MAXAR

NASA Restore-L Program

On-Orbit Satellite Servicing Mission

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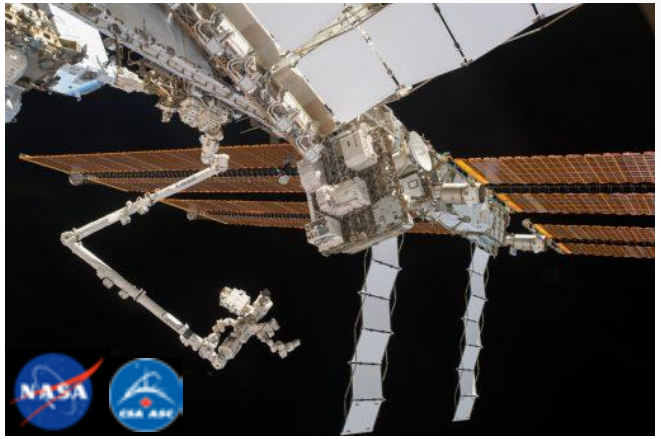
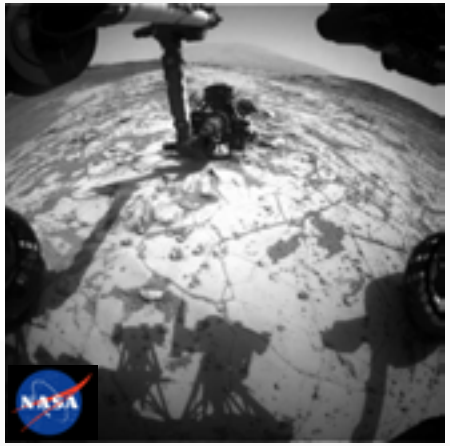
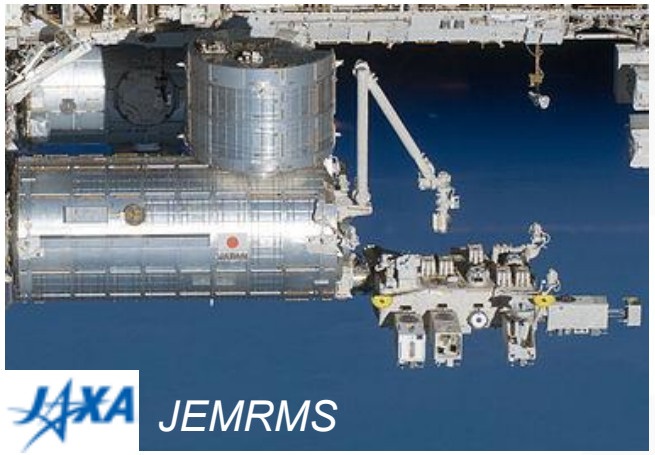
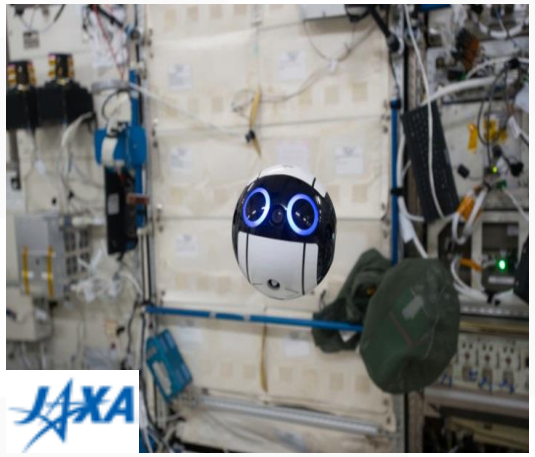
Daily Use of Space Robotics

