

NASA Space Tech: EXPLORE

Transformative Missions and Discoveries



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Space Technology Focus Areas

GO

**Rapid, Safe, and Efficient
Space Transportation**

LAND

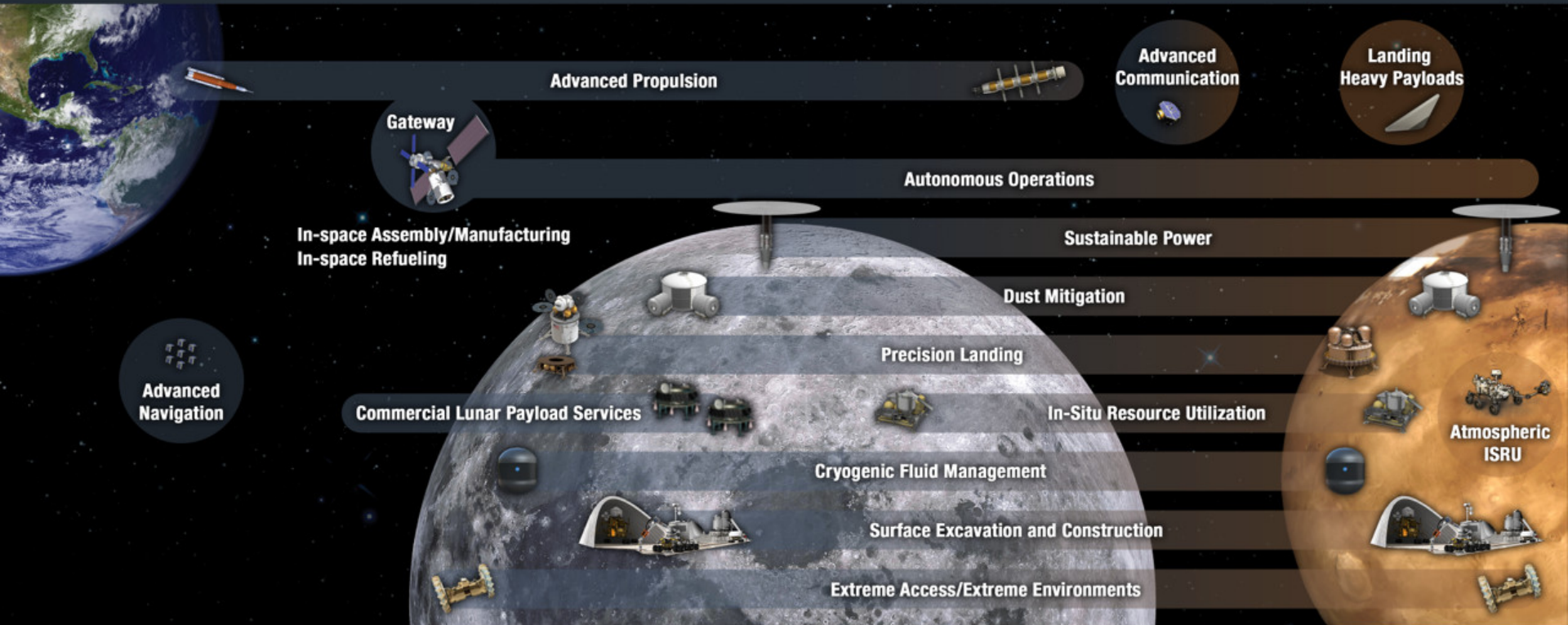
**Expanded Access to Diverse
Surface Destinations**

LIVE

**Sustainable Living and Working
Farther from Earth**

EXPLORE

**Transformative Missions
and Discoveries**



Explore

Transformative Missions and Discoveries

- Develop next generation high performance computing, communications, and navigation.
- Develop advanced robotics and spacecraft autonomy technologies to enable and augment science/exploration missions.
- Develop technologies supporting emerging space industries including: Satellite Servicing & Assembly, In Space/Surface Manufacturing, and Small Spacecraft technologies.
- Develop vehicle platform technologies supporting new discoveries.

