



Canada's Space Exploration Activities

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Canada's Space Strategy



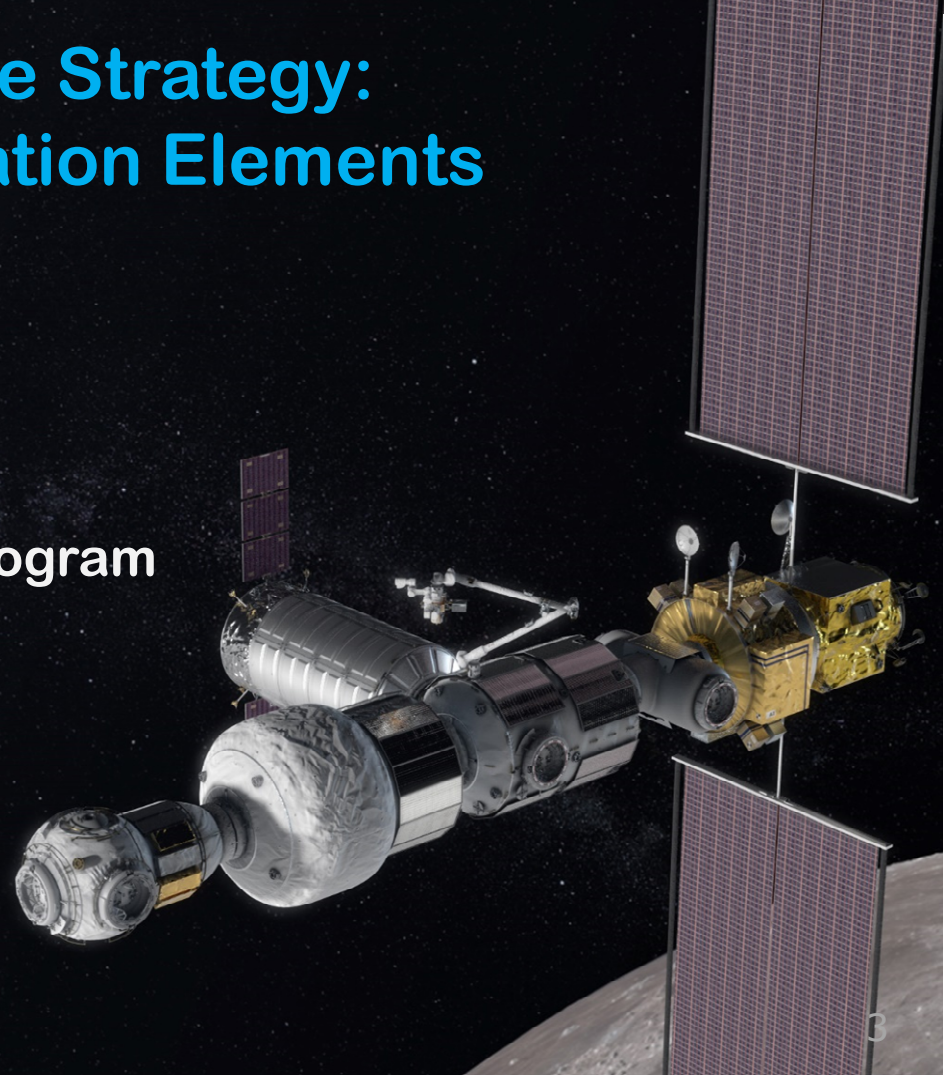
- Emphasizes the importance of **advancing science** and of nurturing strong **international partnerships**
- Describes how the Government of Canada will position Canada's **commercial space sector** to take full advantage of the growing global space economy
- Reflects the Government's commitment to the continued provision of **Earth observation and climate change** monitoring data
- Places priority on harnessing space science and technology to solve important **challenges on Earth**; exploring how the delivery of **healthcare** services in isolated communities can be improved; and learning more about **growing food** in harsh environments as part of the Government's effort to improve access to nutritious food for all Canadians
- Confirms Canada's commitment to participate in the **Lunar Gateway** program
- Builds on our existing **STEM-related** activities to engage youth in science, technology, engineering and mathematics