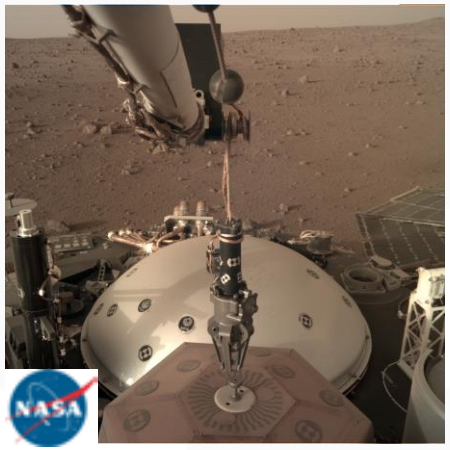
- ISS external robotics
- ISS internal robotics
- Mars rover & lander
- Teleoperation
- Supervisory Control
- Semi-Autonomy & AI











On-Orbit Robotic Refueling of Landsat-7

Funded and managed by NASA Space Technology Mission Directorate (STMD) Tech Demo Missions

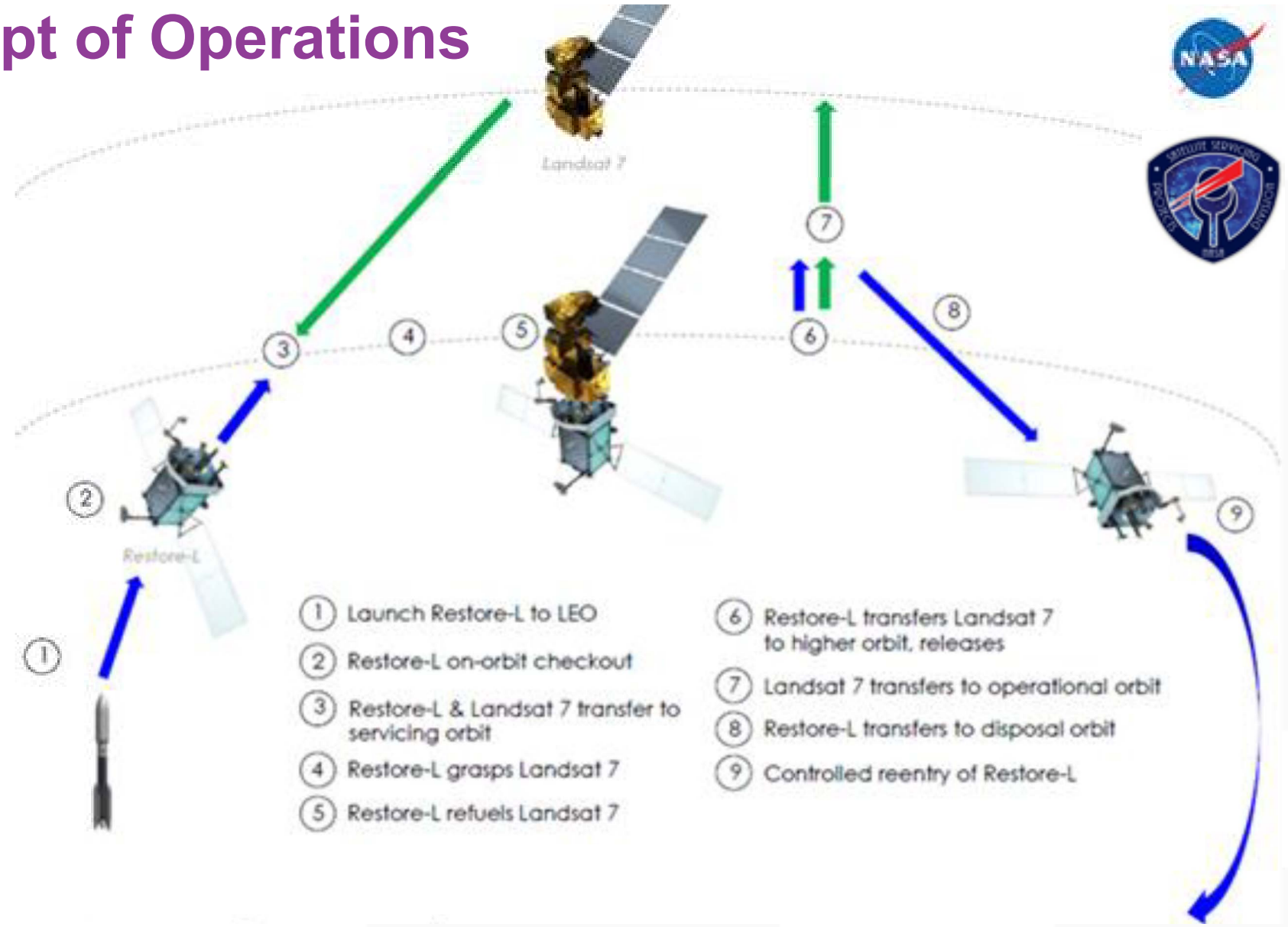
- Robotic On-Orbit Servicing
- NASA* is mission prime & payload

