Canadian Space Agency Overview of Space Exploration Programs

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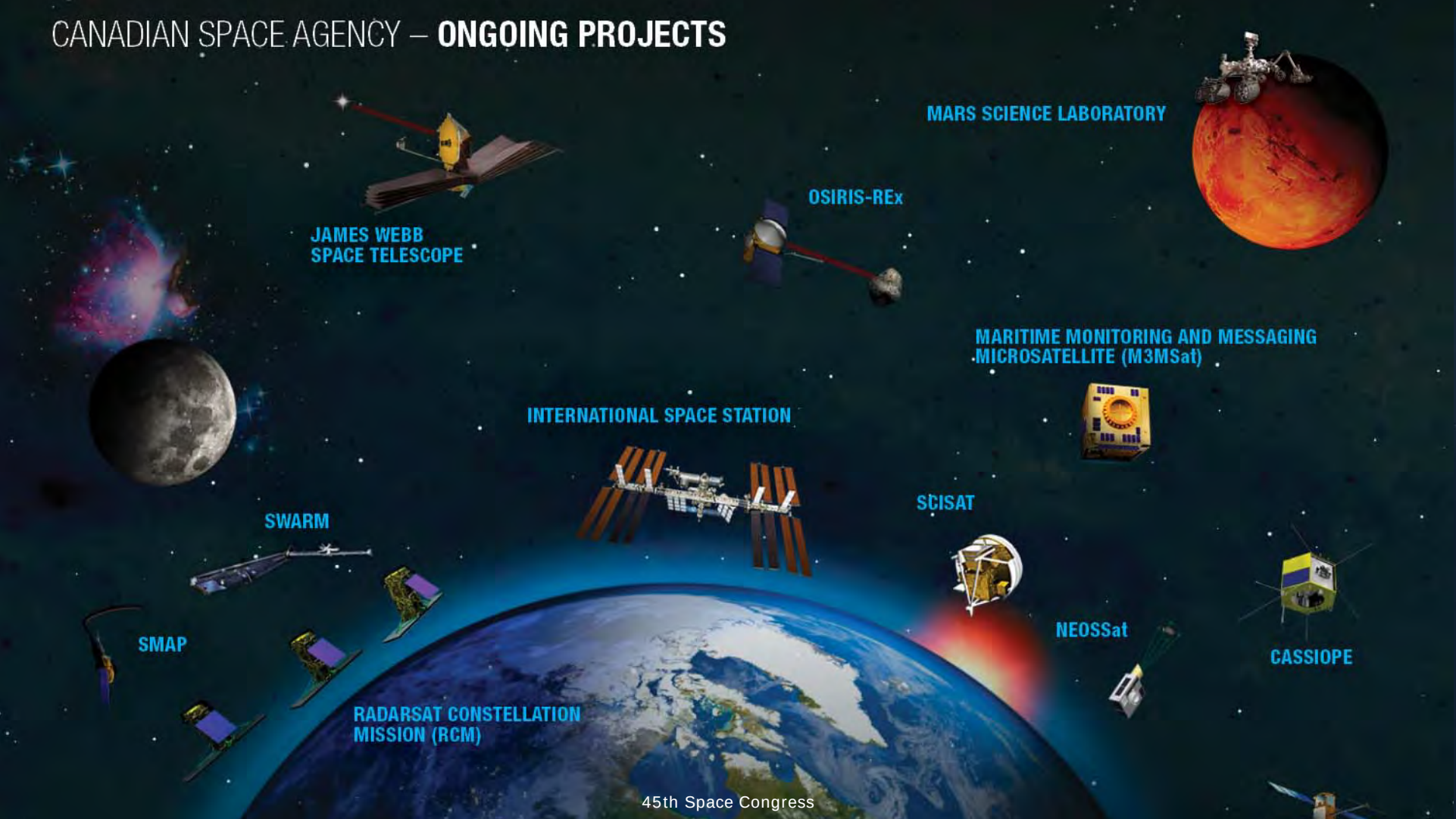
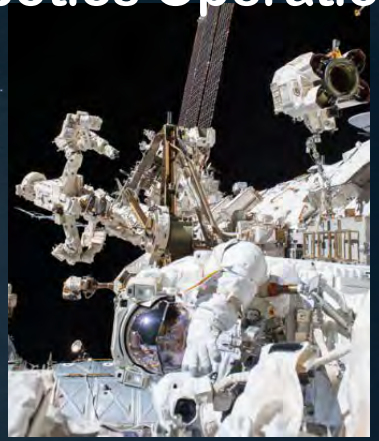
CANADIAN SPACE AGENCY – **ONGOING PROJECTS**



