Panel des Directeurs généraux de l'Agence spatiale canadienne

Mise à jour sur les activités de l'ASC et opportunités

Canadian Space Agency Directors General Panel

CSA Update and Opportunities

Conférence CASI ASTRO'18
CASI ASTRO'18 Conference
Québec, 2018.05.16

Canadian Space Agency Directors General Panel

Jean-Claude Piedboeuf

DG, Space Science and Technology

Éric Laliberté

DG, Space Utilization

Gilles Leclerc

DG, Space Exploration

Mary Preville

DG, Policy

Jean-Claude Piedboeuf

Director General

Space Science and Technology

CSA Departmental Results Framework (DRF)

Core responsibility: Canada in space

4 Expected Results:

Space research and development advances science and technology

Canadians engage with space

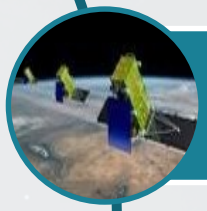
Space information and technologies improve the lives of Canadians

Canada's investments in space benefit the Canadian economy

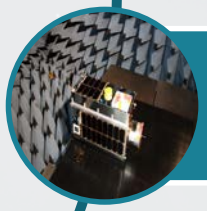
Four CSA Programs under DRF

4 Programs:

Space Exploration



Space Utilization



Space Capacity Development

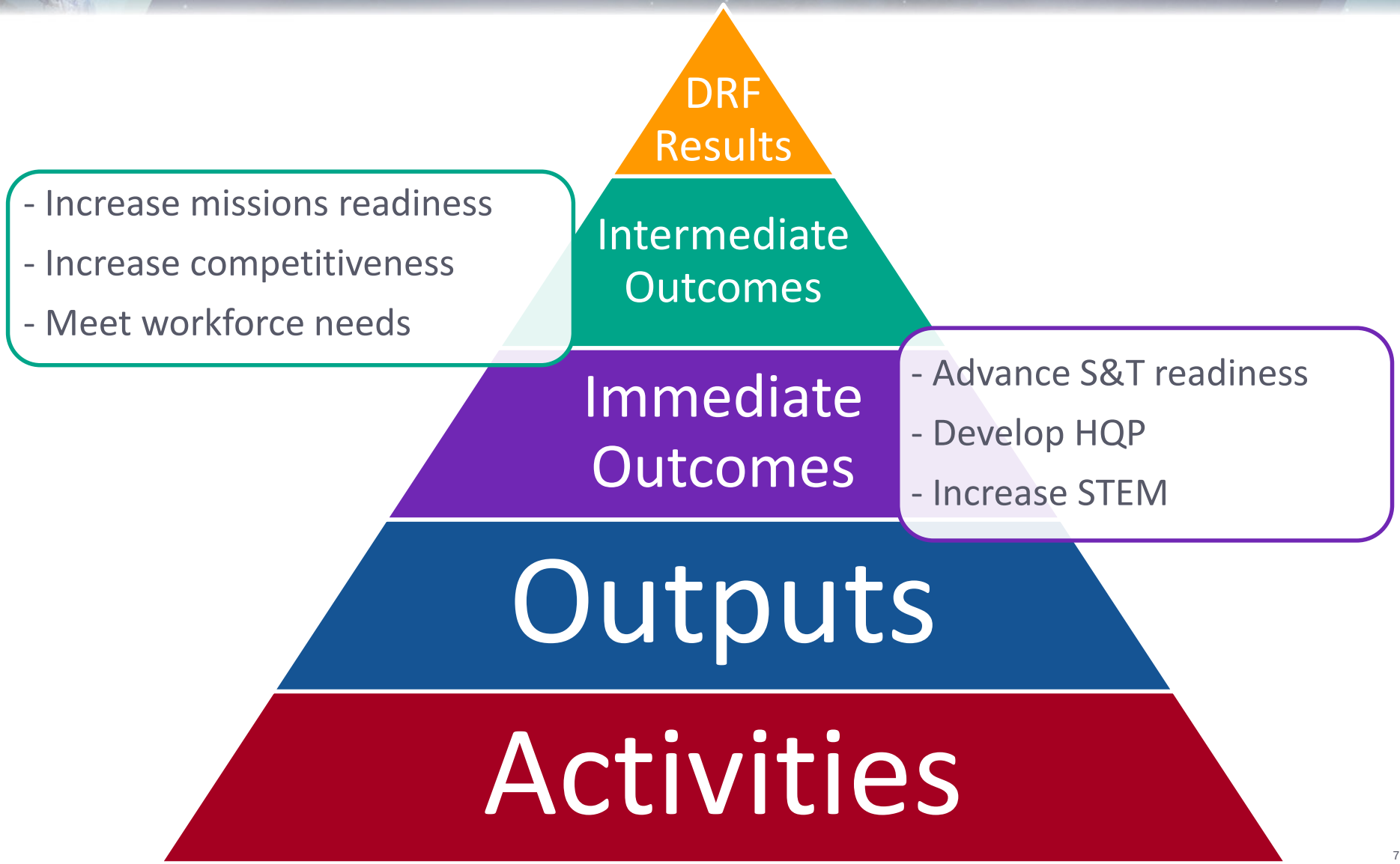
Internal Services

SCDP – Seven Integrated Initiatives

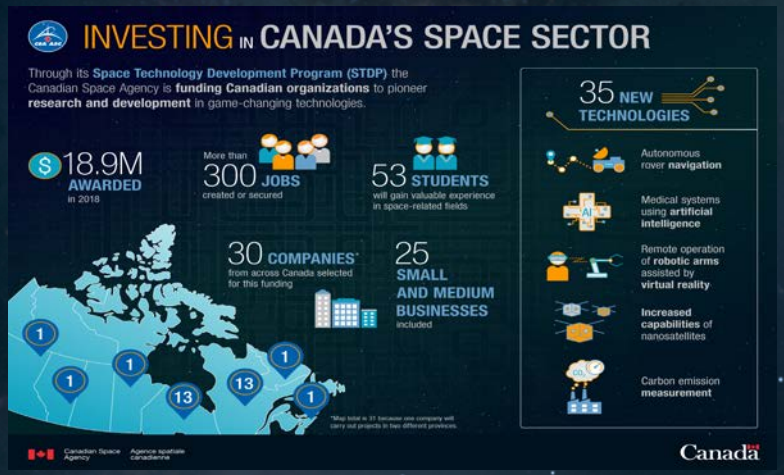
Inspiration/Ideas → Maturation → Global opportunities