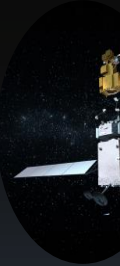
Laser and Optical Communications



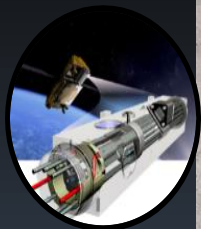
CAPSTONE



OSAM-1



OSAM-2 Archinaut



Atomic Clock



Surface Robotic Scouts



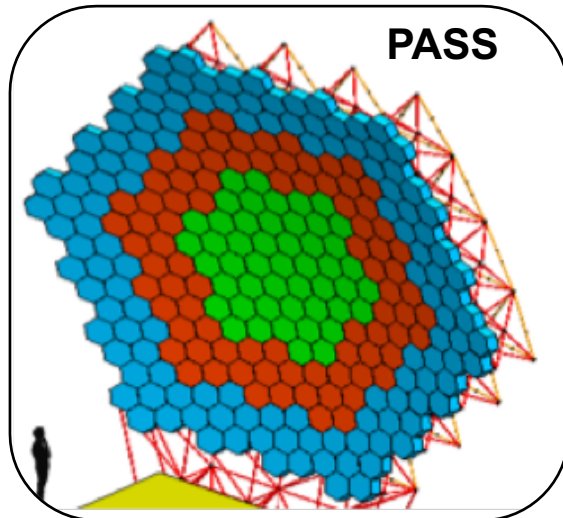
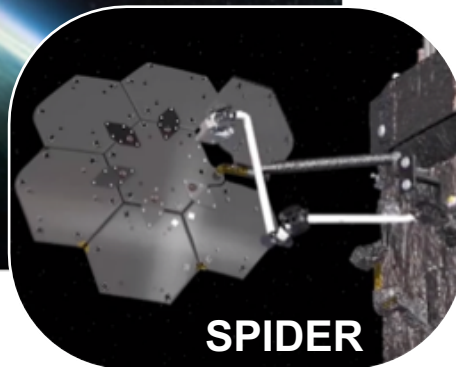
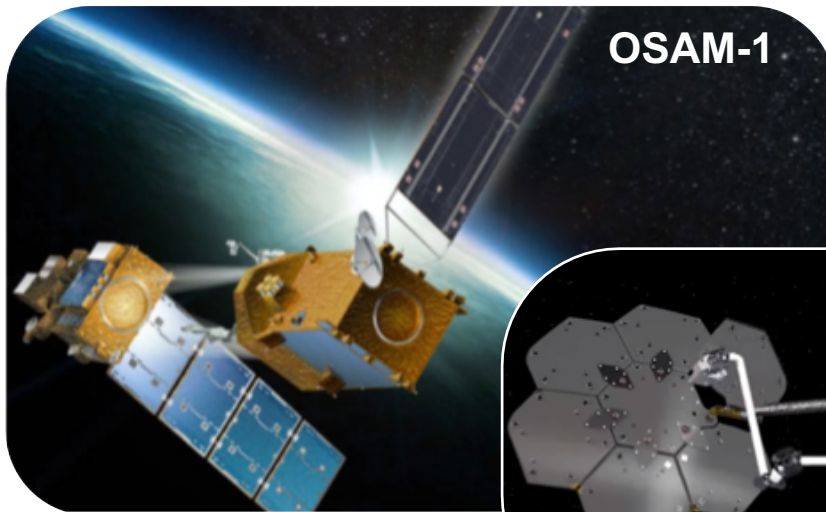
Bulk Metallic Glass Gears



In Space Manufacturing



Satellite Servicing & Assembly



Archinaut: On-orbit manufacturing (2022)

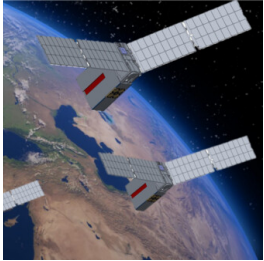


ANIMATION COURTESY OF MADE IN SPACE, INC.