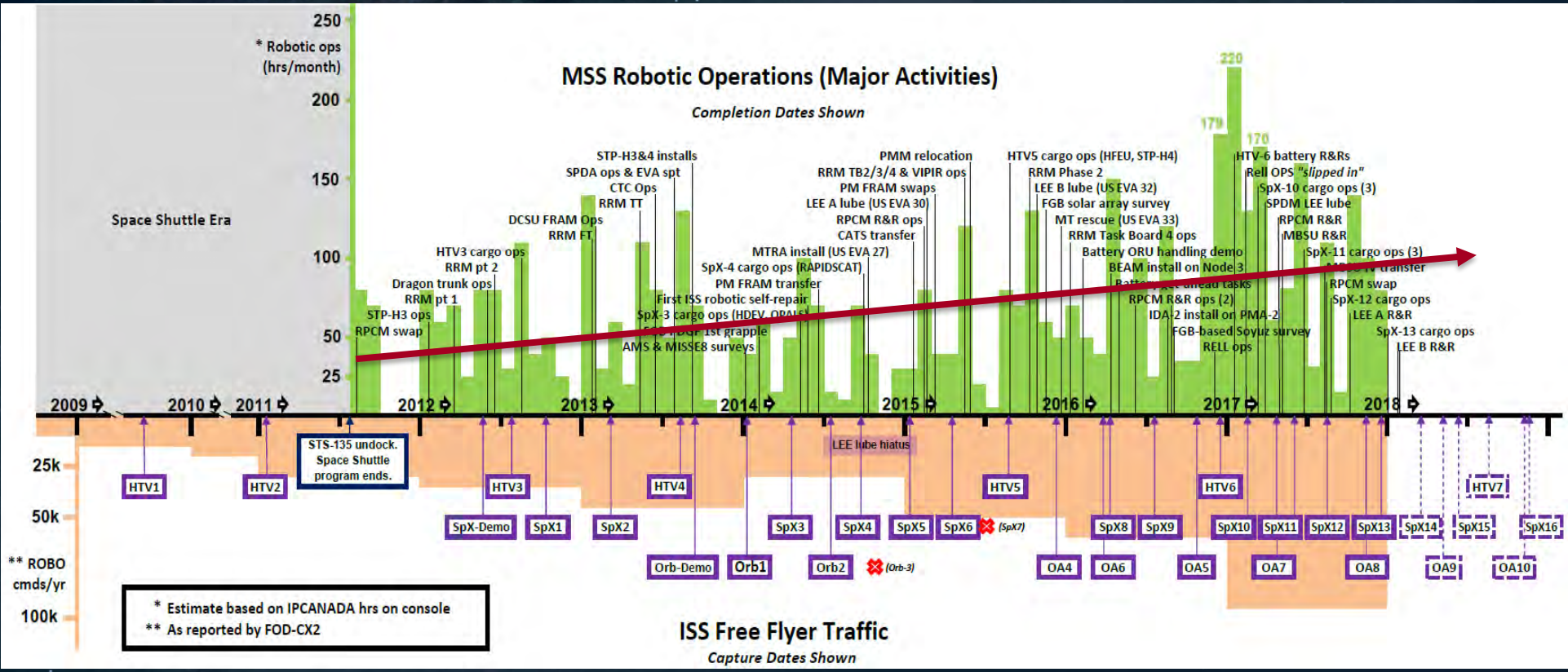
Mobile Servicing System Operations

Unprecedented level of Robotics Operations



Modular and repairable

The Most Space Robotics in History (as of January 9, 2018)



Bringing Autonomy to MSS

Drivers for Autonomy

Now:

- Unprecedented MSS utilization
- High overhead
- Rapid re-planning

Deep Space:

- Remote
- Limited Crew manning

Benefits

- Efficiency
- Streamlining
- Reaction time
- Execution time
- Complimentary with existing Ops strategies
- Overlays
- Safety monitoring
- Robotic Payload Support
  - RELL
  - DDVS

International Engagement

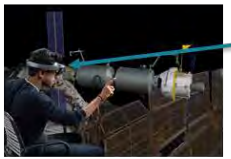
- International Space Exploration Coordination Group
  - The Global Exploration Roadmap provides a coordinated vision for human space exploration while recognizing the criticality of increasing synergy with robotic missions
- International Space Station Exploration Capabilities Study Team member
  - Deep Space Gateway/Lunar Orbiting Platform
- Human Enhanced Robotic Architecture Capability for Lunar Exploration and Science
  - A partnership between ESA, JAXA and CSA with NASA participation

Deep Space Technologies

- Deep Space Exploration Robotics
- Relative Navigation System
- Other areas of interest
  - RF and optical communications
  - Lunar surface mobility
  - Health and Medical systems
  - Synthetic Aperture Radar

