National Aeronautics and Space Administration

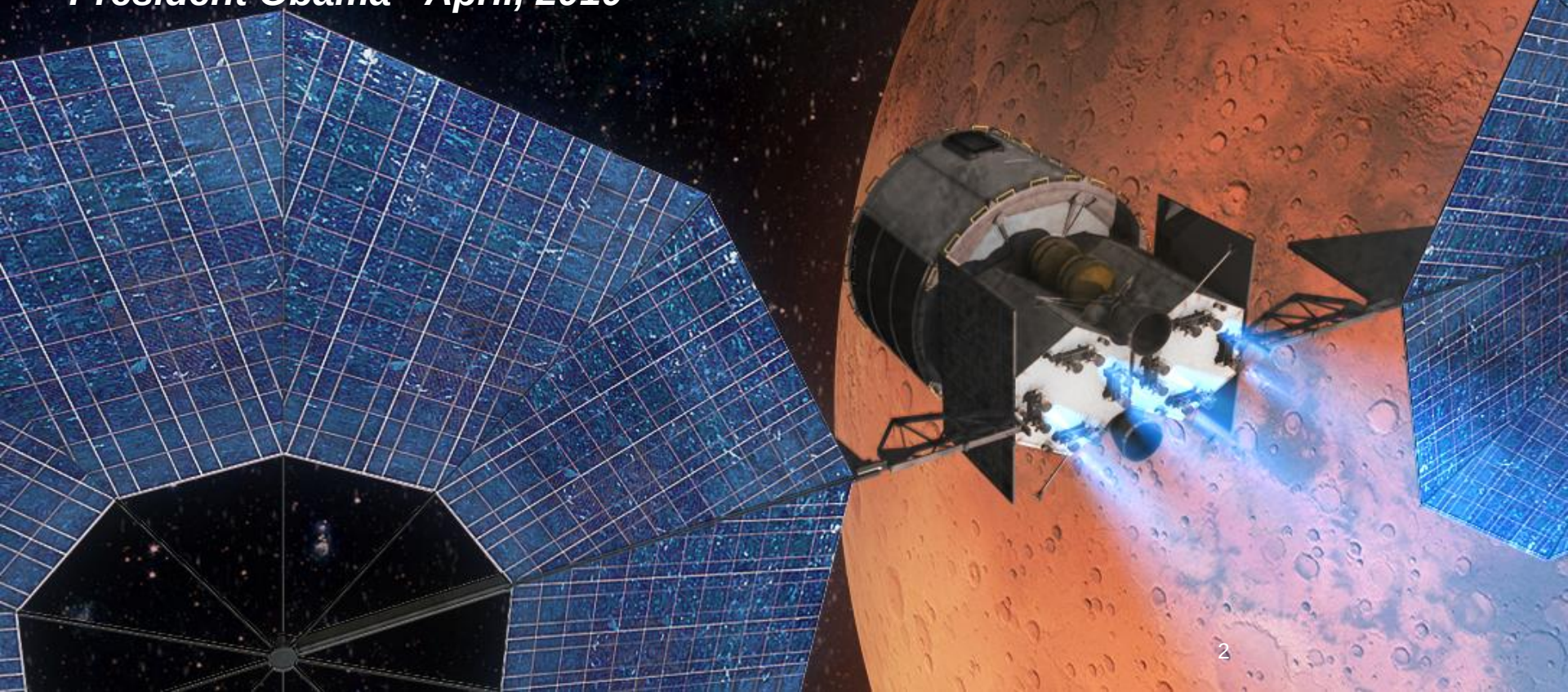
WANTED: New Technologies for NASA's Journey to Mars

Tia Ferguson
Acting Center Chief Technologist for
Marshall Space Flight Center (MSFC)
Huntsville, Alabama
January 24, 2016