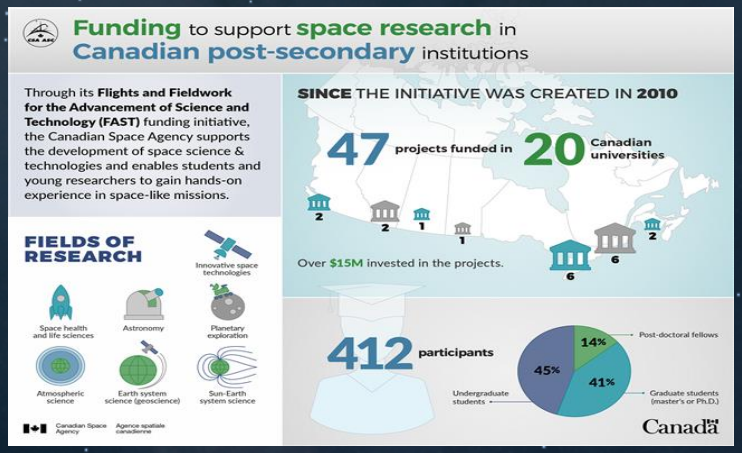
An end-to-end EXPERIENCE to further space innovation

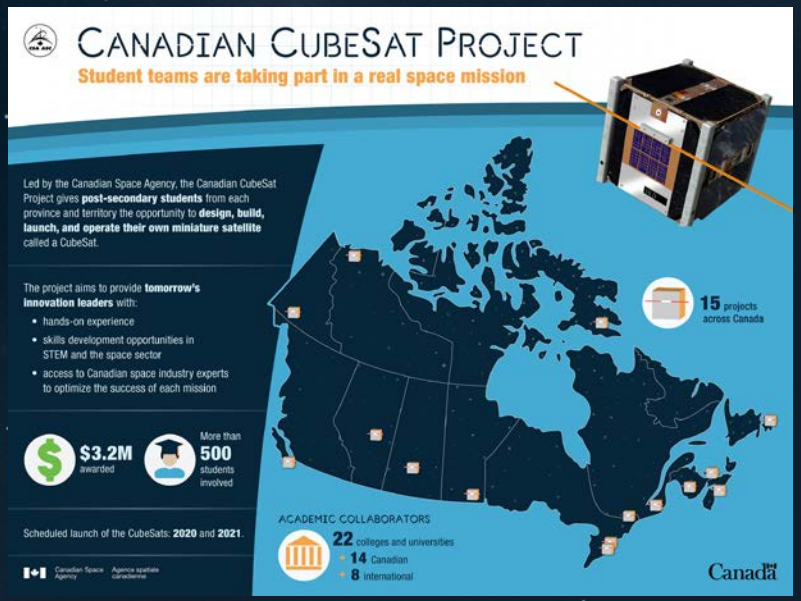
SCDP: Think Results



Planned Activities in 2018-19

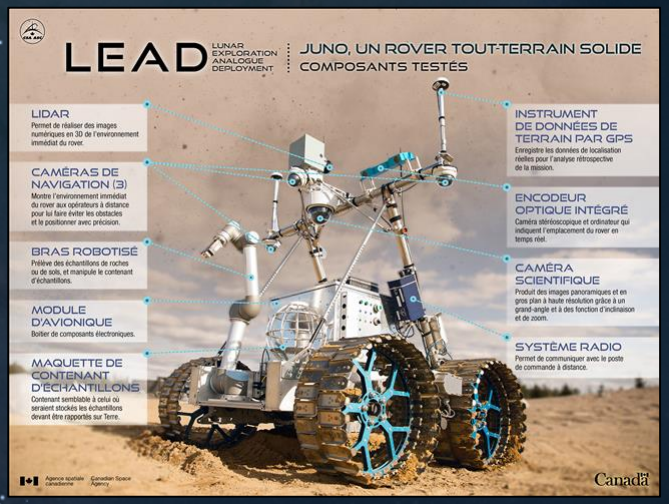




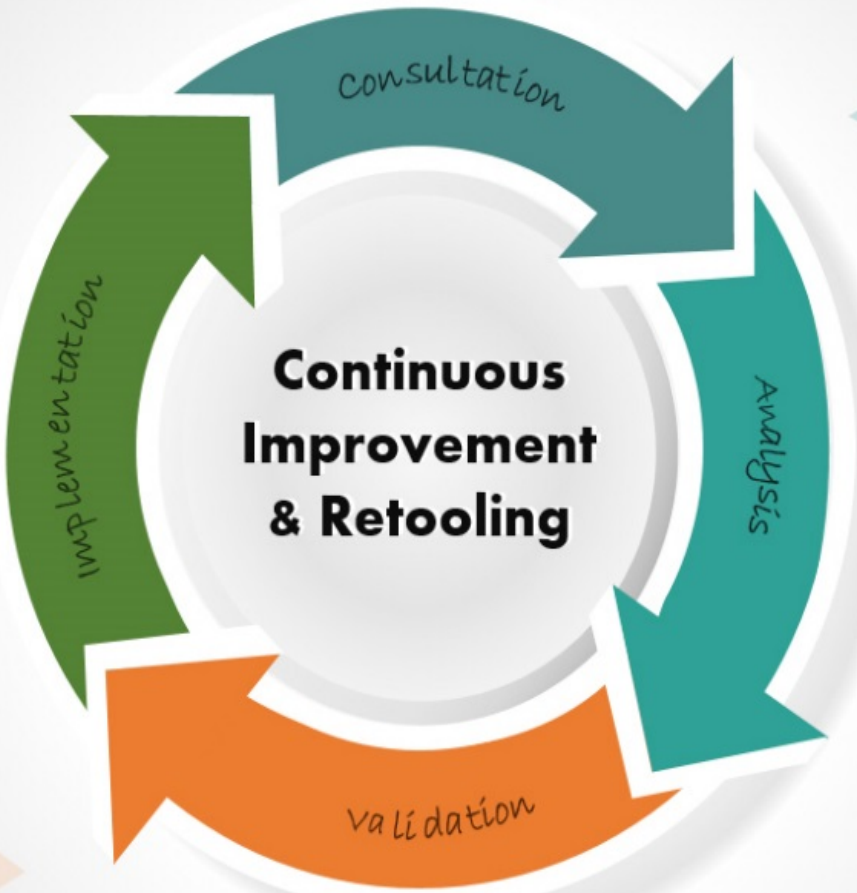


Planned Activities in 2018-19

Strato Science 2018



Continuous Improvement



01 CONSULTATION

Information gathering and stakeholder engagement

02 ANALYSIS

Gaps/Needs analysis and recommended options

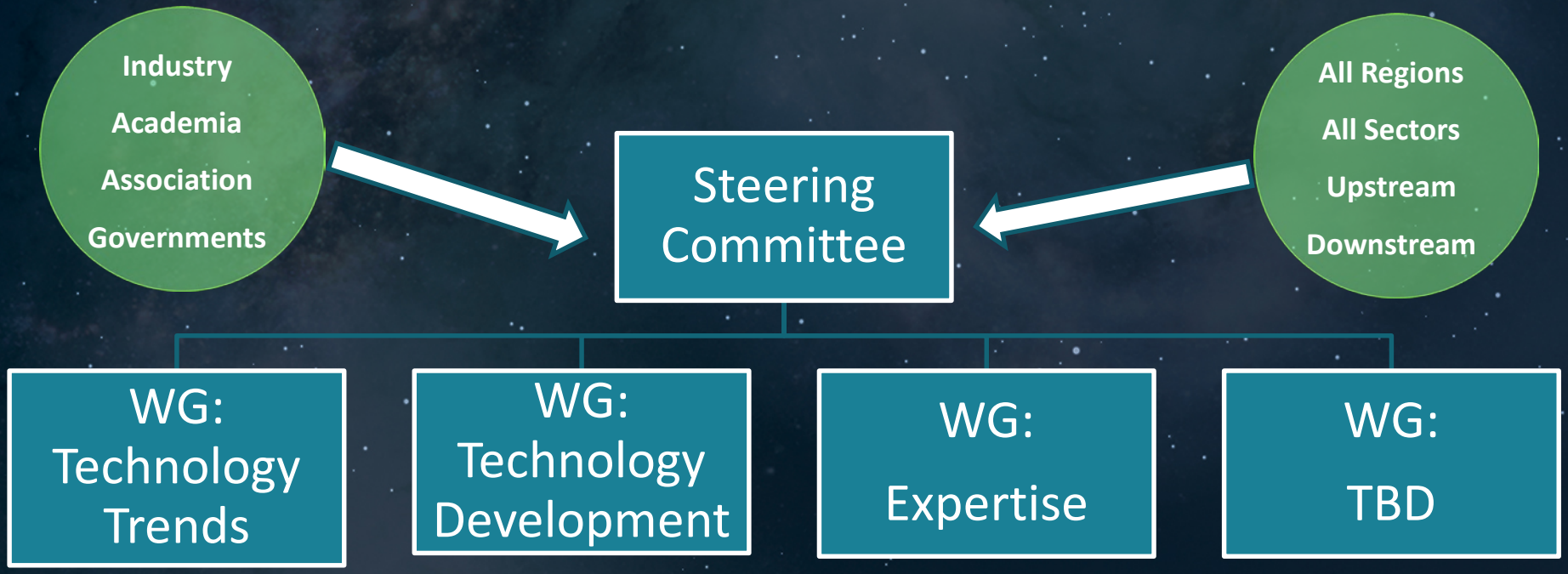
03 VALIDATION

Stakeholder validation and CSA management endorsement

04 IMPLEMENTATION

Plan and Implement validated improvements

SCDP Consultation Committee



To ensure optimal relevance of our activities and services

Éric Laliberté
Director General

Space Utilization

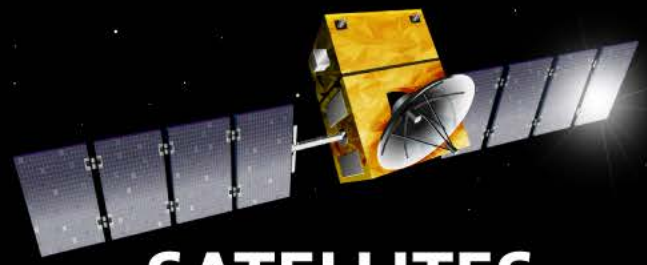
Space Utilization Program
Mandate and Strategic Objectives

Ensure that Canada takes full advantage of the potential offered by space for the benefit of its citizens.

Ensure that the Canadian public sector, industry and academic organizations have access to space data and space-enabled information and services to:

- Inform policy and decision making;
