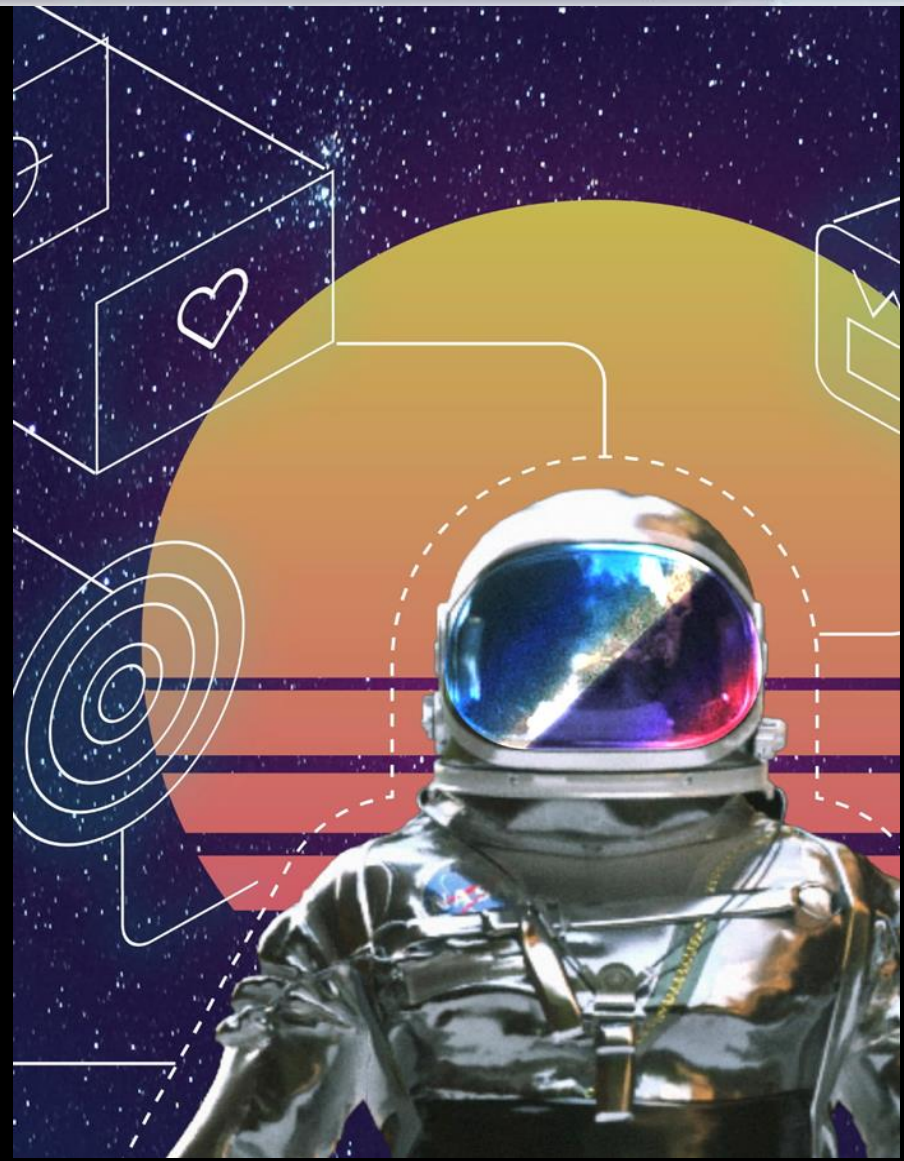
# CONNECTED CARE MEDICAL MODULE ($C^2M^2$)

- Enable agile, rapid prototyping and iterative operation of Connected Care Medical Modules ($C^2M^2$) on Earth, with the ultimate objective of operation in space
- Core computer-based system that facilitates the incorporation, interconnection (i.e., flow of information), and usage of the latest medical technologies



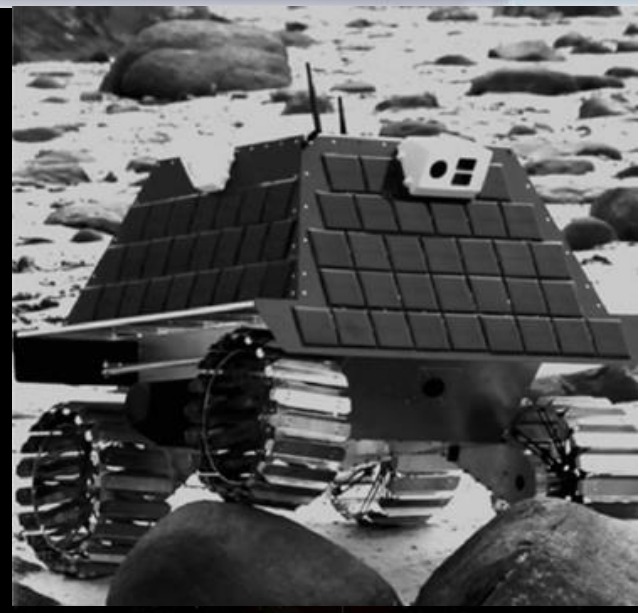
# ONGOING ACTIVITIES

- $C^2M^2$ RFP
- Deep Space Healthcare Challenge
- Engagement Activities
  - Think Tank Sessions
  - Health Beyond Summit