Satellite Servicing Projects Division (SSPD)

- Maxar building the Restore-L bus
- Maxar building robotic arms

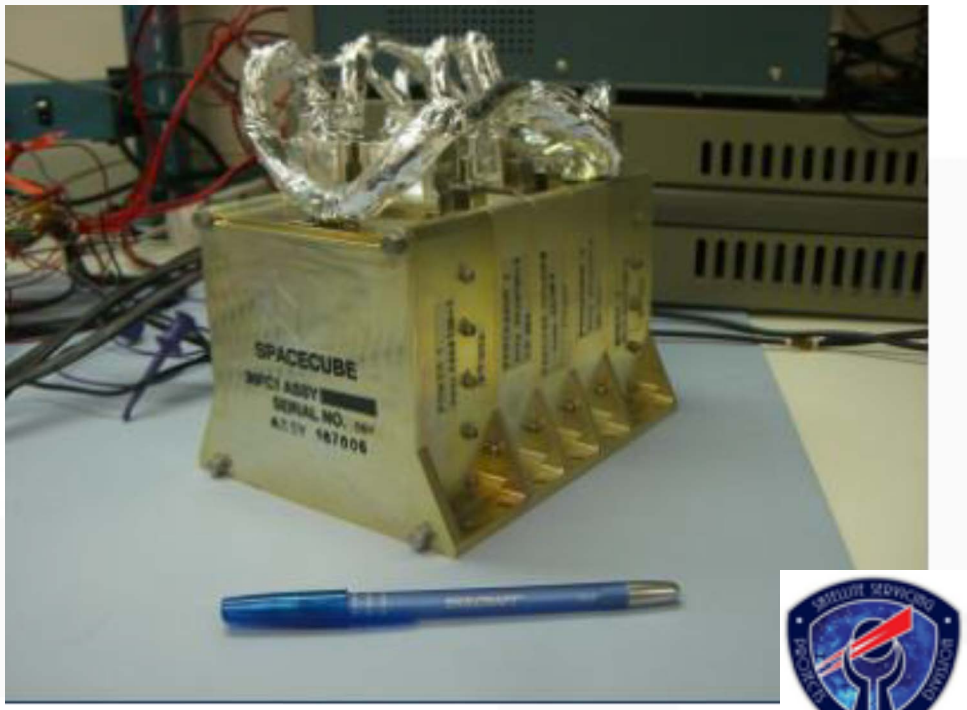
Restore-L Concept of Operations

- Launch to LEO SSO
- Checkout / characterize
- Refuel Landsat-7
- Relocate Landsat-7
- Residual capability demos
- Controlled reentry