MADE
IN SPACE

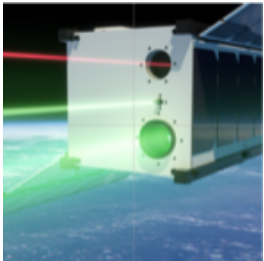


Small Spacecraft (Upcoming Missions)



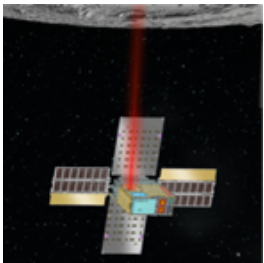
V-R3x (2021) and Starling (2022)

Demonstrate autonomous operation of multiple, coordinating spacecraft



CLICK: CubeSat Laser Intersatellite Crosslink (2021-2022)

Demonstrate optical communications (20 Mbps) between two moving spacecraft (580 km separation)



Lunar Flashlight (2021)

Measure surface ice at the lunar south pole using a laser spectrometer.



CPOD: CubeSat Proximity Operations Demonstration (2021)

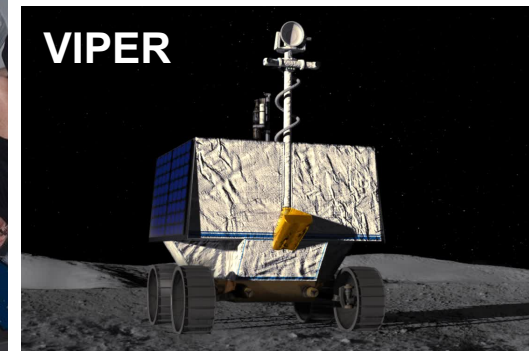
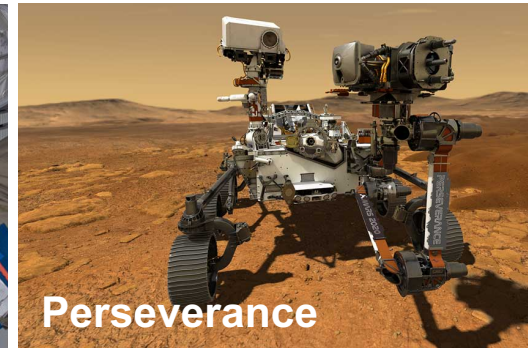
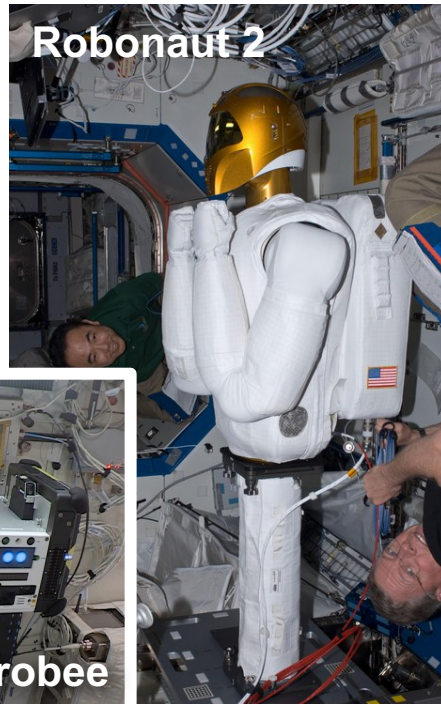
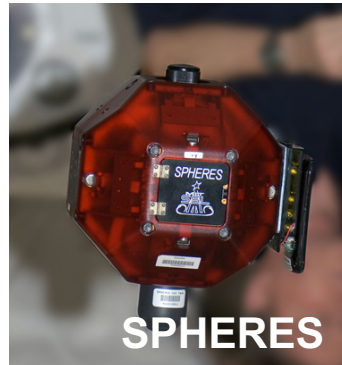
Demonstrate rendezvous, proximity operations and docking using two small “3U” (10x10x30 cm) CubeSats.