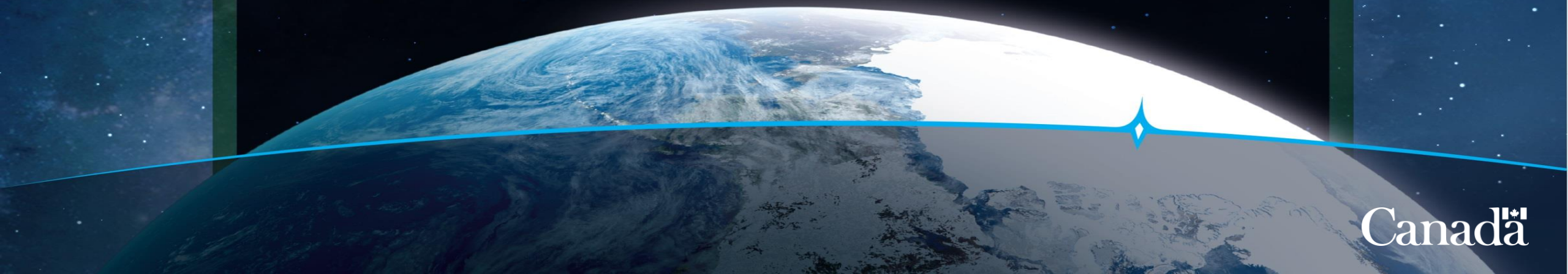
# LEAP
## *Lunar Exploration Accelerator Program*

- Lunar rover
  - Two concepts in parallel development;
  - 30 kg / 5 instruments / Late 2026 / 42 Earth days+ (night survival);
  - Down selection to Preliminary design (Phase B) imminent.
- Lunar Science Instrument
  - PRISM 2 call unsuccessful;
  - 10 kg (lander, rover TBC).
- Capability Dev & Tech Dev ongoing
- Science grants
- 2nd Lunar Workshop (June 2023)



# Space Utilization Program

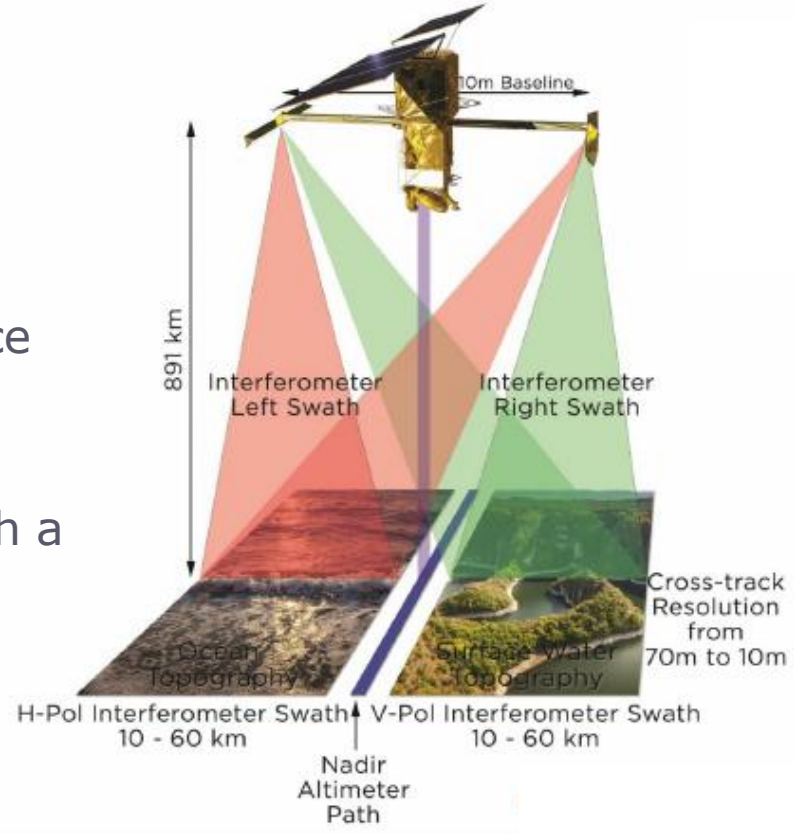
**Eric Laliberté**
Director General
Space Utilization