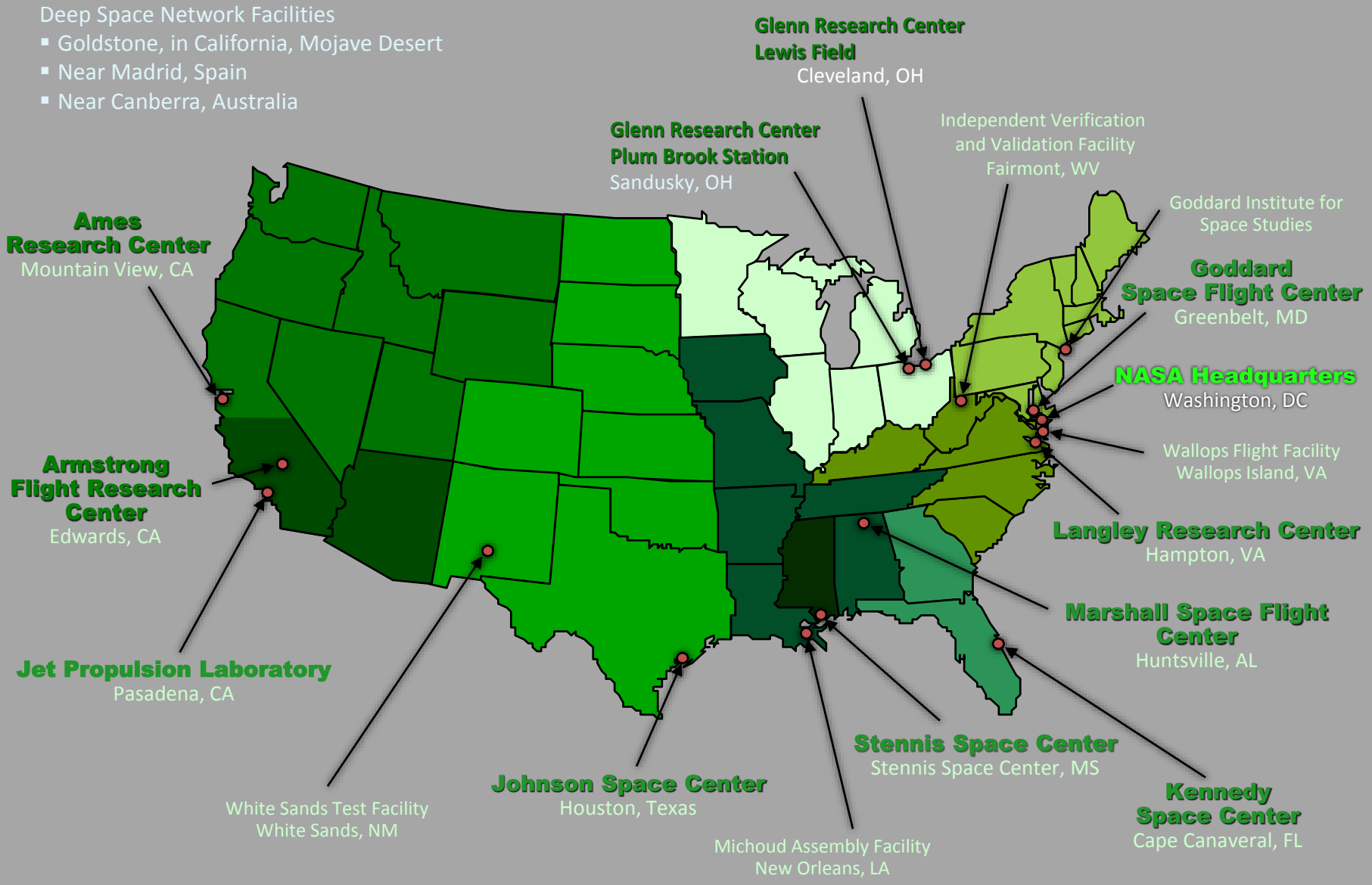
Pioneering Space - Goals

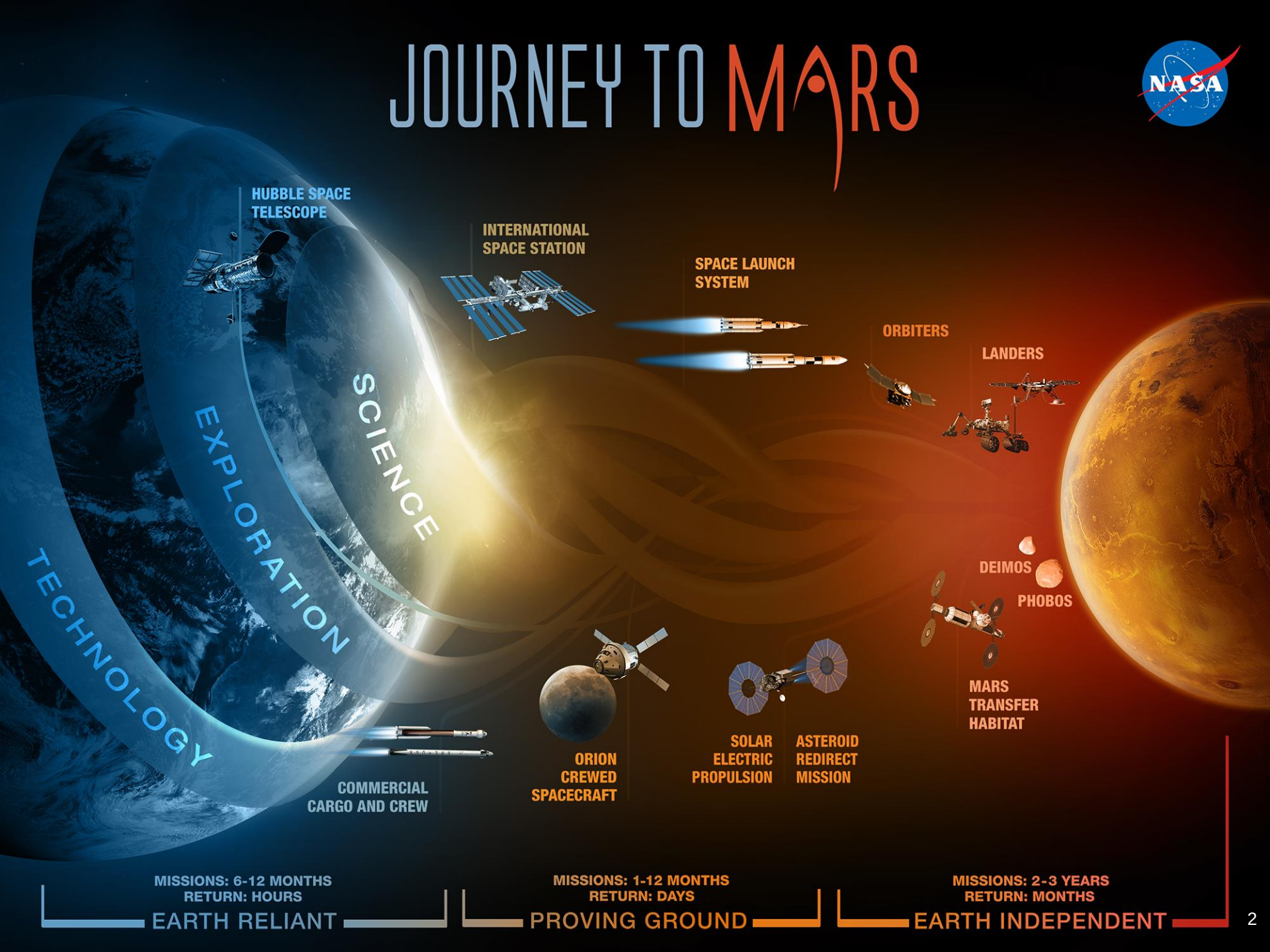
"Fifty years after the creation of NASA, our goal is no longer just a destination to reach. Our goal is the capacity for people to work and learn and operate and live safely beyond the Earth for extended periods of time, ultimately in ways that are more sustainable and even indefinite. And in fulfilling this task, we will not only extend humanity's reach in space -- we will strengthen America's leadership here on Earth."

- President Obama - April, 2010



NASA Centers and Installations




JOURNEY TO MARS
NASA
HUBBLE SPACE TELESCOPE
INTERNATIONAL SPACE STATION
SPACE LAUNCH SYSTEM
ORBITERS
LANDERS
SCIENCE
EXPLORATION
TECHNOLOGY
DEIMOS
PHOBOS
MARS TRANSFER HABITAT
ORION CREWED SPACECRAFT
SOLAR ELECTRIC PROPULSION
ASTEROID REDIRECT MISSION
COMMERCIAL CARGO AND CREW
MISSIONS: 6-12 MONTHS
RETURN: HOURS
EARTH RELIANT
MISSIONS: 1-12 MONTHS
RETURN: DAYS
PROVING GROUND
MISSIONS: 2-3 YEARS
RETURN: MONTHS
EARTH INDEPENDENT