- Connect Canada and Canadians;
- Understand Earth and its immediate environment;
- Support government plans to foster innovation, science and international collaboration.

Climate Change – Disaster Management – Arctic – Health



SATELLITES

IN EVERYDAY LIFE

COMMUNICATIONS

- Mobile communications
- Satellite TV, radio, and internet
- Telemedicine
- Consumer and business services

NAVIGATION

- Ship and aircraft identification
- Navigation through icy waters
- Search and rescue
- Emergency response
- Vehicle GPS

EARTH OBSERVATION

- Weather forecasting
- Agriculture
- Environmental monitoring
- Resource management
- Severe weather

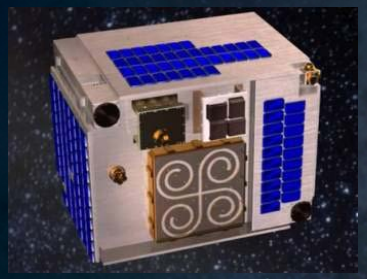
MONITORING SPACE ENVIRONMENT

- Solar storms' effects on Earth
- Orbiting spacecraft safety
- Meteorites and asteroids

Space Utilization Program
Planned Activities in 2018-19

- RADARSAT Constellation Mission Launch
- Delivery of Canadian contribution to the Surface Water and Ocean Topography Mission
- Explore new concepts in the technology areas of Space Radar and Space Optics to support Public sector priorities
- Foster new discoveries in the fields of Solar-Terrestrial sciences and Earth Systems sciences