Canada

# The SWOT mission

- **Mission architecture**
  - Partnership between NASA, CNES, CSA and UKSA
  - Core payload: Ka-band radar interferometer with Jason-class altimeter
  - Scheduled launch in December 2022
  - 3-mth commissioning phase, 3-mth Cal/Val phase, 3-yr science phase
- **Mission requirements**
  - Over the oceans, provide sea surface heights every 1 km² with a vertical precision of 2.4 cm
  - Over land, produce a water mask able to resolve 100-m wide rivers and lakes of 250 m x 250 m in size with a water level accuracy of
    10 cm and a slope accuracy of 1.7 cm/km (over 1 km²)
  - Cover at least 90% of the globe, every 21 days



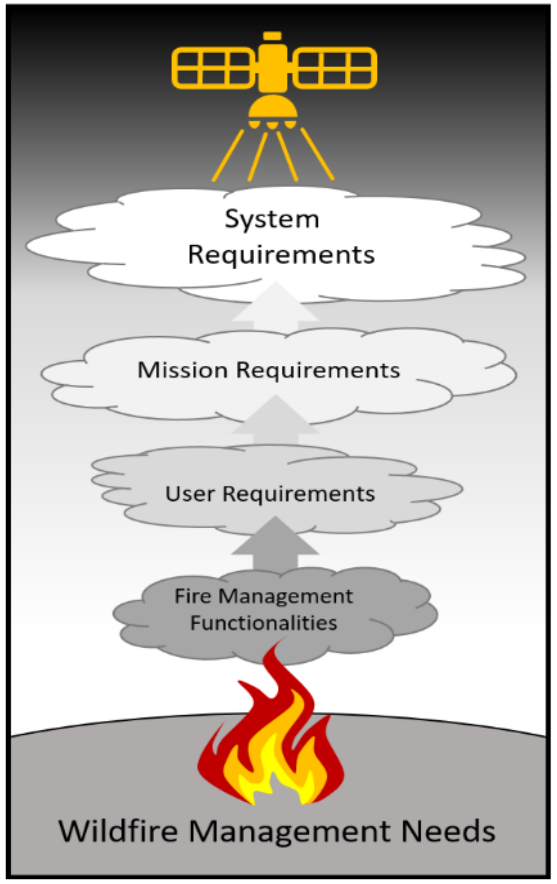
# WildFireSat

Key Features:

- VIS/NIR (200 m)
- MWIR/LWIR (400 m);
- Daily peak burn overpass;
- FRP optimised;
- Detection capacity at 15 x 15 m fire;
    - *open canopy (Johnston et al, 2018)
- 30 min data latency.

Fire Monitoring Capability:

- Near-real-time data delivery;
- Early detection (remote access fires);
- Active perimeter mapping and progression;
- Perimeter mapping of ROS (m $min^{-1}$) when combined with VIIRS (Johnston, 2016);
- Perimeter mapping of FI (kW $m^{-1}$), (Johnston et al, 2017);
- Mapping of Fuel Consumption (kg $m^{-2}$);
- Near-real-time measurements of carbon emissions and smoke plume dynamics.

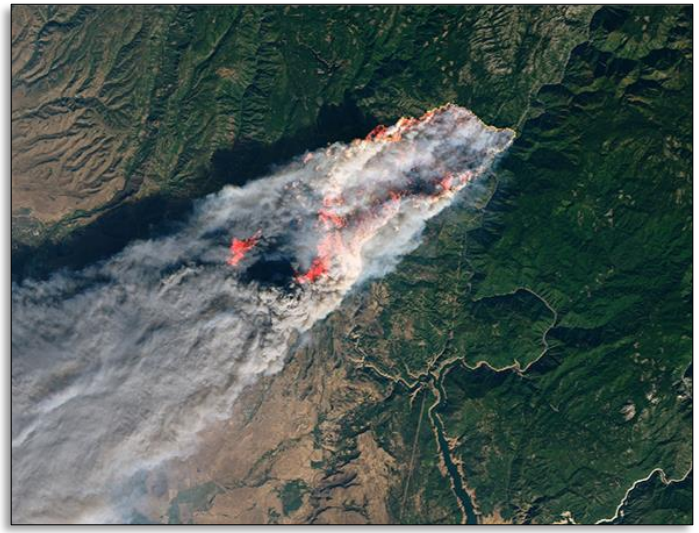

(Johnston *et al*, 2020)