Evolvable Mars Campaign – Capability & Mission Extensibility

EARTH RELIANT | PROVING GROUND | EARTH INDEPENDENT

Capabilities

International Space Station

70+ MT SLS

Asteroid Redirect Vehicle

105+ MT SLS

Exploration Augmentation Module

Advanced Propulsion

Long Duration Habitat

130+ MT SLS

EDL Pathfinder

EDL/Lander

Long Duration Surface Systems

Staying Healthy

Working In Space

Transportation

Mars Surface

ISRU

All Paths Through Mars Orbit

EM-X Crewed Missions in Cis-lunar space

Mars 2020

Asteroid Redirect Robotic Mission

Proving Ground Missions to Returned Asteroid & EAM for Mars risk reduction

ISS Deep Space & Mars Risk Reduction

Deep Space Mars Preparation

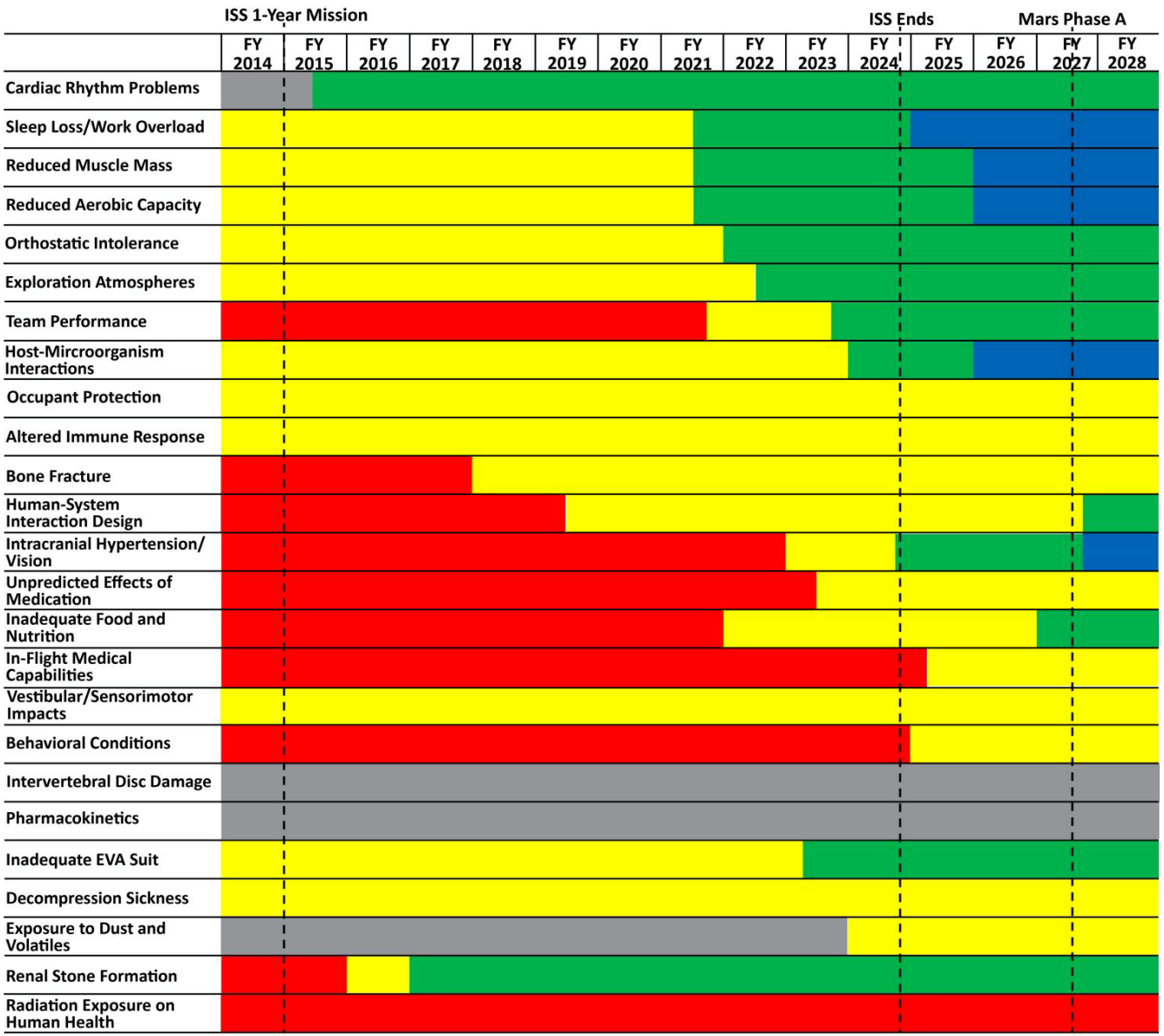
Missions

Mars Moon Missions

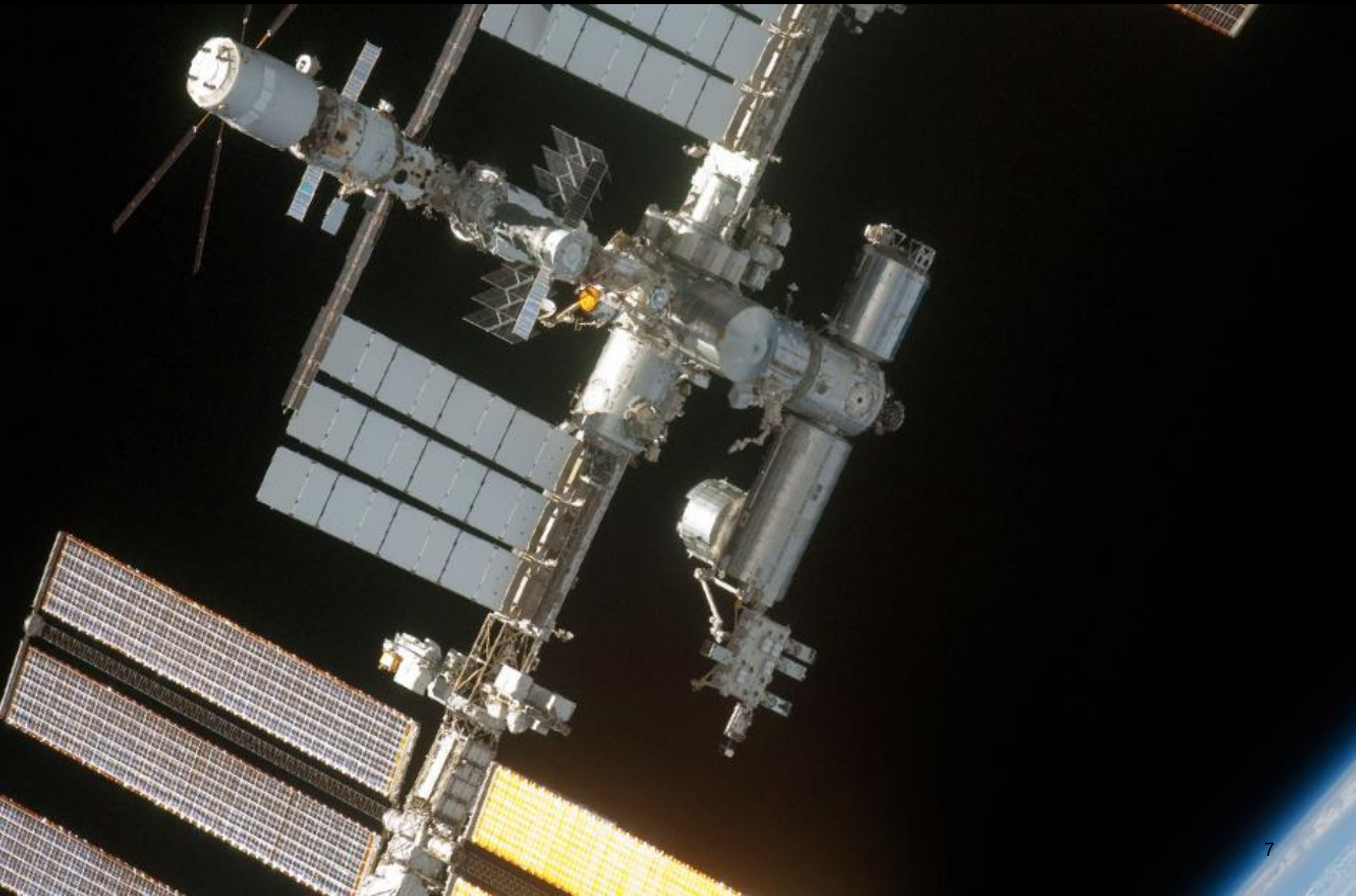
First Human Mission to Mars Surface

Long Duration Human Missions

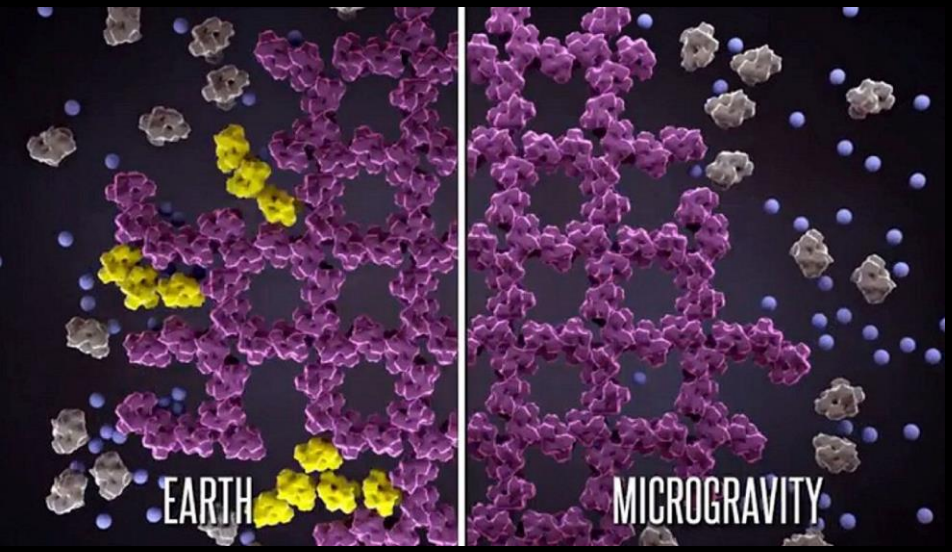
Solving Risks with Technology Development