Space Robotics

Uses

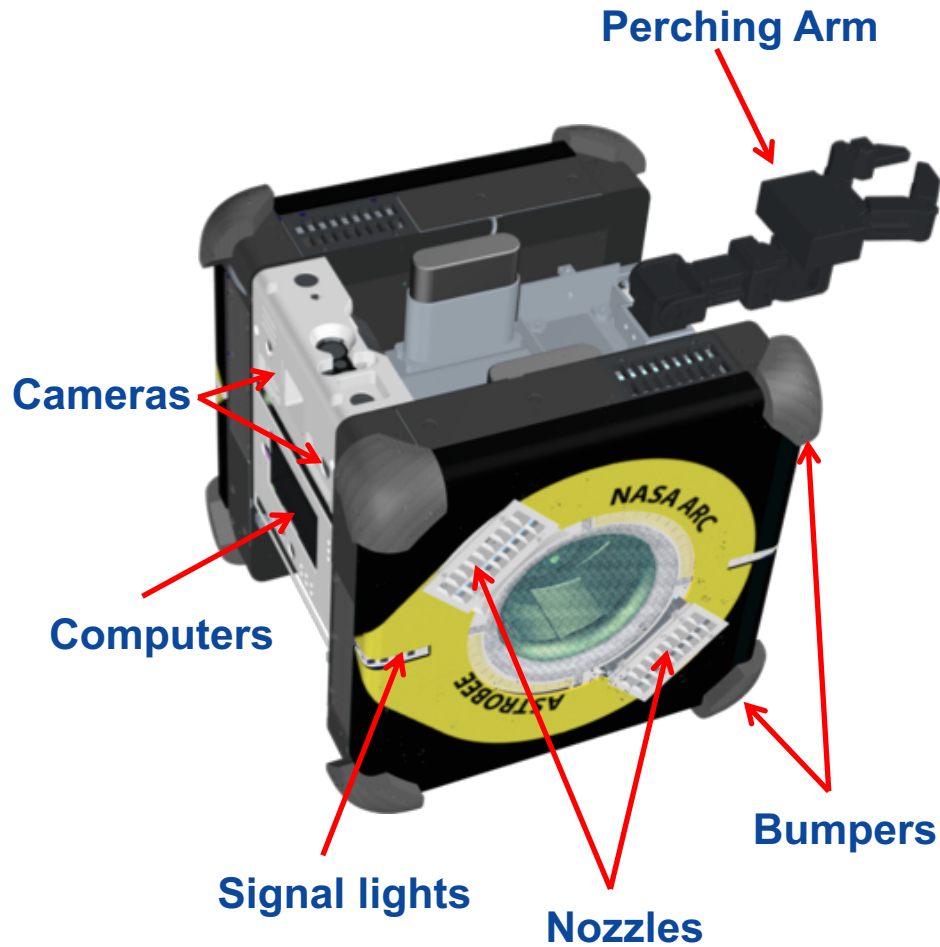
- Exploration (assembly, maintenance, crew/payload positioning, ISRU)
- Science (instrument deployment, measurements, sampling, analysis)
- Technology development and research (NASA and non-NASA)