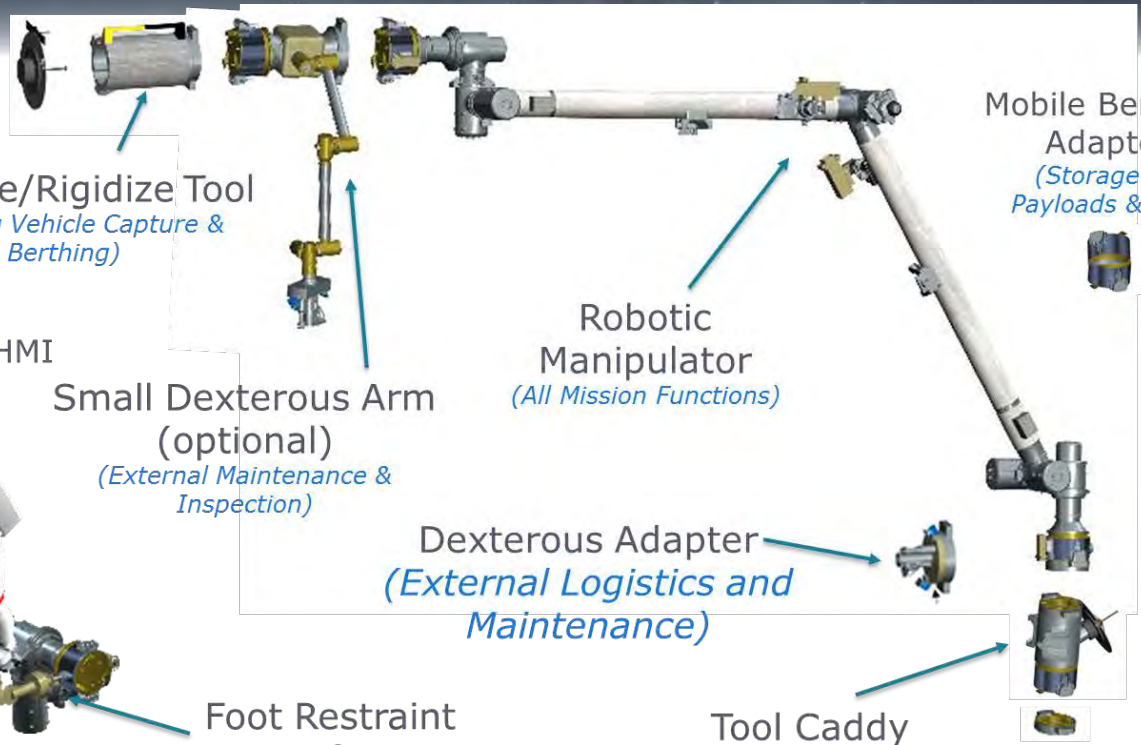
Deep Space Exploration Robotics

Mission Planning
(Cognitive Model Based Mission Planning Software)



Immersive HMI

Executive Control Software



Capture/Rigidize Tool
(Visiting Vehicle Capture & Berthing)

Mobile Berthing Adapter
(Storage for Payloads & LAE)

Robotic Manipulator
(All Mission Functions)

Small Dexterous Arm (optional)
(External Maintenance & Inspection)

Dexterous Adapter
(External Logistics and Maintenance)

Foot Restraint Interfaces
(EVA Support)

Tool Caddy
(External Maintenance & Logistics)

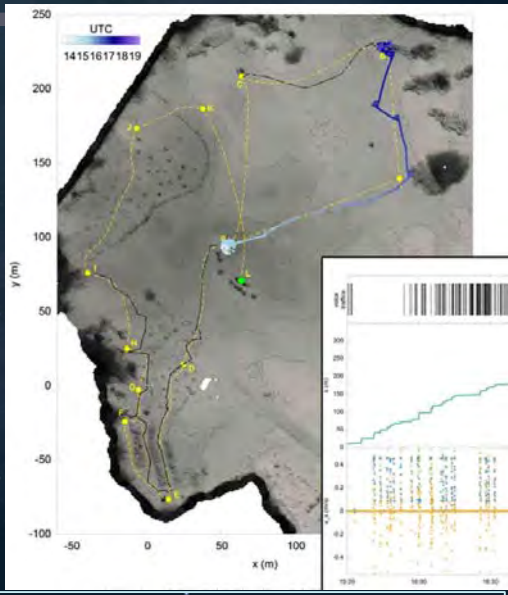
An Evolutionary Path to Human-Rated Systems

Mission Objectives

- Prepare for human missions to the Moon by implementing, demonstrating and certifying technology elements for future human lunar landing
- Create opportunities for scientific research (e.g. sample return)
- Gain science and exploration knowledge about the Moon
- Create opportunities to demonstrate and test technological and operational capabilities for future Mars exploration missions

Rover

- The rovers main purpose is to perform surface operations and sampling
  - Transport the sample container and with a device to extract samples from the lunar surface and transfer it to the container
  - Capable to survive and operate during the lunar night
  - Capable to communicate directly to the station
  - Transfer the sample container to the Lunar Ascent Module
  - Operate in 3 different modes:
    - Autonomous
    - Tele-operated/Super-visual (Orbit or ground)
    - Tele-operated/Fully manually (From orbit)



Rover	
Mission	Long duration surface operation
Mission	Sample collection
Duration	12 months
Mass	500kg
Technology	Tele-operation
	Radioisotope power system

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