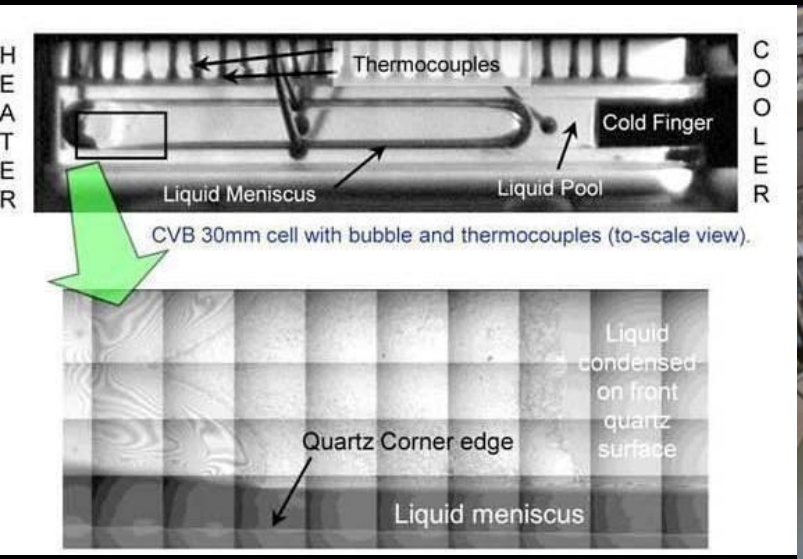


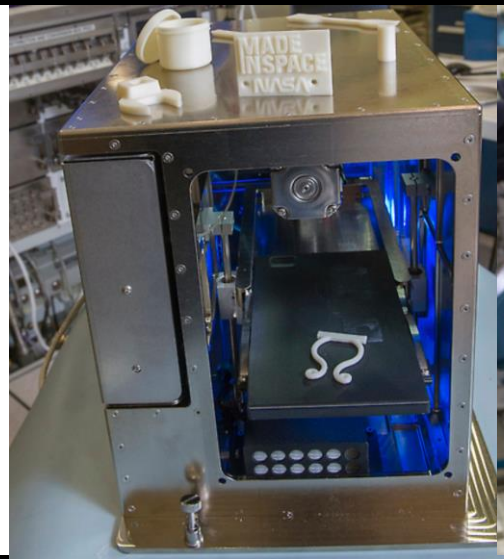
Earth Reliant Phase – Working on ISS



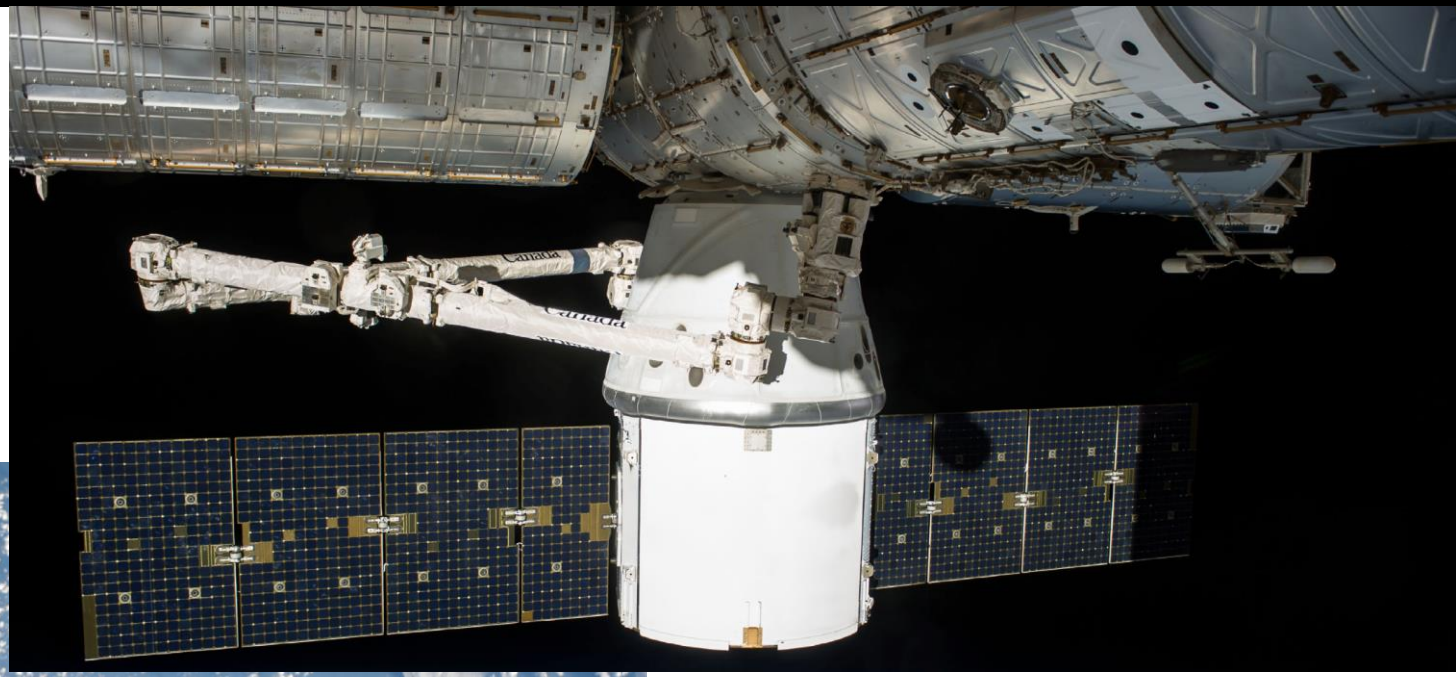
ISS Research

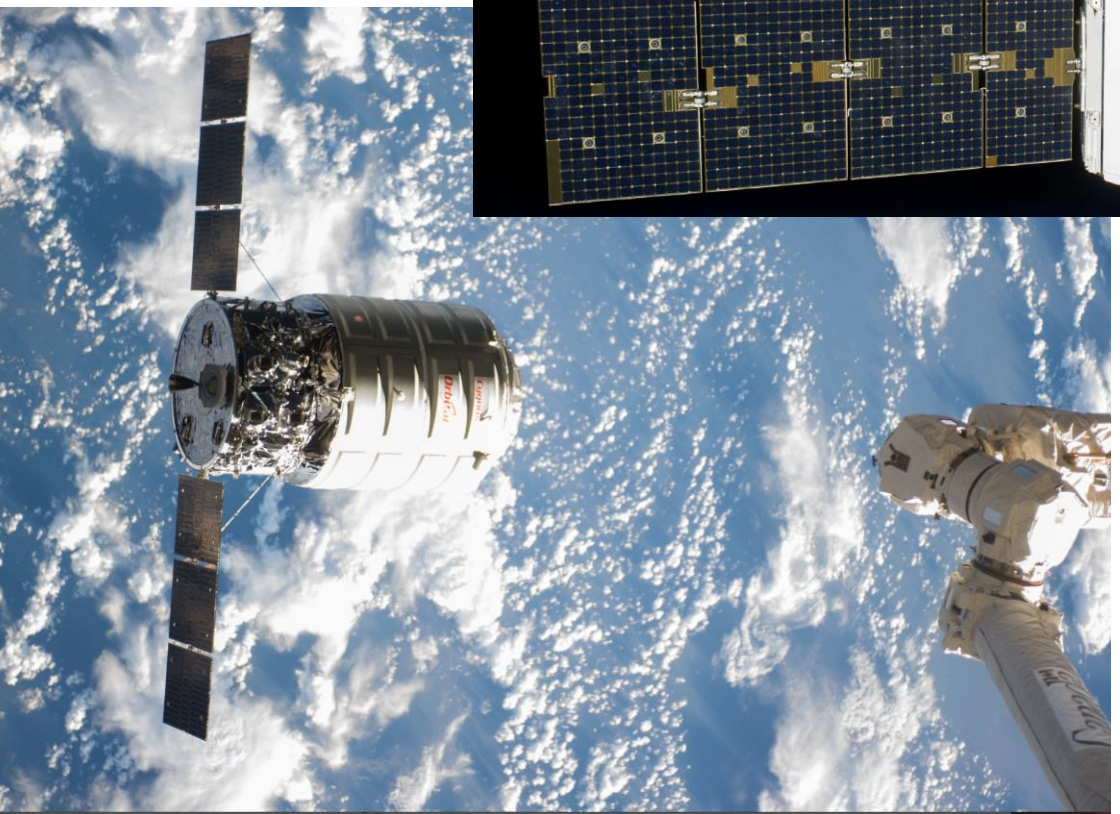




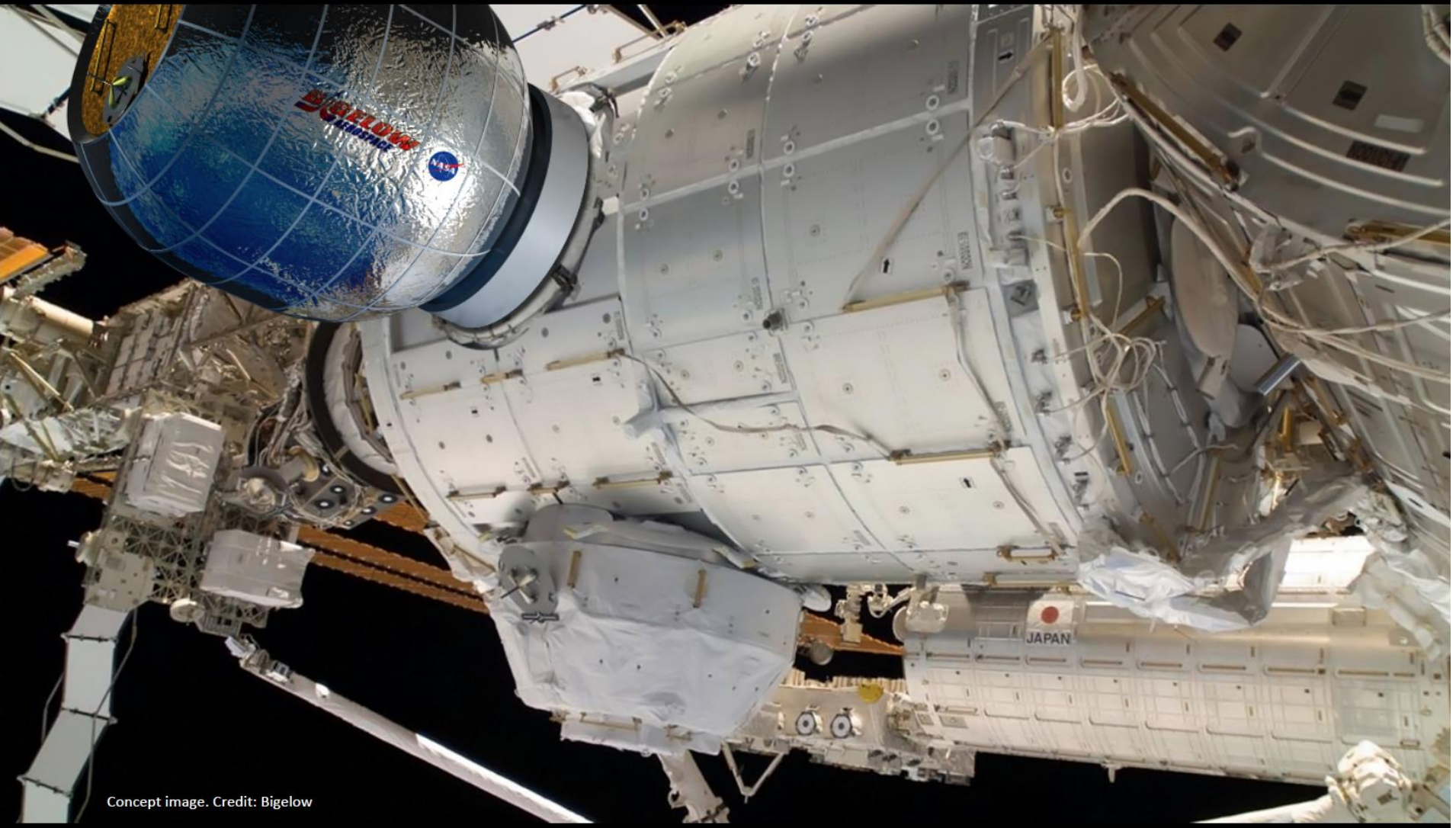


Commercial Cargo



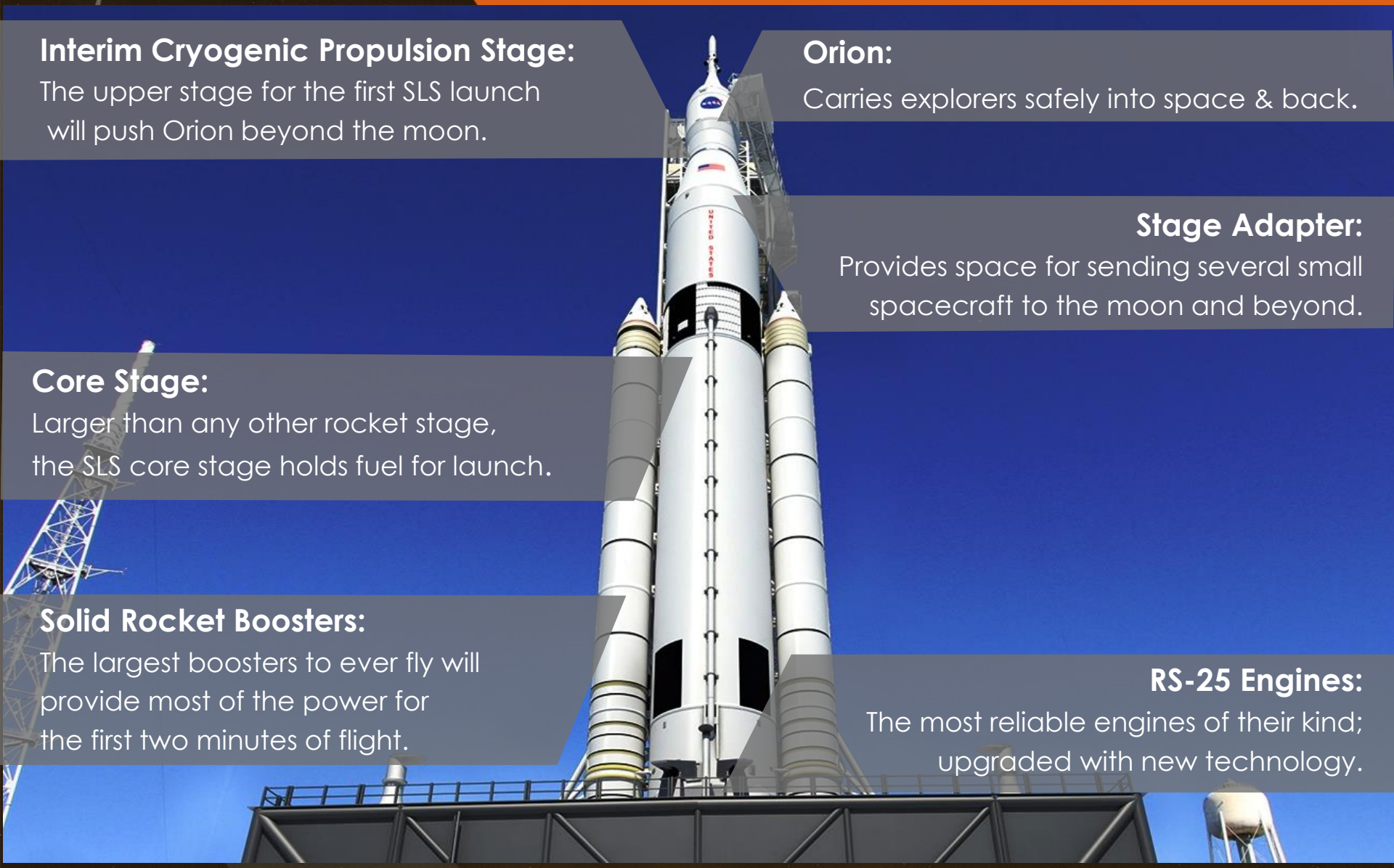


Commercial Partnerships



Concept image. Credit: Bigelow

THE WORLD'S MOST POWERFUL ROCKET



Interim Cryogenic Propulsion Stage:
The upper stage for the first SLS launch will push Orion beyond the moon.

Orion:
Carries explorers safely into space & back.