Space Station Internal Robots



Astrobee



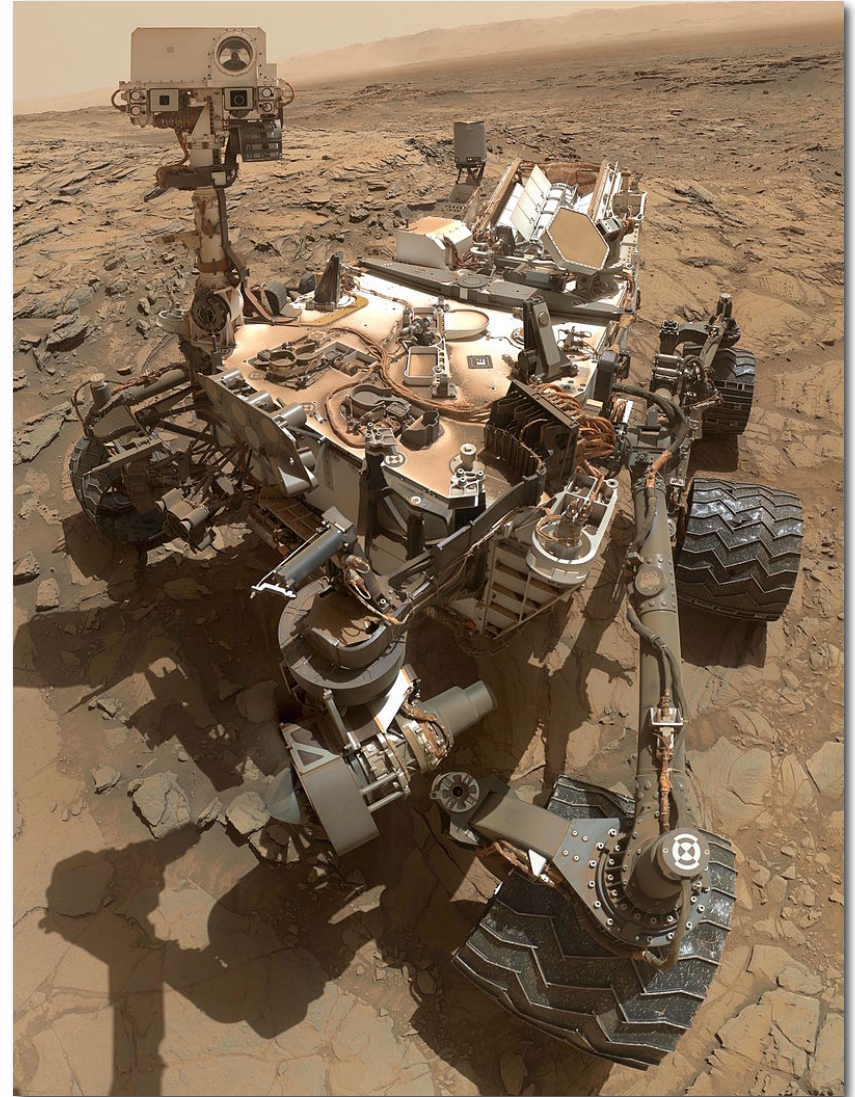
Astrobee "Bumble Bee" 1st On-Orbit Activities

**Astronauts Anne McClain,
David Saint-Jacques, & Christina Koch**

Mars Rovers



**Mars Exploration Rover on Mars
(artist concept)**

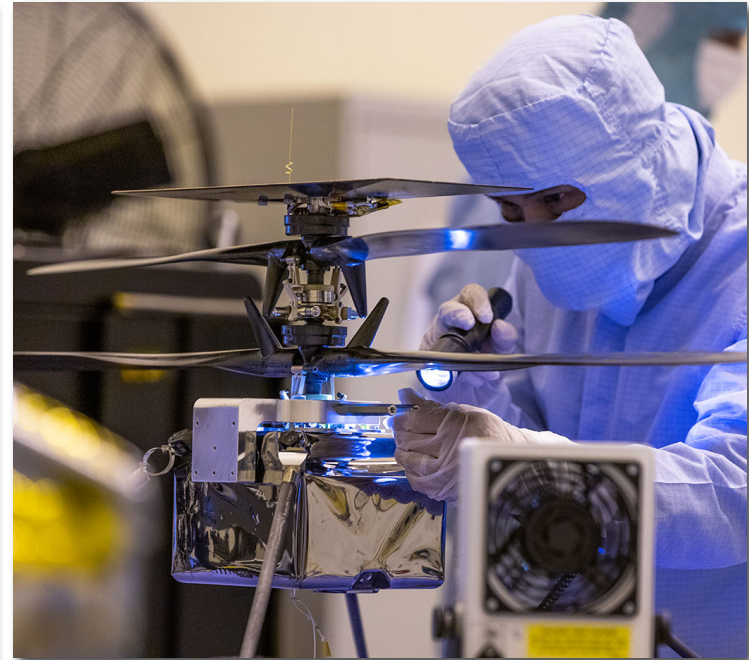


Curiosity at “Big Sky” on Mars (2015)