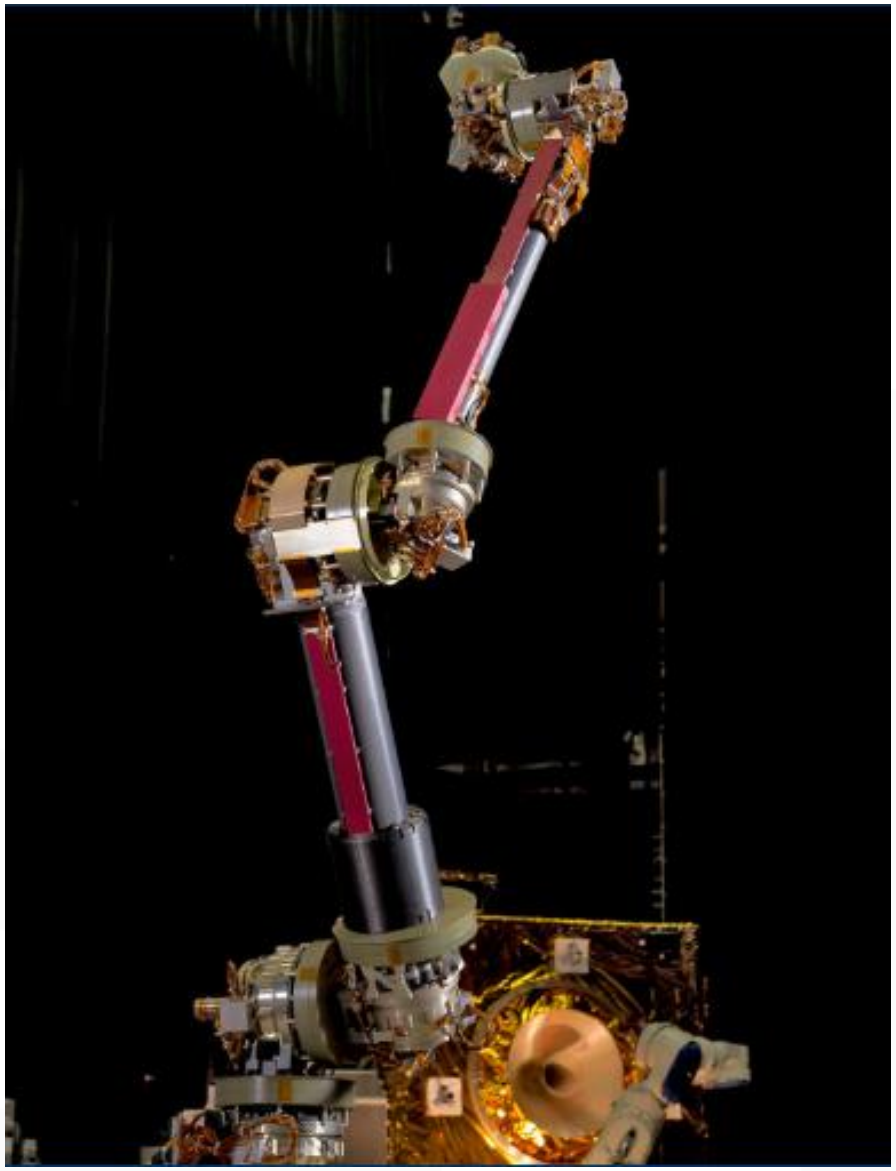
Servicing Avionics

- NASA GSFC' Space Cube
- Mission Manager
- Relative Navigation
- Guidance and Control
- Robot & payload control