Stage Adapter:
Provides space for sending several small spacecraft to the moon and beyond.

Core Stage:
Larger than any other rocket stage, the SLS core stage holds fuel for launch.

Solid Rocket Boosters:
The largest boosters to ever fly will provide most of the power for the first two minutes of flight.

RS-25 Engines:
The most reliable engines of their kind; upgraded with new technology.

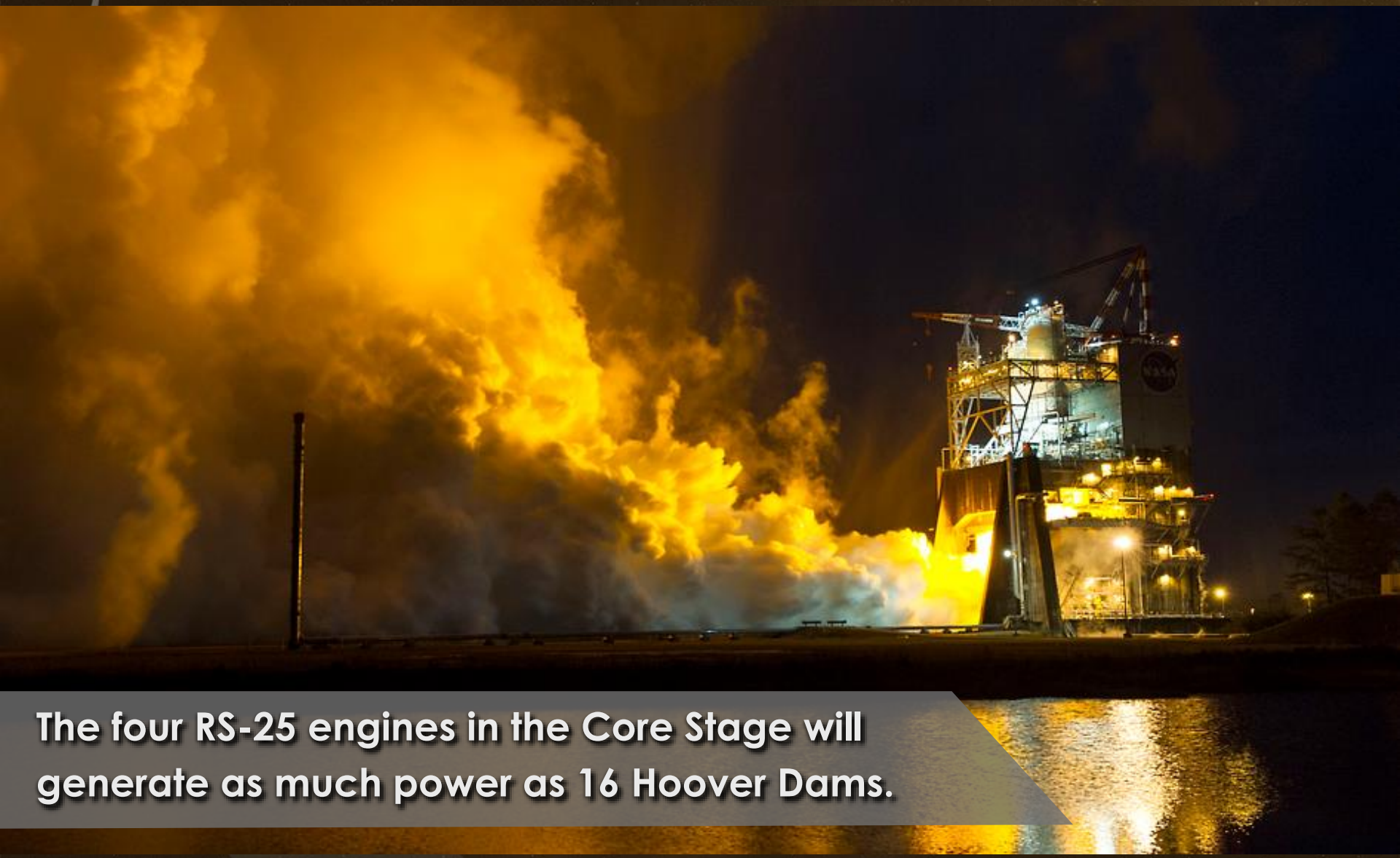
LAUNCHING THE JOURNEY

In December 2014, the Journey to Mars took a huge leap forward with Orion's first flight, Exploration Flight Test-1.