Space Utilization Program
Planned Activities in 2018-19

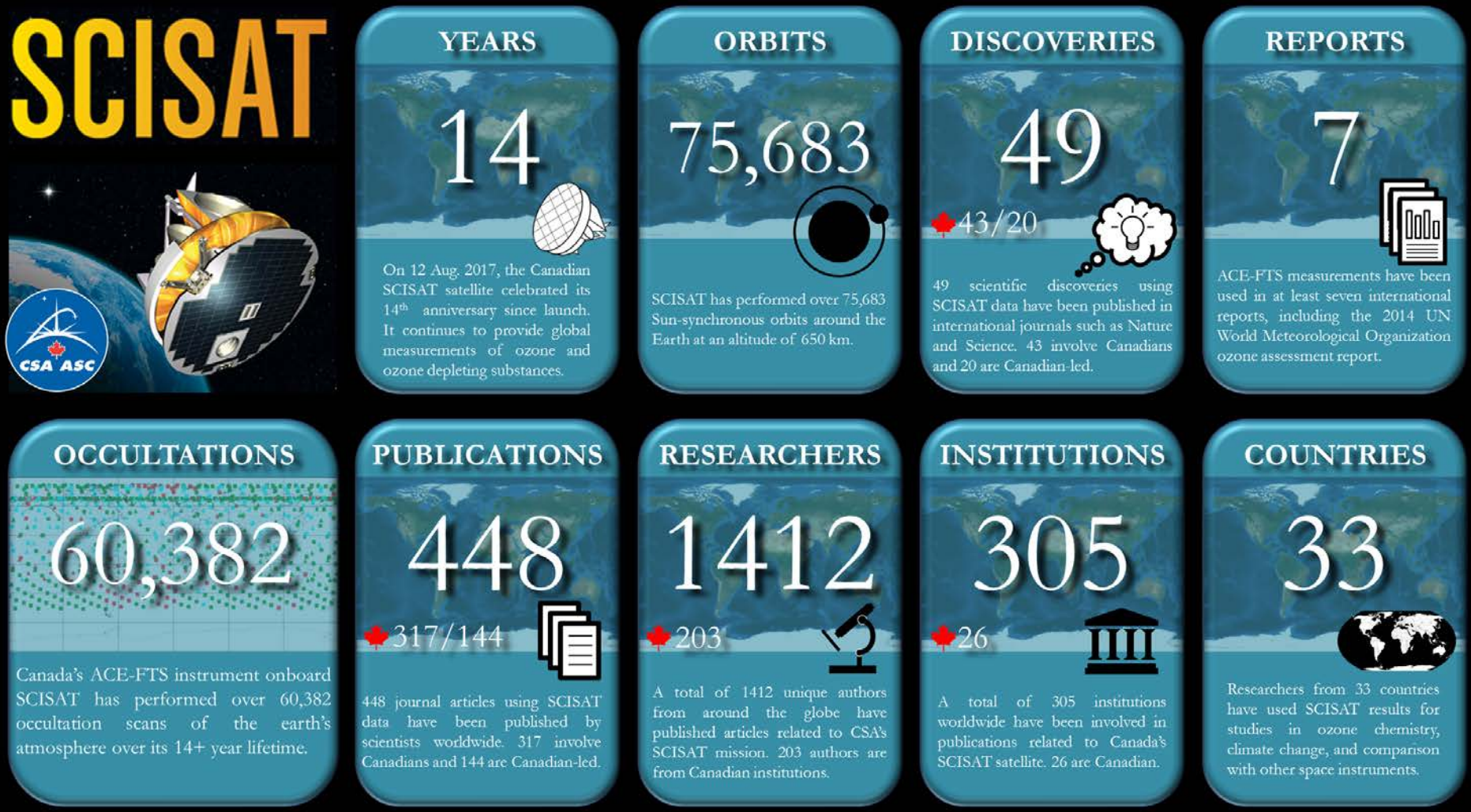


- **Operations of on-going Missions**

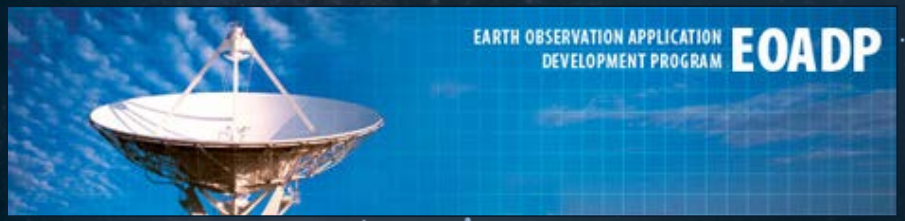
- **Operations of instruments on International missions**

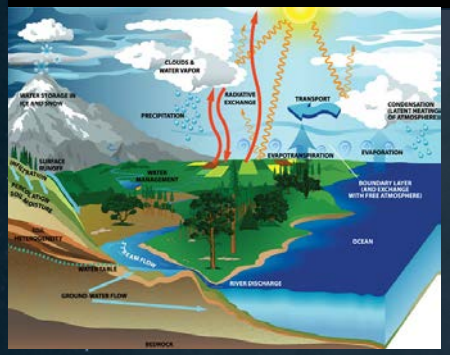
- **Support Space Observation Systems**

The SCISAT Success



Space Utilization Program
Planned Activites in 2018-19






Source:ESA/AOES Medialab

Data Utilization and Applications

- **Climate Change Impacts and Ecosystem Resilience**
- **Support Data analysis initiatives in Earth System Sciences and Solar-Terrestrial Sciences**
- **Consultations on Program Delivery**

Gilles Leclerc
Director General

Space Exploration

Space Exploration
Mandate and Strategic Objective

- **Ensure that Canada plays a vital role in space exploration**
  - Define, plan and manage human and robotic space exploration missions
    - space astronomy
    - planetary science
    - human spaceflight

The CSA will continue to use space exploration to position Canadian scientists and industry to take part in missions of discovery and inspire Canadians.

Space Exploration

Planned Activities 2018-19

1. The International Space Station

- Support David Saint-Jacques' training, launch and expedition mission to the ISS.
- Canadarm2 and Dextre will capture, manoeuvre, unload and release six U.S. commercial vehicles and one Japanese cargo vehicle.
- Complete the preliminary design phase of the DEXTRE deployable Vision System and support the production of the MSS Replacement Cameras flight models, providing Canadian technologies for the International Space Station.
- Perform investigations and operate science payloads onboard the ISS: Marrow, Vascular Echo, At Home in Space, T-Bone, Wayfinding, Vection, and LSRS and RADI-N2. advancing health sciences for space with a view to improving life on earth.
- Deliver, launch and commission two elements of the Life Science Research System: Bio-Monitoring and Bio-Analysis, paving the way for expanded research and medical capabilities on the ISS.
- Initiate the MicroPrep project to develop a biological sample preparation system that will complement and enhance the research capabilities of LSRS and future bioanalysis devices.