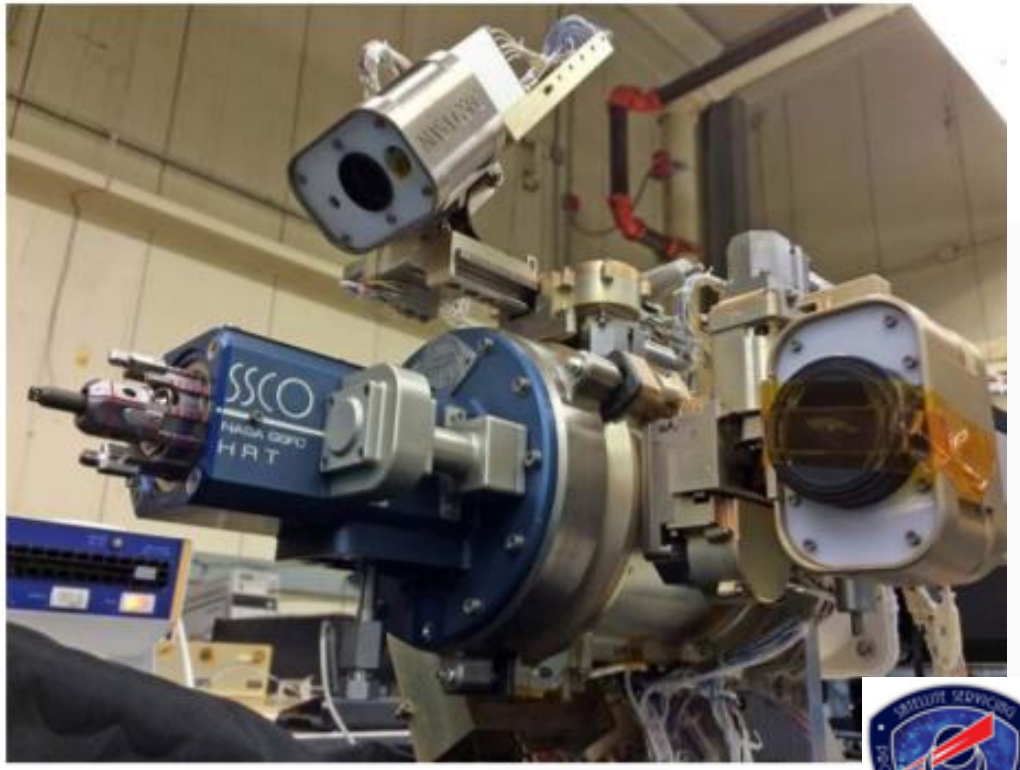
Dexterous Robotic Arms

- Maxar building arms for NASA SSPD
- Two arms on Restore-L – 7 DoF each
- Berth Landsat-7 to Restore-L
- Reach fill-drain valves with dexterity
- Accommodates verity of attachable tools



Tool Drive and Tools

- Advanced Tool Drive System (ATDS)
  - Torque drive
  - Cameras
  - Power and data
- Attachable tools
  - Grasping and berthing
  - Thermal blanket cutters & handling
  - Fill-drain valve sockets
  - Future growth / expansion

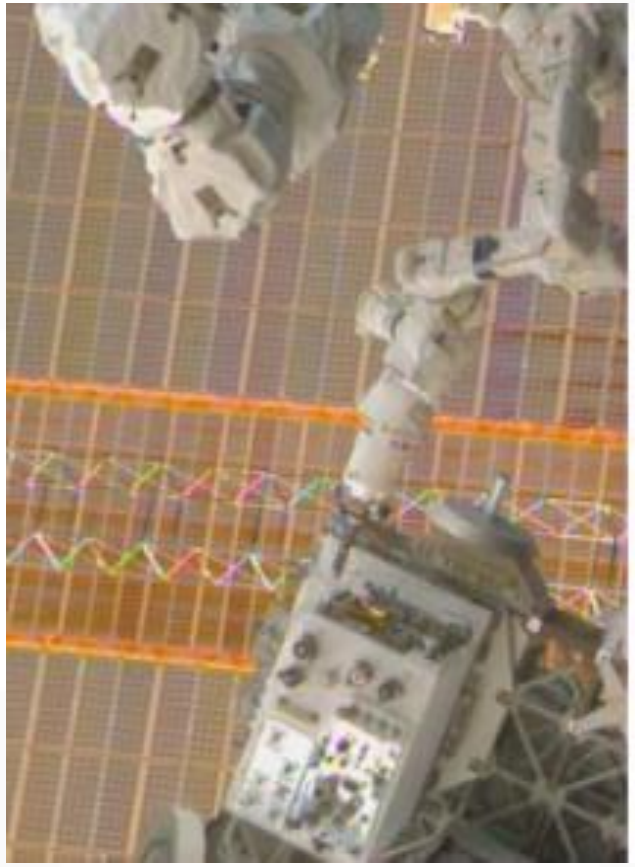


Propellant Transfer System

- Repeatable refueling technique
- Applicable to various clients and amounts
- Manages client tank conditions
- Control temp, pressure, and rate
- Refueling tool demonstrated in the lab
- Demos on ISS as well - RRM

Robotic Refueling Mission (RRM) on ISS

- RRM demonstrations on ISS
- Standard commercial fill-drain valves
- Dextre* robotic arm plus tool under teleop.
- RRM 3 primary objectives:
  - 1. cryogenic liquid methane transfer in micro-gravity
  - 2. Maintain cryogen fluid mass for six months via zero boil-off



** CSA provided Dextre for ISS*

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