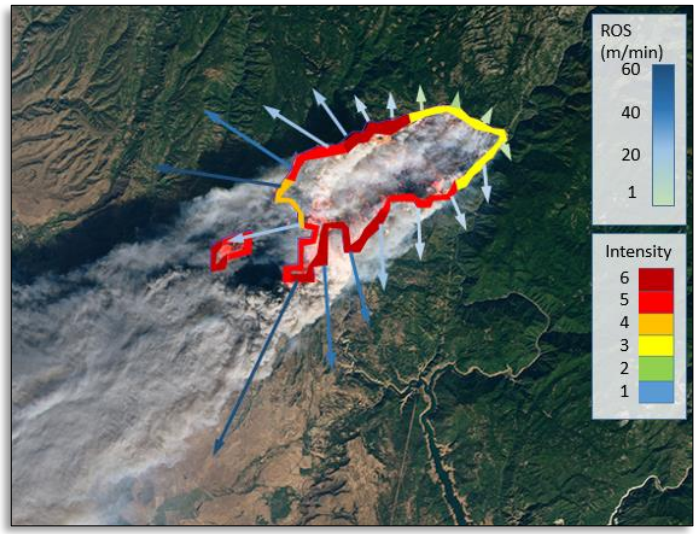
# Key Outcomes

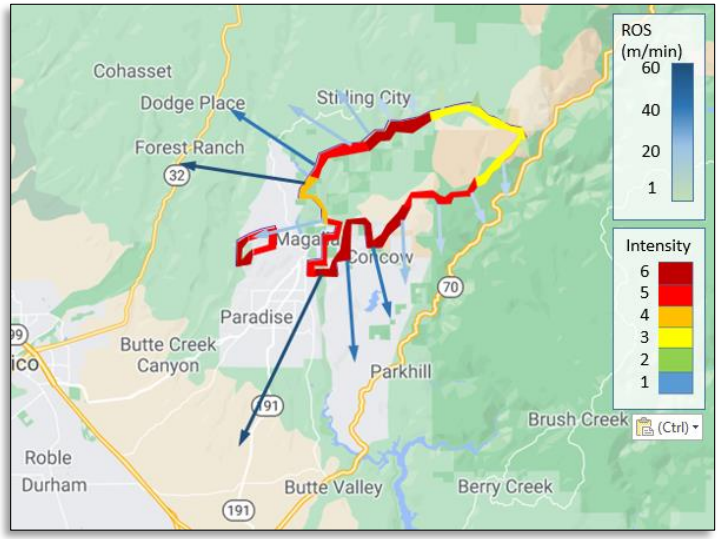
1. Canadian wildfire managers will be given unprecedented strategic intelligence on all active wildfires, daily, and in near-real-time (i.e. approximately 30 minutes);

2. Air quality, smoke, and carbon emissions from wildfires will be better forecasted and monitored in near-real-time; and,

3. Through (1) and (2) there will be a significant reduction of the economic and societal risks and losses associated with the threat of wildfires.