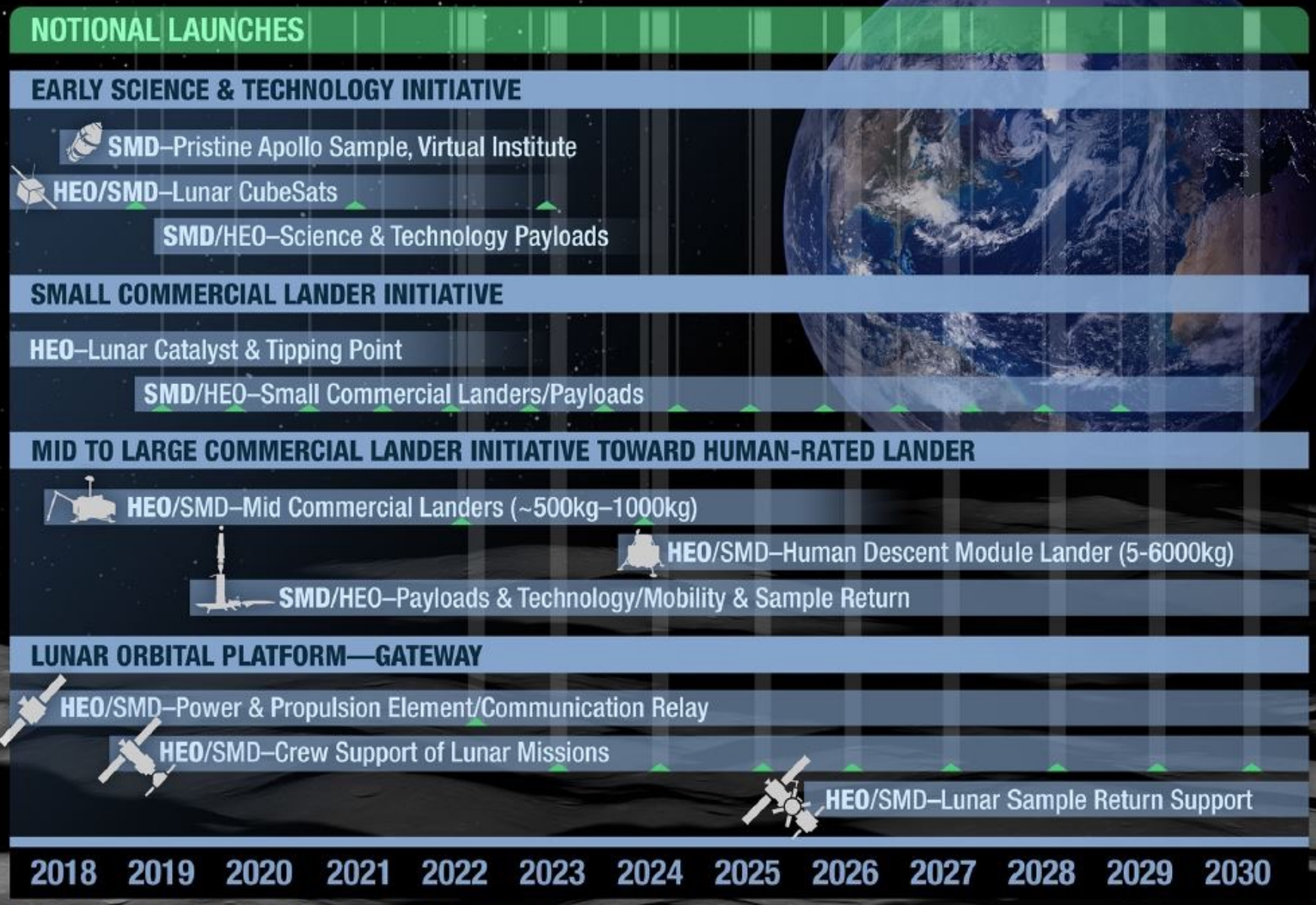
Space Exploration

Planned Activities 2018-19

2. Preparing for Human Exploration into Deep Space

- Completion of options analysis for preparing potential Canadian robotics contributions to deep space human exploration.
- After last year's consultations with the medical community, analyze potential health contribution options for human space exploration in the next decade.
- Achieving Preliminary and Detailed design for the MSS application computer, setting the path for the future of operations in space robotics.

NASA Lunar Exploration Campaign



Timelines are tentative and will be developed further in FY 2019

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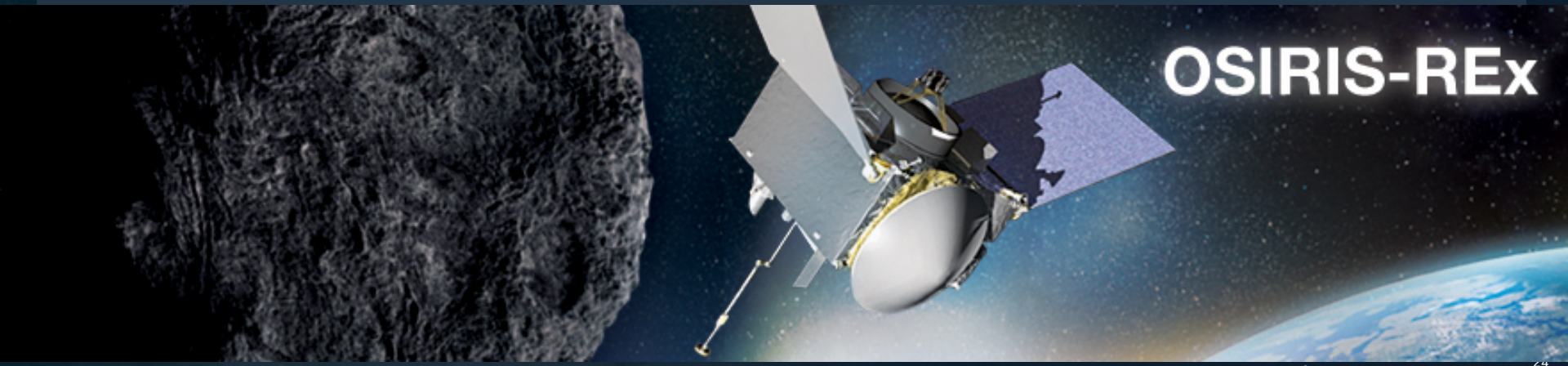
Space Exploration