Mars 2020

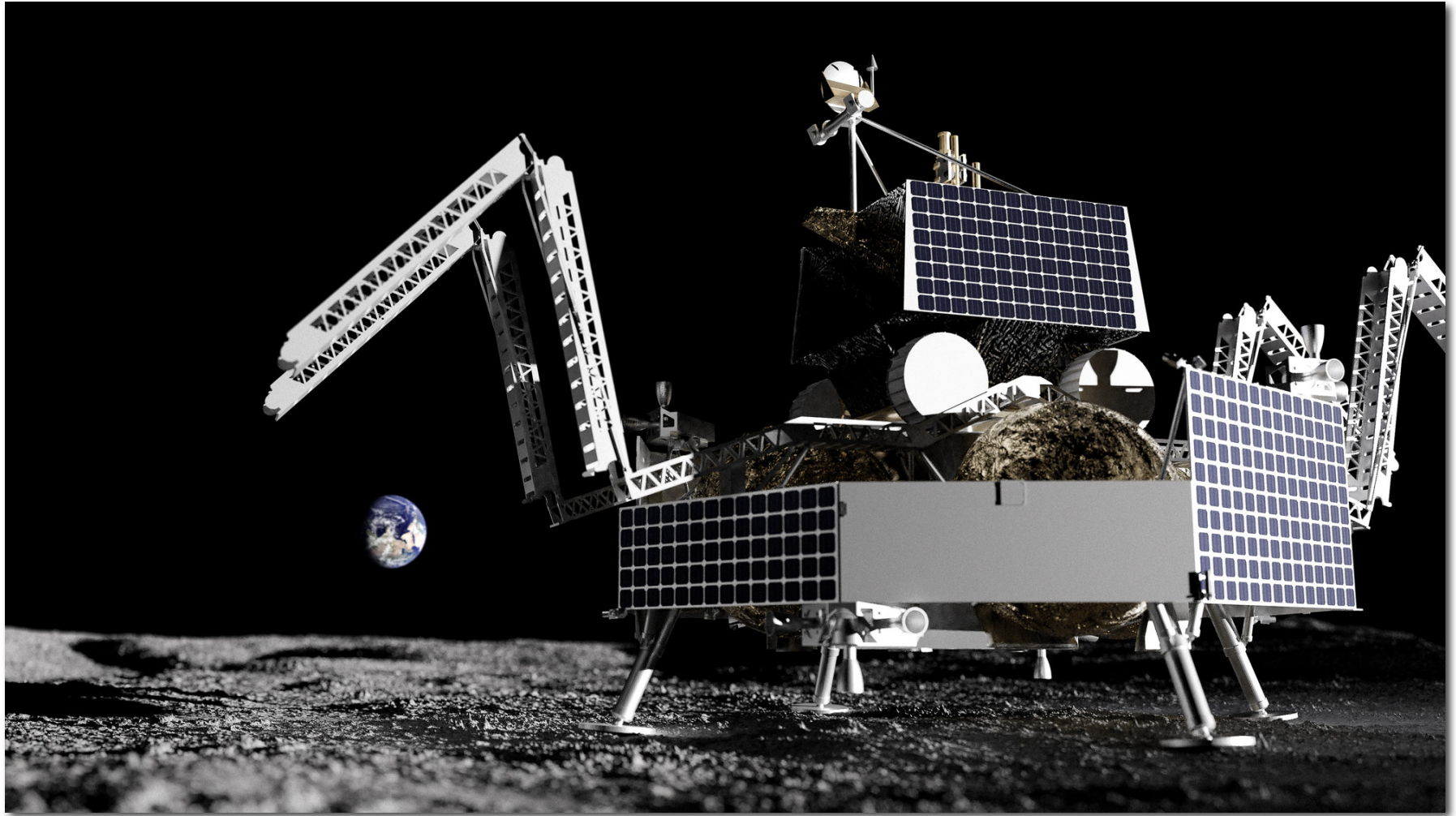


Perseverance rover



Ingenuity helicopter

Volatiles Investigating Polar Exploration Rover (VIPER)