# Aérosols, vapeur d‘eau, nuages et leurs interactions avec le rayonnement

# High-altitude Aerosols, Water vapour and Clouds

AVENIR HAWC

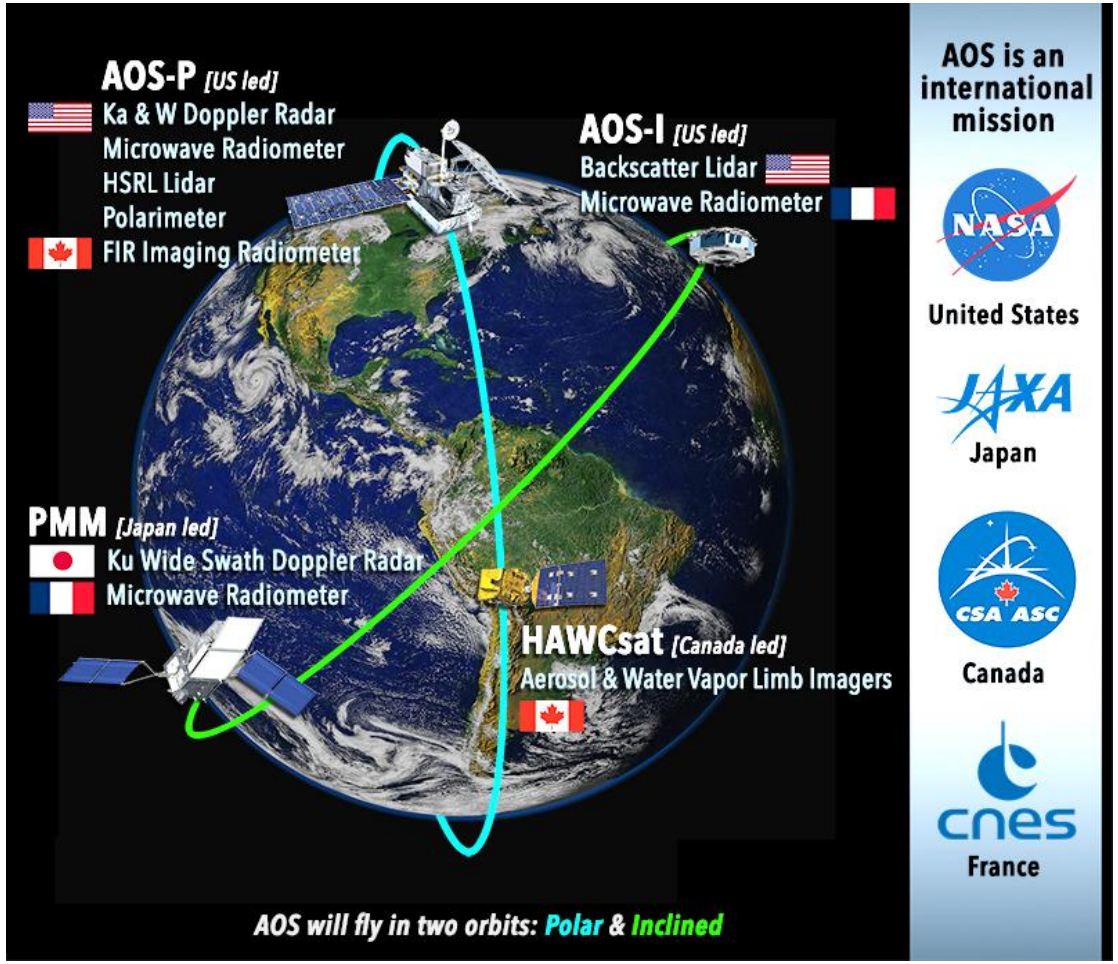
## HAWC on AOS

## Atmosphere Observing System

**One Constellation**

**Multiple Projects**

**Synergistic Science & Applications**

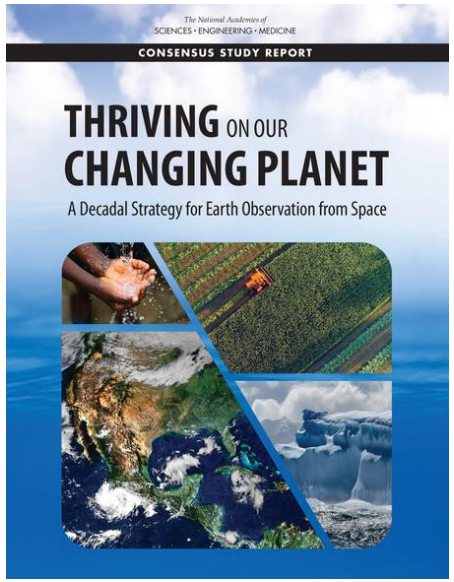


# Atmosphere Observing System:
## One Constellation / Multiple Projects / Synergistic Science

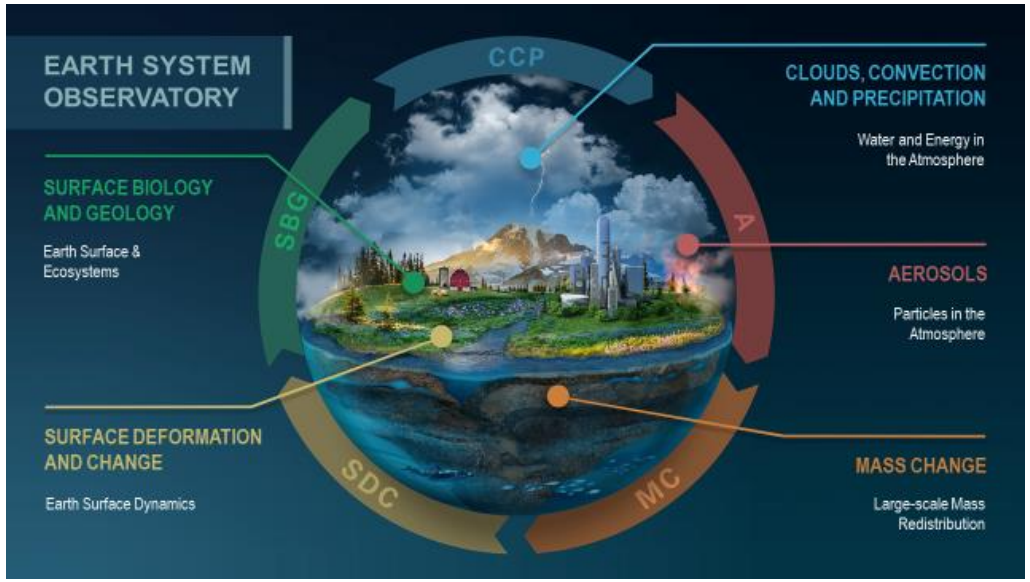
| ACCP Study | Pre-Phase A | Phase A | Phase B | Phase C | Phase D | Phase E |
|---|---|---|---|---|---|---|
| Assessing designs for mission | Concept studies | Concept & technology develop-ment | Preliminary design & technology competition | Final design & fabrication<br>*Polar: Phase C lasts through Dec 2029* | System assembly, integration & test<br>*Polar: Phase D through Dec 2030* | Operations and sustainment activities<br>*Polar: Phase E scheduled for April 2031* |