Planned Activities 2018-19

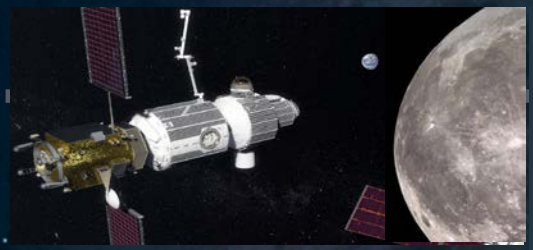
. Space Astronomy and Planetary Exploration

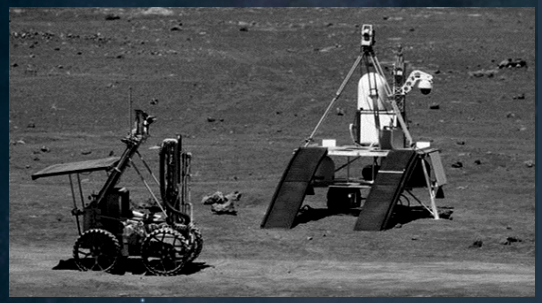
- Provide operation support for the APXS instrument on the Mars Curiosity rover and for the OSIRIS-REX Laser Altimeter encounter with asteroid Bennu, contributing Canadian know-how to the exploration of our solar system.
- Actively take part in the integration, testing, and launch preparation activities of Canadian instruments on the James Webb Space Telescope
- Ongoing consultations with the Canadian science communities in Planetary Exploration, Human Spaceflight, Space Astronomy and Space Exploration Signature Technologies to keep them informed and engaged.

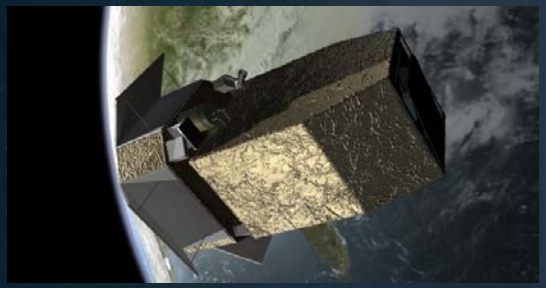


Space Exploration
Current Missions and Activities

The next steps







- Space has inspired generations of Canadians and is now part of the mainstream economy, media and culture, branding Canada as a nation of explorers and innovators
- We live in a golden age of space-based astronomy and solar system exploration. New planetary missions and space observatories are being planned.
- ISS is a stepping stone for future human space exploration: it is a laboratory and a spaceport that enables fundamental research, the demonstration of new technologies and systems, where humans learn to live and work in space. ISS is a successful model for international cooperation in human exploration
- Partners are planning for and investing in deep-space human exploration, including Moon and Mars.
- Being a timely contributor to space endeavours will be essential to maintaining space expertise and industry capacity in Canada.
- CSA is preparing to contribute critical, innovative and visible elements to the next chapter in human and robotic exploration. These contributions will be visible, critical, scalable, showcase Canadian innovation, bring tangible terrestrial benefits and inspire Canadians