February 2019



Canada's Space Strategy: Key Space Exploration Elements

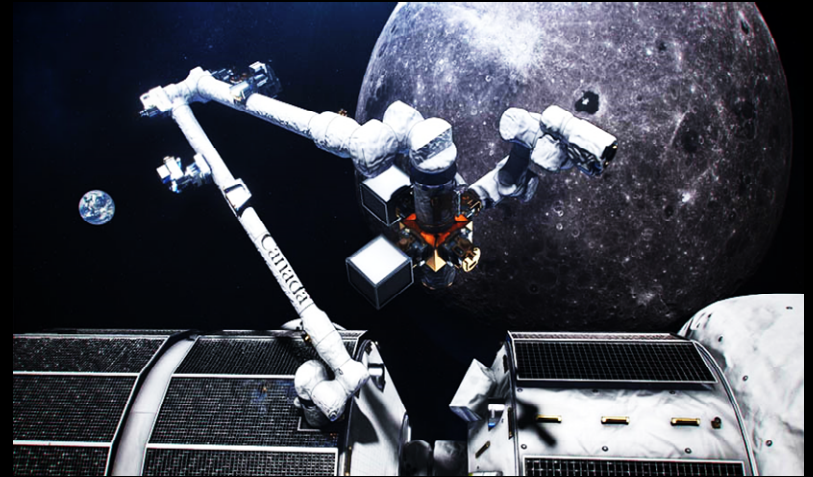
- Gateway: Canadarm3
- Lunar Exploration Accelerator Program
- Junior Astronauts Initiative



Gateway

Canada's Robotic System Concept

- The eXploration Large Arm (**Canadarm3**) and its Tools
 - Allows the system to perform inspection and maintenance operations, deploy payloads, capture and berth visiting vehicles, support spacewalking Astronauts, reconfigure the Gateway and assemble Lunar Landers
- The eXploration Dexterous Arm (small arm)
 - Enhances the capabilities of the large arm and perform its maintenance, possibly can be deployed inside Gateway for Intra-Vehicular Robotics
- Gateway External Robotic Interfaces (**GERI**)
 - 2 Types:
 1. Large (Basepoints): Allows large arm to access (walk to) elements of the Gateway
 2. Small (Payloads): Required for any payload handling
 - Robotic interfaces required early for first Gateway module (2022)
 - Phase A contract issued mid-August
- Ground Segment (GS) and Robotic Integration
 - Ground infrastructure that will provide planning, monitoring, commanding, and visualization functions in support of operating the Robotics system from Canada
 - End-to-End planning, integration, and execution of Gateway External Robotics: Assembly, maintenance, logistics and utilization
- Artificial Intelligence (AI) – Autonomy Capabilities
 - Autonomy and AI-driven operations needed to achieve higher level of self-reliance and efficient operations



Canadarm3 Concept
Industry solutions pending



LEAP

Lunar Exploration Accelerator Program

Will help Canadian businesses and academic institutions test and use new technologies in lunar orbit and on the surface of the Moon, including robotics & AI, science instruments, astronaut health.

LEAP Program Components

- Contribution to partner agencies' selected missions
- Contributions to Lunar Science & Technology Capability Demonstration
- Technology development for commercial supply chain
- Lunar science/technology payloads
- Planning and preparation for future mission and technologies
- Advance strategic capabilities with the health and biomedical communities and perform early demonstration in remote indigenous communities in Canada's North and Arctic (LEAP Health)

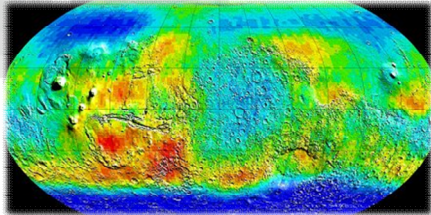
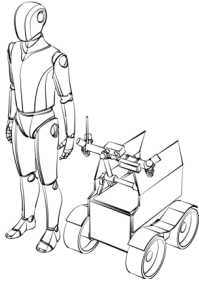




- Get Canadian youth excited about science using space
- Inform them about space careers and what it takes to become an astronaut
- Show them how they can play a role in future missions to the Moon