2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032

- 2028 Launch AOS-I and PMM
- 2030 Launch HAWCsat
- 2031 Launch AOS-P







# EOSC - THE VISION

Bartering with international space agencies

Free & Open

Ensure continuity

Resilient

Adaptable

Fiscally responsible

Commercial Imagery

National Capabilities

# EOSC - THE PLAN

- ✓ **Investigate a suitable replacement for our national C band SAR capability**
- ✓ **Explore the possibility of investments in the new space economy and commercial imagery (C, X, and L bands)**
- ✓ **Collaborate with international space agencies to barter imagery and coordinate AOIs (C, X and L bands)**
- ✓ **Invest in applications development and ensure they are operationalised**
- ✓ **Bring free & open imagery to Canadians**
- ✓ **Make heritage imagery readily available to Canadians (ex.: R1 and R2)**
- ✓ **Advance and promote technology through research and development**

# utiliTerre

# smartEarth

**Favoriser une utilisation intelligente des données satellitaires pour développer des solutions aux principaux défis sur Terre et dans notre vie de tous les jours**

**Fostering a smart use of satellite data to develop solutions to key challenges on Earth and in our everyday lives**

## ACCELERATEUR
Accélérer l'innovation

## INTEGRATEUR
Stimuler l'utilisation des capacités spatiales

## FACILITATEUR
Développer les capacités

## ACCELERATOR
Accelerating innovation

## INTEGRATOR
Stimulating uptake of Space Capacities

## ENABLER
Developing Capacities

Canada

# 2022 GC EO Forum

- October 4th – 6th, Saint-Hubert, QC
- Nearly 400 participants from government, industry, academia, and indigenous organizations
- Large amount of feedback collected online and through in-person breakout sessions
- Summary report coming soon

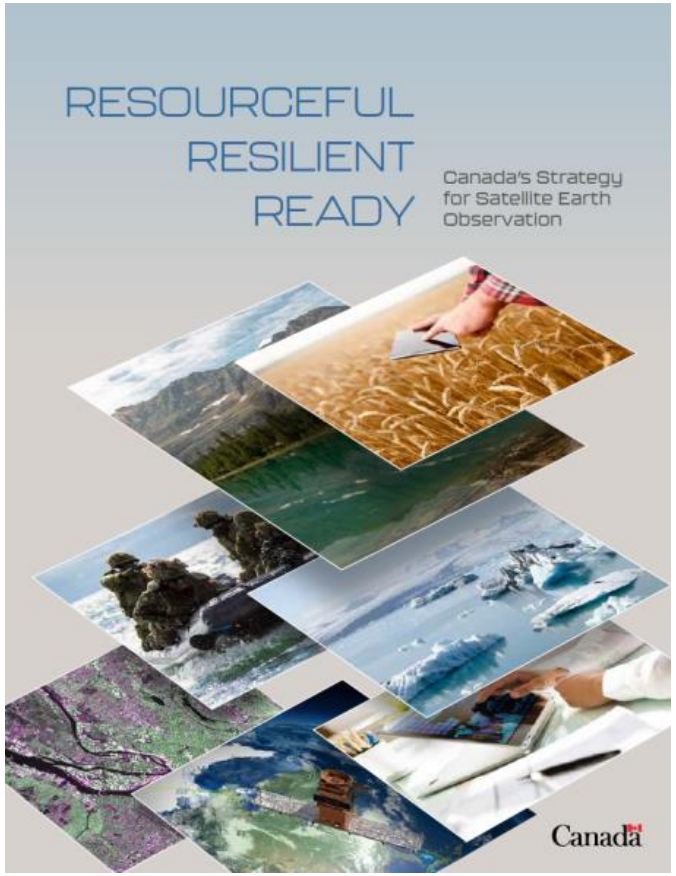
# Resourceful, Resilient, Ready: Canada's Strategy for Satellite Earth Observation

Economy | Press Release

## Canada Announces Strategy for Satellite Earth Observation

Twenty-one Canadian organizations receive funding to make innovative use of Earth observation data LONGUEUIL, QC, Jan. 20, 2022 /CNW/

1) Ensure the benefits of satellite EO are maximized
2) Harness satellite EO to tackle climate change and issues that matter to Canadians
3) Strengthen delivery of critical services to keep Canadians healthy, safe and informed
4) Inspire satellite EO skills and capacity development for the next generation




### MESSAGE FROM THE MINISTERS

In 2019, the Government of Canada proudly announced *Exploration, Innovation, Imagination: A New Space Strategy for Canada*[1]. In that document, our Government committed to ensuring Canada's leadership in leveraging satellite data to support scientific excellence, innovation and economic development. With the impacts of climate change becoming more evident every day, innovations in space technologies provide Canadians with reliable and timely information to support science-based decision making, while supporting countless services across the country and driving our economy.