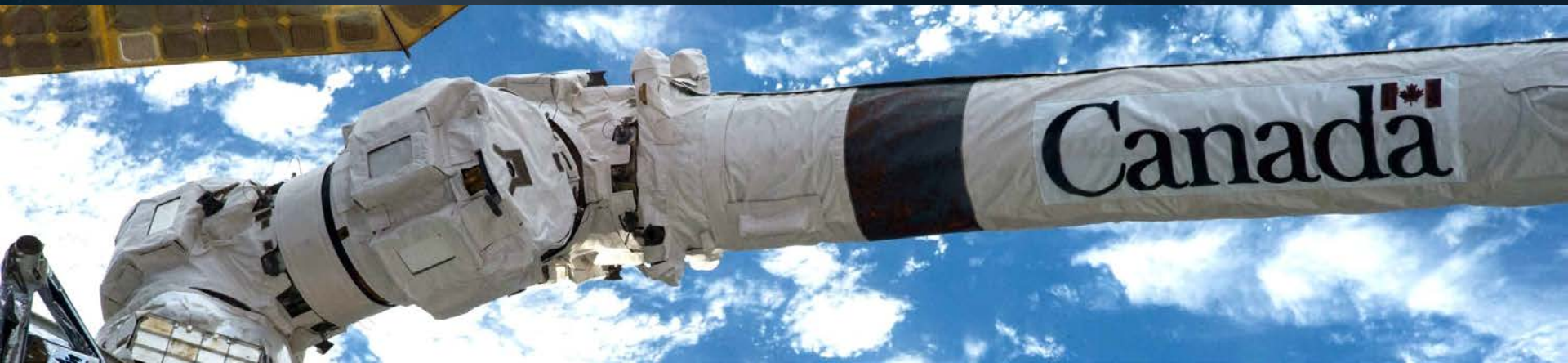
Mary Preville
Director General

Policy
et opportunités

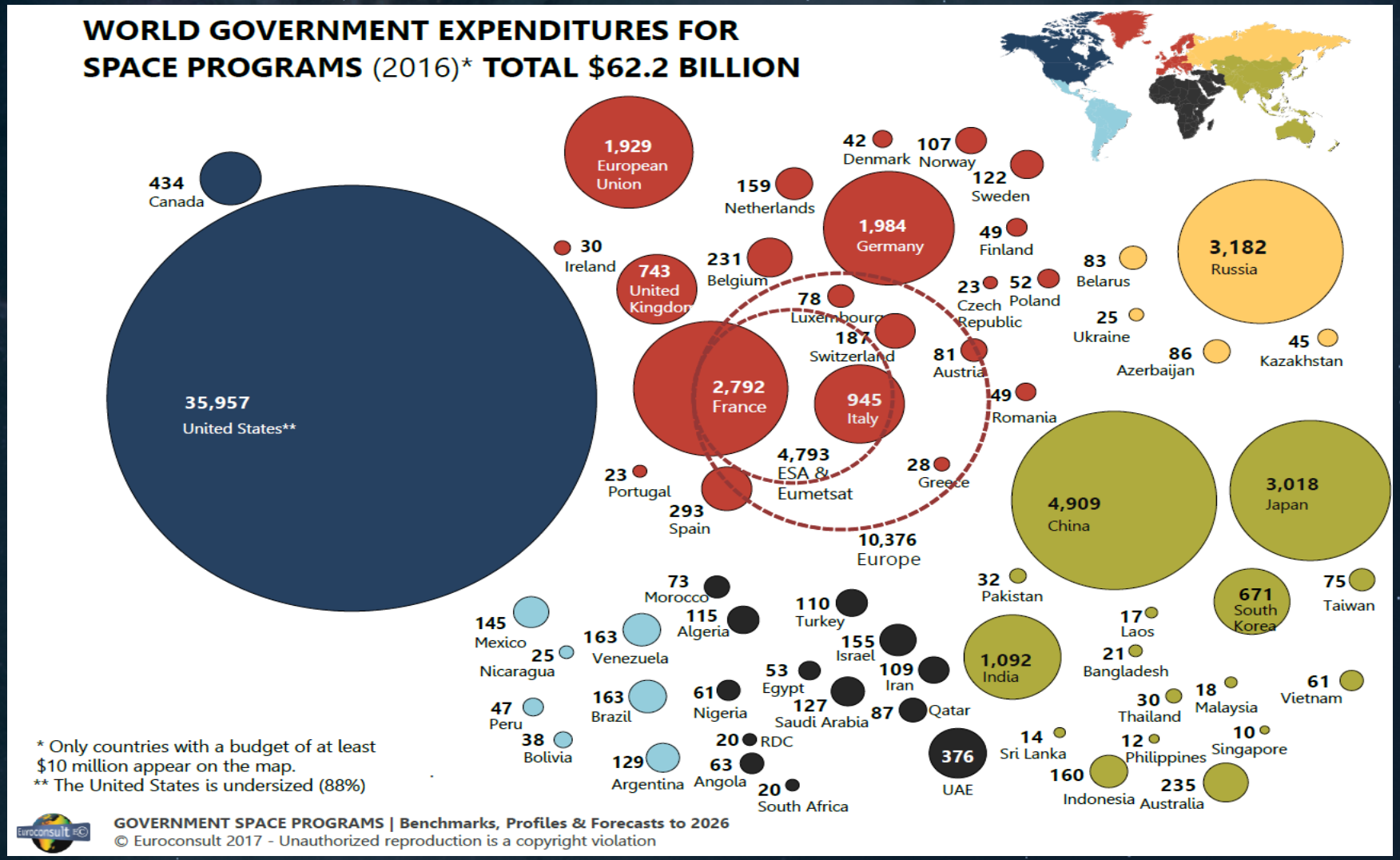
Space Policy

One of the key functions in the *CSA Act* is:

- Assisting the Minister in coordinating Government of Canada space policies and programs
  - Strategic policy
  - Economic trends and analysis
  - International cooperation
  - “new opportunities”
- Opening new markets for Canadian industry
- Providing new opportunities for Canadian researchers



The Global Space Sector (2016)



Canadian Space Sector (2016)

Upstream → **Downstream**

Research & Engineering Services	Manufacturing	Satellite Operations	Products and Applications	Services (incl. broadcasting)





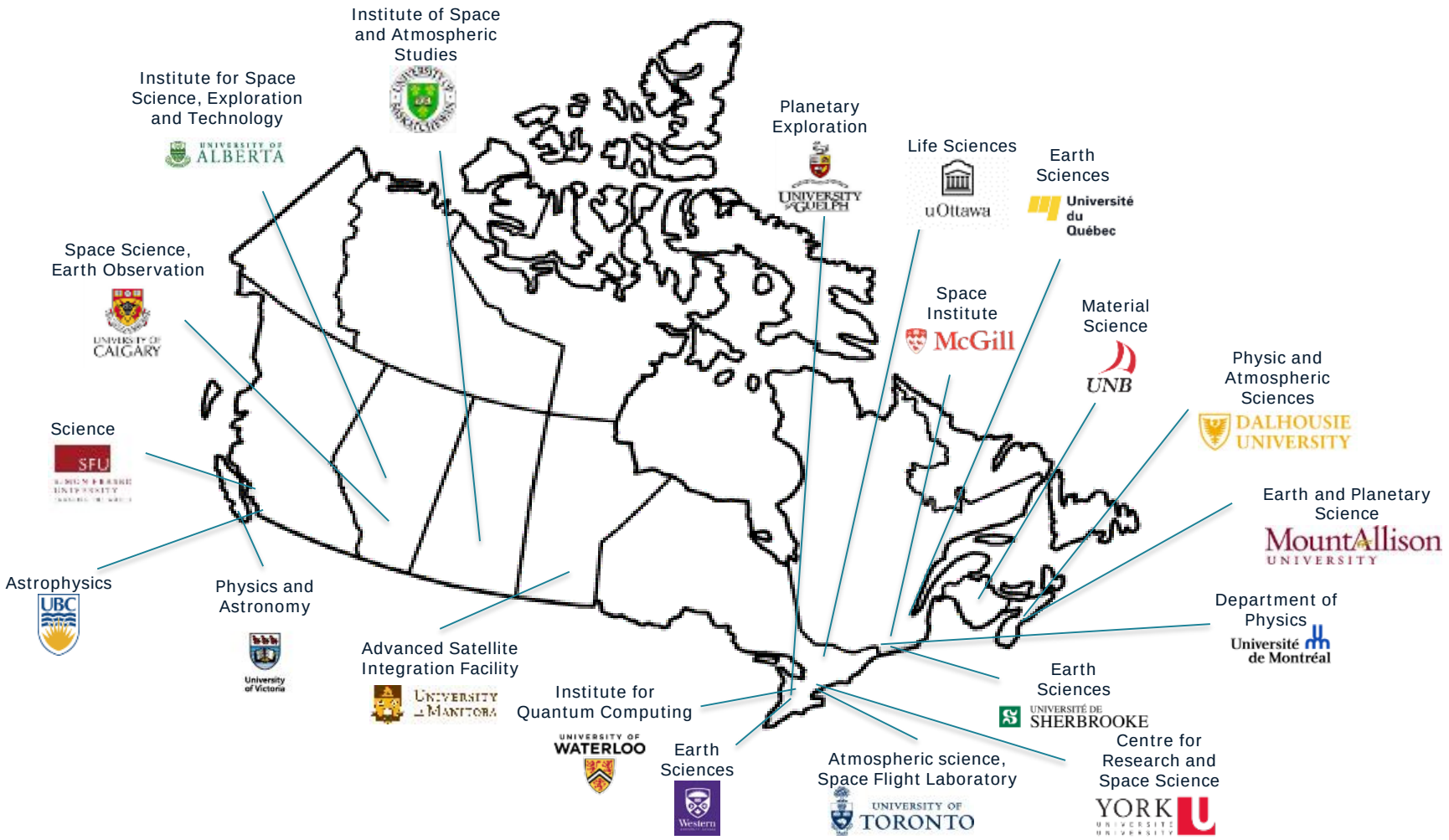
- CSA annual Census-style space sector survey sent to 200+ organizations (began in 1996)
- 2016 *State of the Canadian Space Sector* report based on data from 150 organizations on revenues, exports, workforce R&D, inventions and patents
  - 74% upstream / 26% downstream
  - 76% companies / 24% academia
- Joint CSA-CIPO "Patents in Space Report" to be published Summer 2018