**VIPER Rover on Astrobotic Griffin Lander
(artist concept)**

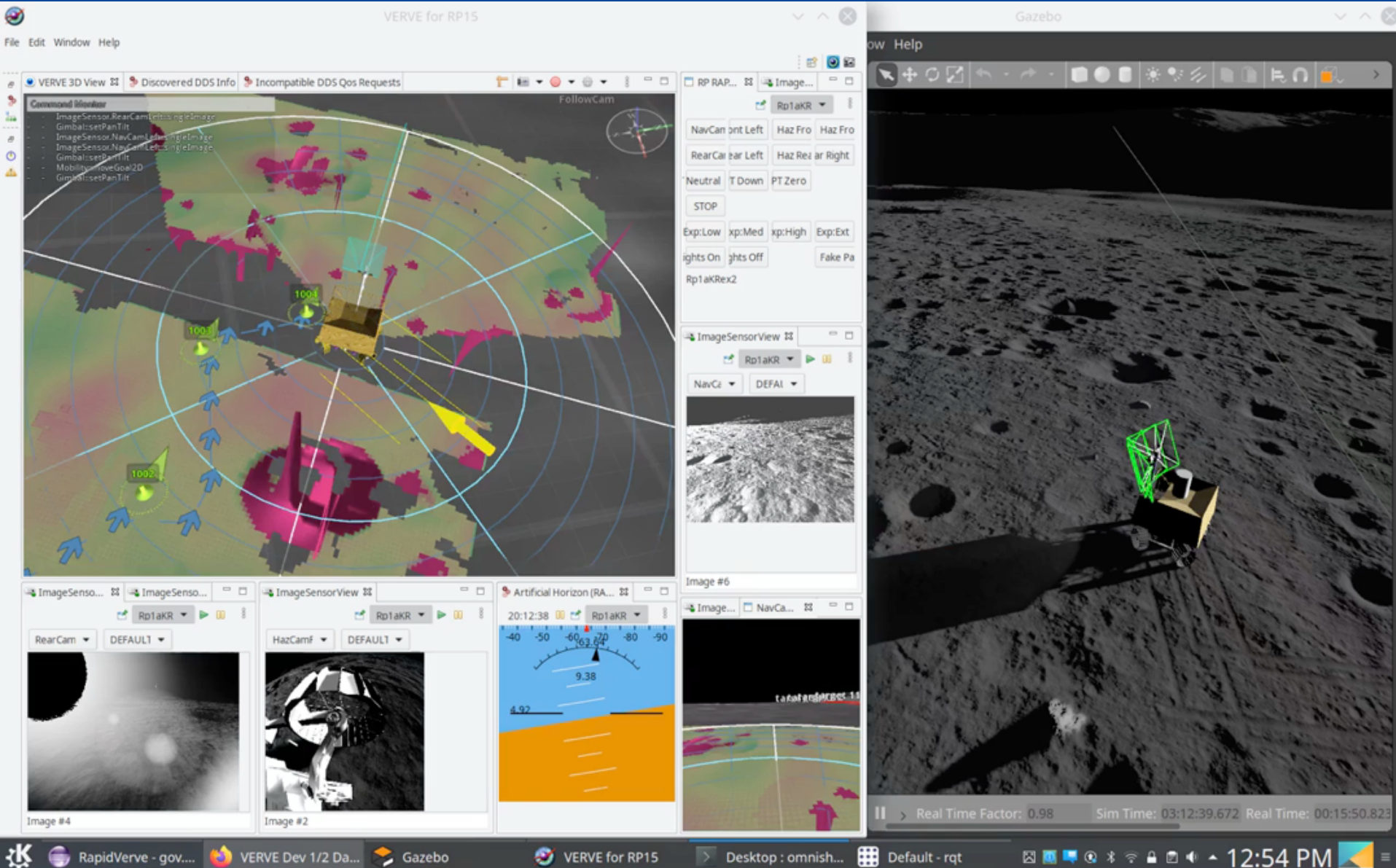
Volatiles Investigating Polar Exploration Rover (VIPER)



Narrator: We know from decades of study



VIPER Operations



Questions?