Canada has a long history as a global leader in satellite Earth observation technology, beginning in 1962 when Canada became only the third country to operate a satellite in orbit. We are now laying the groundwork for the continuation of that excellence. As the Minister of Innovation, Science and Industry, in collaboration with the Honourable Steven Guilbeault, Minister of Environment and Climate Change and the Honourable Jonathan Wilkinson, Minister of Natural Resources, we are following up on the commitments made in the Space Strategy by presenting our vision for the future: *Resourceful, Resilient, Ready: Canada's Strategy for Satellite Earth Observation*. Developed in consultation with industry and academia, our new strategy outlines the path to equipping Canada with as many tools as possible to confront climate change and to support Canadians in the 21st century.

Satellites are an integral part of our lives. Many of our everyday decisions, from bringing an umbrella on a walk to deciding if roads are safe to drive, are informed by data provided by satellites passing over our country. National safety and security are also dependent on the unique vantage point of space as increasingly detailed satellite data supports decision making in our communities related to wildfires, floods, and other natural hazards. Satellites help keep Canadians healthy by monitoring air quality in our cities, modelling the movement of disease-spreading species, and forecasting harmful algal blooms in our water. For Canadian industry, the growing demand for environmental and industrial intelligence is bolstering high-tech development. Start-ups and Earth observation firms are using artificial intelligence and advanced data analytics to provide science-based services, from daily crop maps that help agricultural producers feed Canadians to advanced forest growth models that help resource companies provide the products we need for a growing and vibrant population.

1 Space Strategy for Canada | Canadian Space Agency (asc-csa.gc.ca)

In this new strategy, we outline the path forward to capitalize on satellite technology for day-to-day evidence-based decision making and planning. Recent and future investments in new satellite data streams and ground infrastructure will not only help ensure core services continue to deliver for Canadians, but will also see them expand their application into areas such as public health and infrastructure. The strategy highlights our plans to bring together Canada's best scientists to work in data-rich, high-powered analytics environments where better solutions for challenges like climate change and disaster management can be developed and implemented faster. It also recognizes the potential, and the power, of bringing our observations from space down to local communities, especially in Canada's North where the use of satellite information is becoming more important as we work to build resilience to climate change. Finally, the efforts outlined in the strategy provide the foundation to directly support Canada's world-class aerospace and high-tech sectors, fuelling innovation, strengthening the economy and making our industries more competitive.

Our Government remains focused on unlocking the full potential of space technology. Recognizing social, economic, and environmental priorities here on Earth, we remain committed to equipping Canadians to excel in the jobs of the future, to support scientific excellence, to monitor and adapt to climate change, and to advance technology development for the benefit of all humankind.

***The Honourable François-Philippe Champagne***,
Minister of Innovation, Science and Industry

***The Honourable Steven Guilbeault***,
Minister of Environment and Climate Change

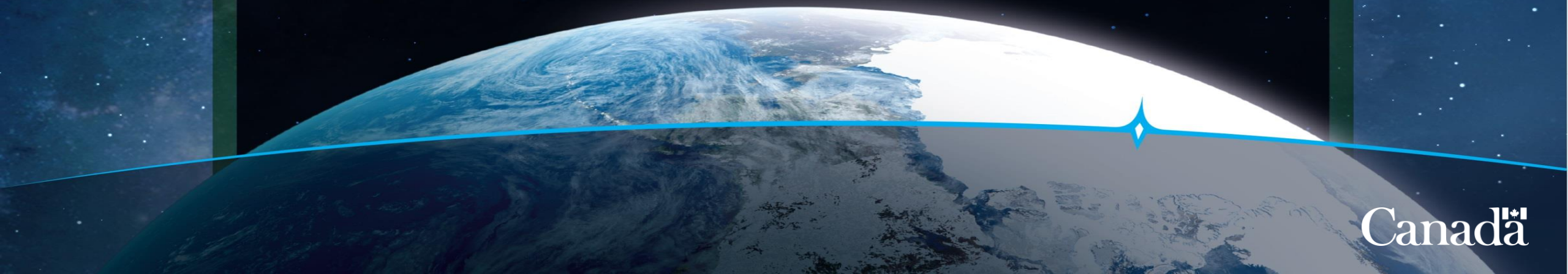
***The Honourable Jonathan Wilkinson***,
Minister of Natural Resources Canada

# Next Steps:
# Collaborative Annual Planning Process

- Work with partners to continue identifying and refining potential investment options across the up, mid, and downstream
- Continuously collect and review initiatives, including commercial offerings
- In collaboration with partners and stakeholders, follow annual planning cycle to implement priority initiatives and SEO Strategy objectives