Return on Investment

- For every $1 of CSA contracts an additional $1.2 above and beyond the contract value is generated
- For every $1 of government contribution to space R&D, an additional $2.9 above and beyond contribution value was generated in commercialization revenues

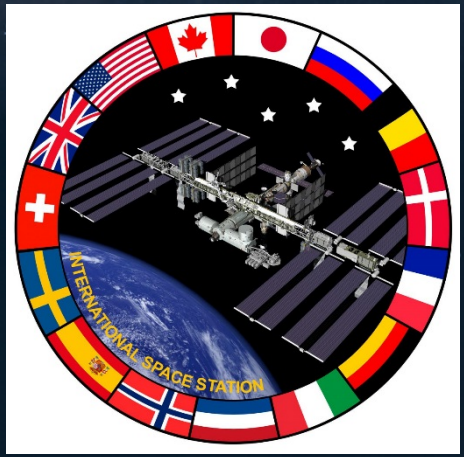
Space Research

- $107M of space-related government funding to 33 universities and research centres in 2016.



International Collaboration

- 21 international MOUs that provide a framework for project level collaboration
  - Numerous program arrangements with many countries
- European Space Agency (ESA)
  - Since 1979
  - 22 member states
- International Space Station
  - ESA, Japan, Russia, USA



UN COPUOS

- United Nations Committee of the Peaceful Uses of Outer Space (UN COPUOS)
  - Canada (CSA) current Chair (2016-2018)

- Currently 2 flagship files both looking at sustainable access to and use of space:
  - UNISPACE+50
  - Guidelines for the Long-Term Sustainability of Outer Space Activities

- Strengthened cooperation and space governance for sustainability

LTS Guidelines

Opening New Markets

- CSA is actively engaged with the Canadian space industry, offering a range of non-monetary actions aimed to support further growth of the industry. The Agency organizes multiple B2B and B2G meetings for the domestic industry stakeholders, helping to create new commercial partnerships and entries into new markets
- Over 100 B2B and B2G meetings with German businesses and DLR during CSA-led mission to Space Tech Expo (October 2017)
- 25 B2B meetings with SNC during DreamChaser for Canada (December 2017)
- 48 B2B meetings with Airbus, OHB and DSI during Industry Day with German companies (April 2018)

New Collaborative Efforts

- Milo Space Science is a joint effort by Arizona State University, GEOshare LLC, and Lockheed Martin Space.

- Goal of the Institute is to increase the number of space science missions executed by making participation affordable and widely available, and generating ideas and interest from outside the traditional funding sources

- Inaugural mission is a Near Earth Object (NEO) encounter mission, to perform detailed up-close characterization of a number of Near Earth Objects through the launch a cluster of propulsive Cubesat and/or Smallsat Encounter Vehicles (EVs) into a heliocentric parking orbit.

New Opportunities

Canada has always punched above its weight in space:

- Great track record in health and life sciences and technologies on the ISS

Partners know we can deliver:

- Longstanding close collaboration with NASA given our industrial capabilities

We asked health and biomedical stakeholders for the advice on what role Canada could take:

- 14 globally recognized industry experts, clinicians and researchers
- Over 300 participants between regional session and National Forum

What they told us:

- Pursue lead integrator and operator for astronaut healthcare role and contribute technologies in areas of Canadian strength

Space Investments Benefit Canadians

- **Past work has led to improved knowledge and technology spin-offs that benefited Canadians**
  - ✓ Radiation technologies adapted for precision cancer therapy; space robotics adapted for specialized precision surgery and non-invasive biopsies
- **Deep space autonomous healthcare have high potential to enable health care delivery, monitoring and management of health in Canadians' homes or community venues**
  - ✓ Facilitating independence and improving quality of life for elderly and chronically ill; improving access to and reducing cost of health care delivery in remote communities; and improving health care delivery in military and first responder settings




Terrestrial Benefits from Space Activities

- Investments in basic sciences, with subsequent space technology and mission development, support breakthrough innovations/applications that have led to many terrestrial benefits
- Below are a few examples of space technologies that have found successful applications on earth

TECHNOLOGY DEVELOPED FOR CSA PROJECTS	ADAPTED TECHNOLOGY APPLICATIONS
Fuel cell technology developed for planetary rovers	Use on submarines and airplanes to power auxiliary systems such as oxygen systems and others to increase autonomy
Prototypes and related technologies for planetary / lunar rovers	Commercial robotic vehicles are used on Earth to replace humans in hazardous operations, such as suspicious package handling, mining exploration, scientific research, extinguish fire remotely, and application of pesticides in agriculture
Vision systems developed for planetary rovers	Laser sensors for navigating mines and guidance systems for helicopter landing
Robotics developed for ISS (i.e., Canadarm technology)	Medical applications (pediatric surgery, neurosurgery and breast cancer screening) and automation for use in nuclear power plants
Satellites (i.e., Radarsat, Radarsat-2 and RCM)	Use of EO data by Federal departments for environmental, sovereignty, and resource mgt priorities, e.g., monitoring/forecasting (artic, coastal wind, forest, fire), oil spill detection, topographic mapping, forest inventory
Specialized interferometer developed for the satellite ACE/SciSat-1	Adapted for use in miniaturized spectrometers to fulfill quality and safety requirements in pharmaceutical, chemical, oil and gas, semiconductor, and metallurgy industries.
Hershel Space Observatory - telescope technology	Adapted into the terahertz microscope used for breast cancer diagnosis
Astroskin biometric shirt	Adapted for use to monitor sleep, physical training and basic health parameters

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