BUILDING A BETTER BOOSTER

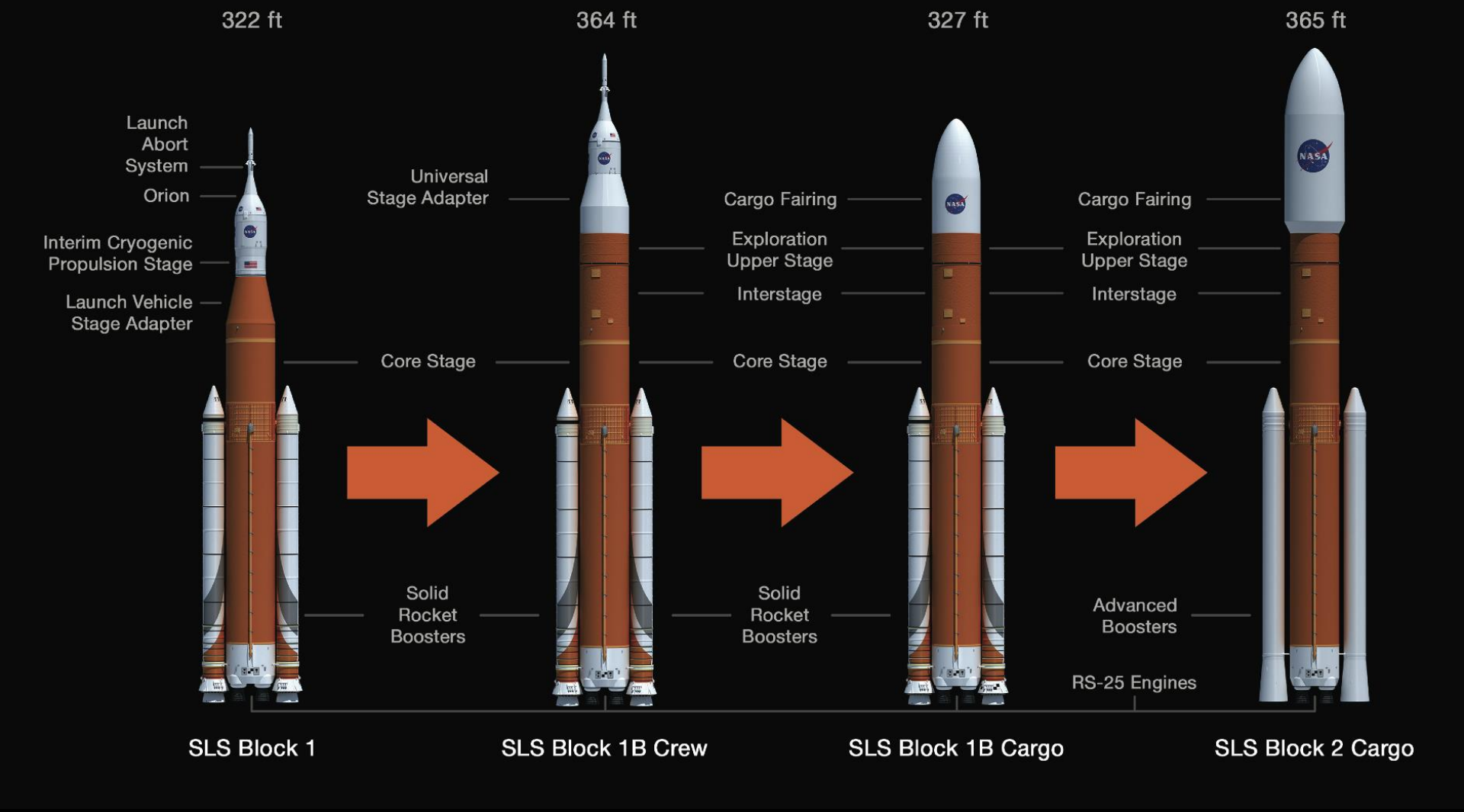
Each of the two SLS solid rocket boosters weighs 1.6 million pounds, or as much as four blue whales. Each booster generates 3.6 million pounds of thrust.

DESIGNED FOR PERFORMANCE

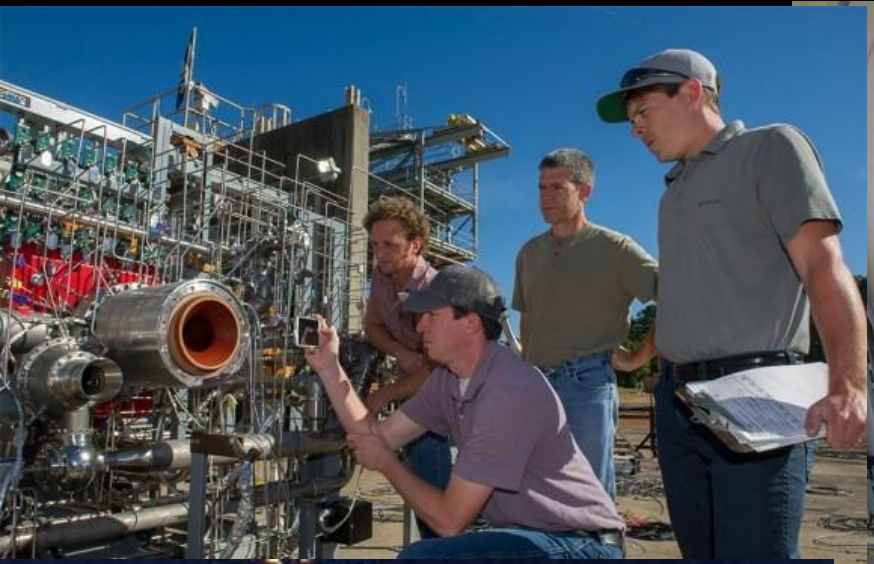


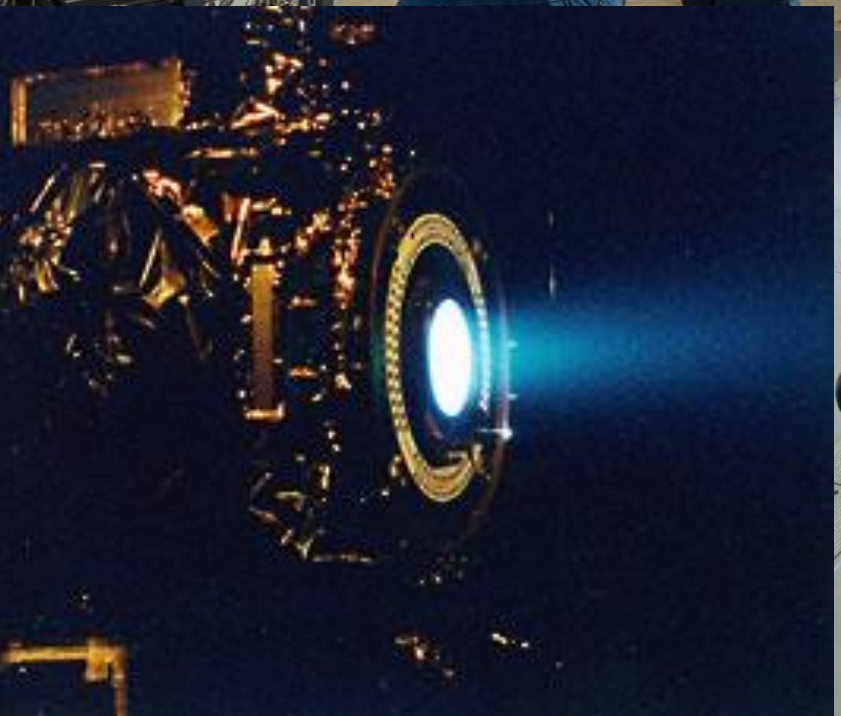
The four RS-25 engines in the Core Stage will generate as much power as 16 Hoover Dams.

Future Evolution Plans for Space Launch System (SLS)