# Space Capacity Development Program

**Eric Vachon**
Director General
Space Science and Technologies



Canada

# Future is closer than we think...

**Innovating** and
**Inspiring** the next generation
to achieve our bold **ambitions**
**in space.**

# Funding Programs

- Developing and sustaining a space capacity in Canada
- Positioning the Canadian space sector for global opportunities
- +$60M/year
- R&D including in-space demonstrations
- Competitive Contracts, Grants & Contributions
- Industry, Academia and Research Institutions

# Space Technology Development Program (STDP)

Contributes to the Canadian space program's **FUTURE NEEDS**

Trains and retains **HIGHLY QUALIFIED PERSONNEL**

Allows Canadian industries to participate in **INTERNATIONAL MISSIONS**

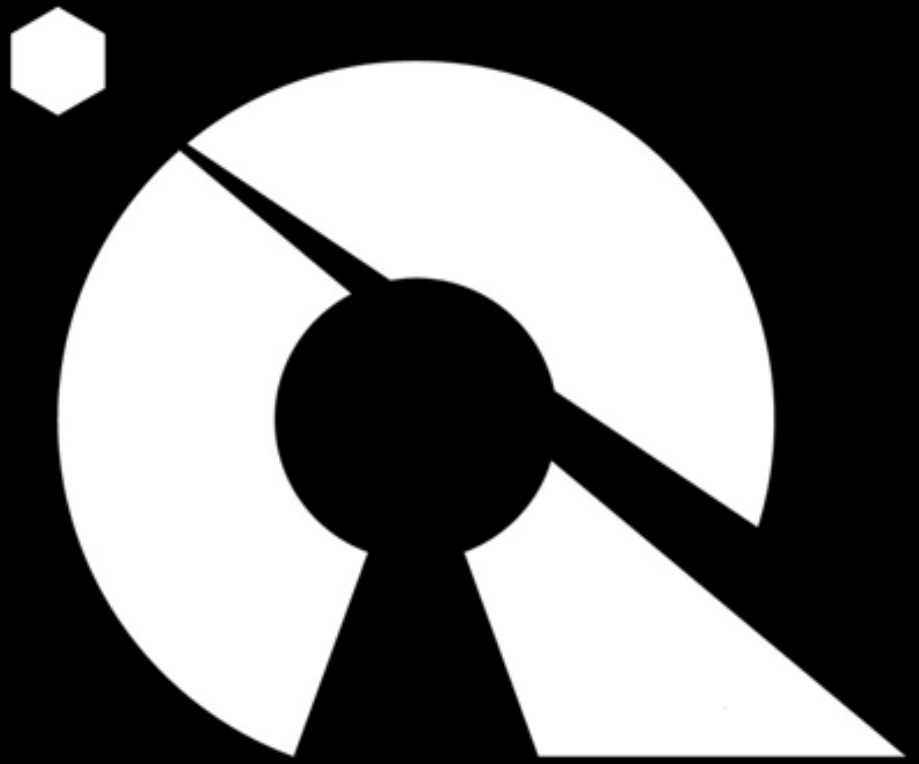
Generates more **COMMERCIALIZATION OPPORTUNITIES**

# Canada-ESA Collaboration Program





Canada



# Quantum Encryption and Science Satellite

QEYS
Sat

# Fieldwork for the Advancement of Science and Technology (FAST)

# CUBICS

CUBESAT

# Space Infrastructures & Expertise

- Specialized Engineers and technicians
- Large Spacecraft Assembly, Integration & Testing Facilities
- Stratospheric Balloons Launch Base (Timmins)
- Mars & Lunar Analogue Terrains
- Rover Platforms
- CubeSat Lab
- …And more to come!!

# John H. Chapman Space Center

## Space Labs & Expertise

# Demonstration Rovers & Analogue Terrains


stratos


# David Florida Laboratory

## 50 Years of Excellence in Spacecraft AIT

# SpaceHub...Adapting to a dynamic global space context

- A culture of **innovation** and **agility**
- A focus on **growing the space sector** while responding to Canadian challenges
- New initiatives to **test**, **learn** and **adapt**
- More **pilot projects** and competitions
- **Work smarter, not harder**: innovative procurement strategies, connecting people, etc.
- **If it ain't broke, don't fix it**: many CSA initiatives and projects will continue unfolding as is

# 3 PILLARS

## CONNECT & ACCESS

**Ensure Canadian organisations can compete globally and scale-up**

Connect all actors from the Canadian space community and facilitate access to infrastructures and expertise

## ACCELERATE

**Support sector growth**

Trigger innovation and advance services, science and technology

## INSPIRE & TRAIN

**Create a steady and diverse pool of highly skilled professionals**

Develop, attract and retain next generation

# FOLLOW US
ON SOCIAL MEDIA

# SUIVEZ-NOUS
DANS LES MÉDIAS SOCIAUX

asc-csa.gc.ca