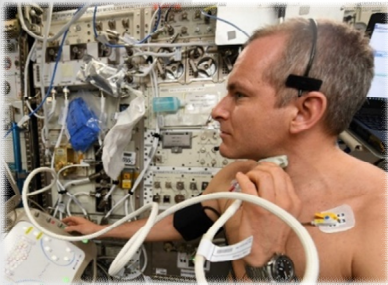


Feed-Forward Planetary Activities



- **LEAP Rover**
 - Primary objective is to demonstrate CDN lunar mobility technology on the Moon. Including lunar night survival
 - Target Launch on CLPS delivery in 2025
- **Mars Ice Mapper**
 - Synthetic Aperture Radar mission building on Radarsat heritage
 - High-resolution Mapping of shallow Martian subsurface water ice reservoirs; supports both science and human exploration goals
- **Canadian Contributions to Future International Lunar Exploration Initiatives**
 - Studies key capabilities/technologies and business domains to support lunar surface activities
 - Proposes transforming the most promising capabilities into New Space exploration contributions and commercial opportunities
- **Food Production**
 - CSA is studying opportunities to advance space-based food production systems that provide benefit terrestrially
 - Naurvik Initiative: Arctic greenhouse with other government and non-profit partners

ISS



- Mobile Servicing System (MSS)

- Operations
 - Capture of 7 free flyers (since Sep 2019)
 - Continued support of maintenance, ISS R&R activities and ISS science
- Sparing adequate to support 2024 and up to 2030
- Autonomy (MAC)
 - Next logical step building on MSS Ground Control experience and capability
 - Advances robotics autonomy necessary for Gateway

- ISS Science

- CSA's ISS utilization focuses on health research
- Numerous on-going experiments

- Health research platforms

- Being developed as precursors for future deep space medical/healthcare systems
- Bio-Monitor, Bio-Analyzer, MicroPREP

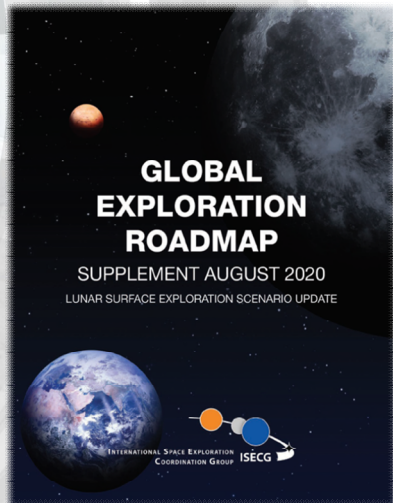
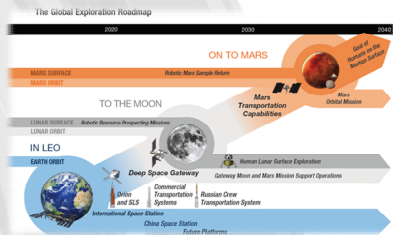
International Space Exploration Coordination Group (ISECG)



- Voluntary, non-binding, consensus-driven coordination forum of 25 space agencies
 - Discuss interests, objectives and plans in space exploration
 - Facilitate collaboration
 - Support promotion of interest and engagement in space exploration activities throughout society
 - Does not create policy, rather reflects agency plans
- CSA became the chair of ISECG in Sep 2020



Global Exploration Roadmap (GER): Supplement



- Since early 2018, a renewed focus on the Moon from around the world
 - NASA human exploration plans
 - Robotic and technology demo missions from many agencies
 - Several new space agency joined ISECG (+9)
- Motivating ISECG agencies to update the Lunar Surface Exploration Scenario and capture the latest lunar activities to aid collaboration
- GER Supplement augments the GER3:
 - Captures the new lunar plans, introduces the new ISECG agencies, recognizes emerging commercial capabilities (without marketing)
- Expected to be used for the dialogue with stakeholders and international or commercial partners to promote collaboration
- The Supplement is an ISECG document, non-binding, rather than owned by any specific agency
- Published August 2020

A Framework for Future Space Exploration Activities

- In October 2020, Canada signed the Artemis Accords, an important first step towards safe and sustainable space exploration activities.
- Consultations with Canadians will help the Government develop a framework for Canada's future space exploration endeavours.
- Canada's space exploration plans are laid out in the [2019 Space Strategy](#).



Summary

- Canada's Space Strategy is driving CSA exploration activities, including international partnerships and positioning of Canada's commercial space sector
- Canadian exploration activities are well aligned with international priorities (e.g., ISECG's GER Supplement)
- Canada is pleased to join other space-faring nations committed to conducting deep-space exploration missions in a safe and sustainable manner and in full compliance with the Outer Space Treaty
- Building off the Artemis Accords, the Government is consulting Canadians on a framework for space exploration in line with Canada's Open Government approach
- Recent Canadian Government investments will allow Canada to play a visible role in future exploration efforts

Canadian Space Agency



Agence spatiale canadienne