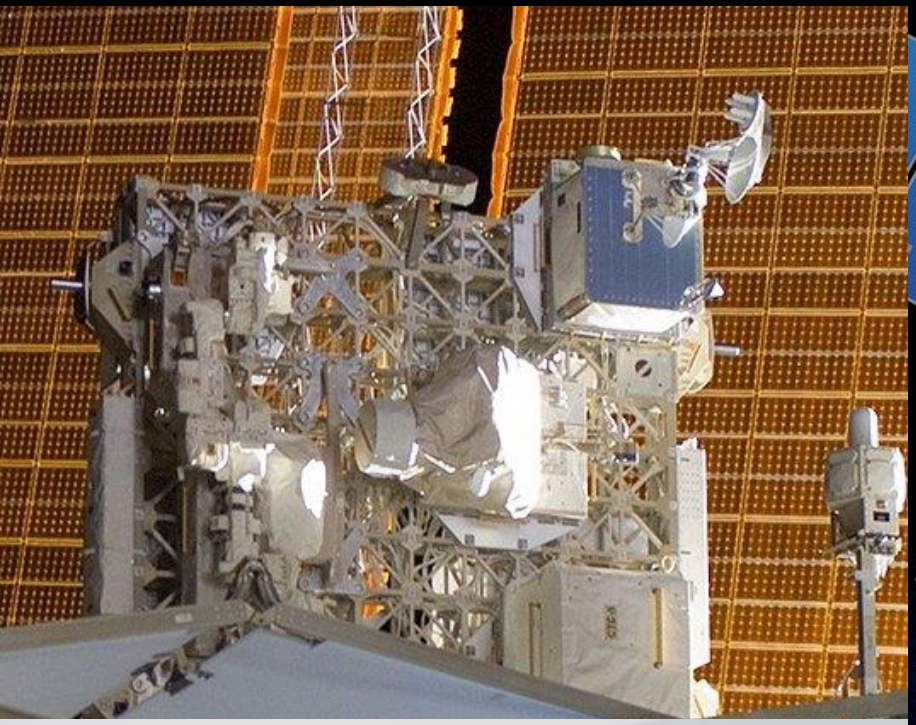


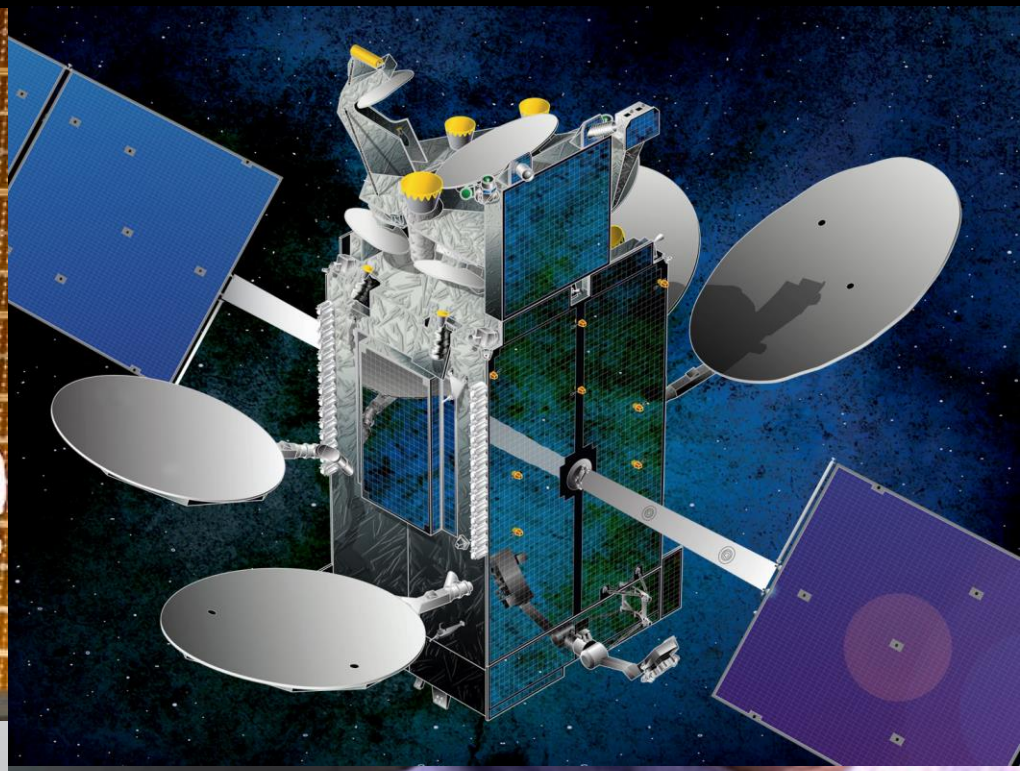
Propulsion Research





Communications





Next Generation Space Suits

Growing Plants in space

Staying Healthy – Human Research Program (HRP)

ISS Medical Project

Human Health and Countermeasures

Exploration Medical Capabilities

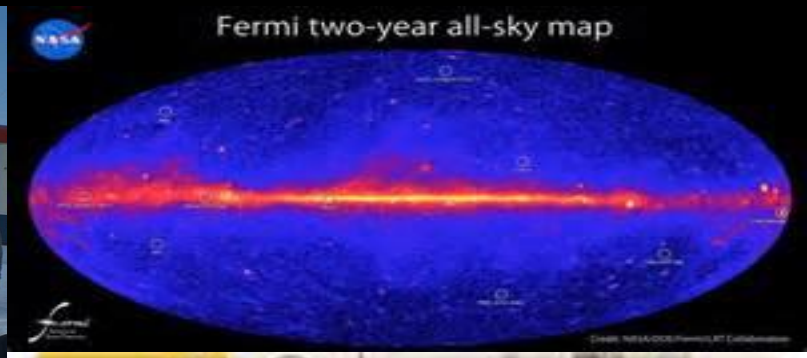
Behavioral Health And Performance

Space Human Factors And Habitability

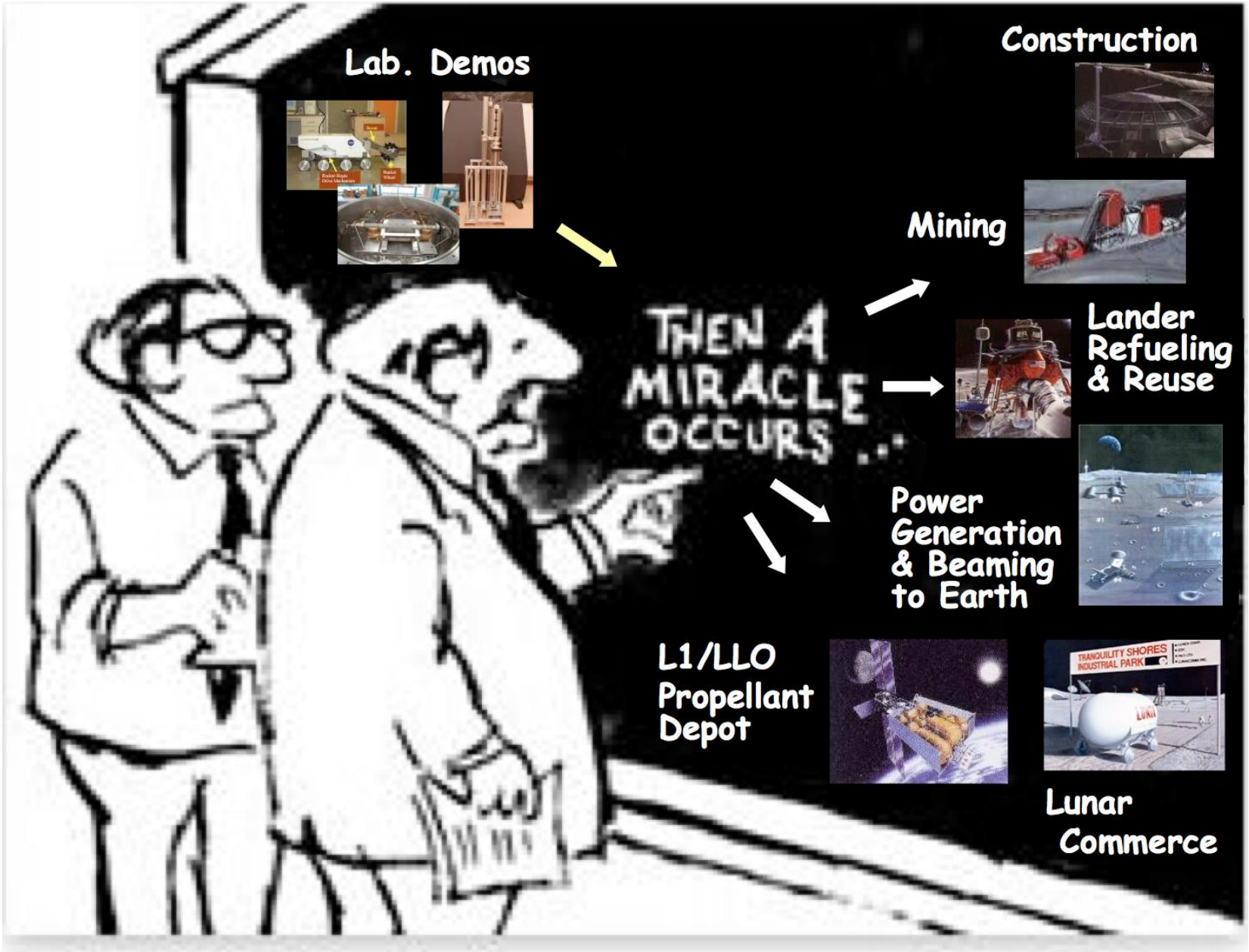
Science Management

Habitat studies

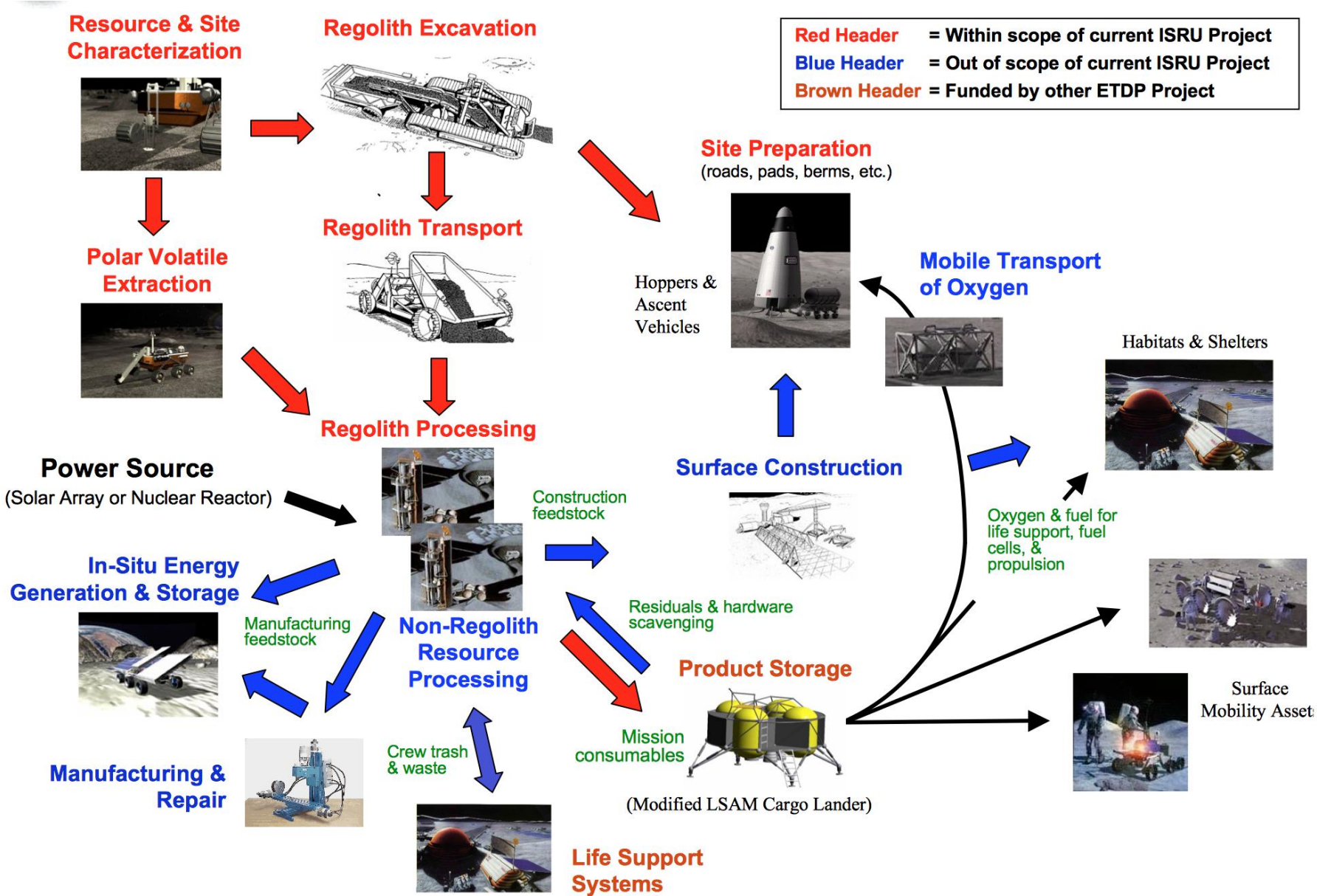
Radiation studies



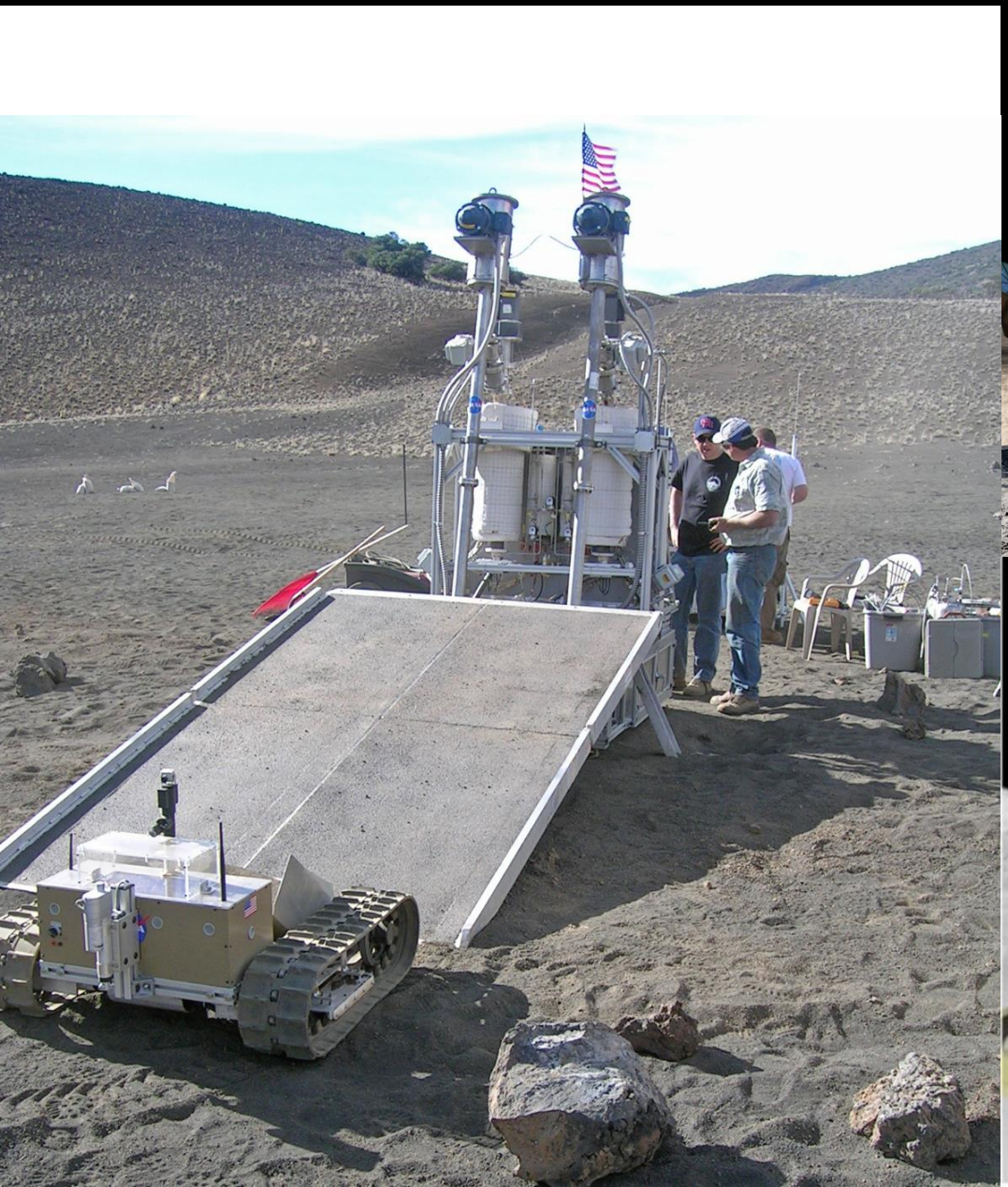
In Space Resource Utilization

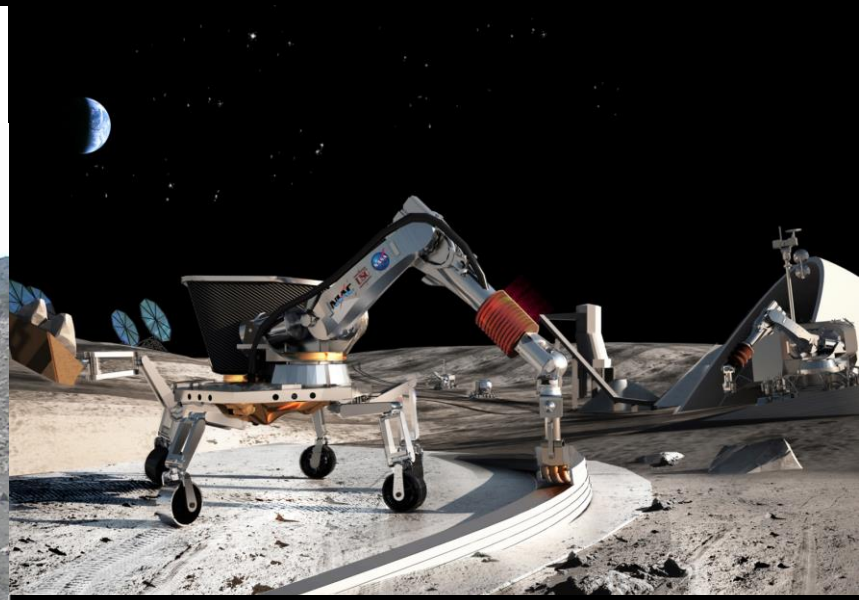


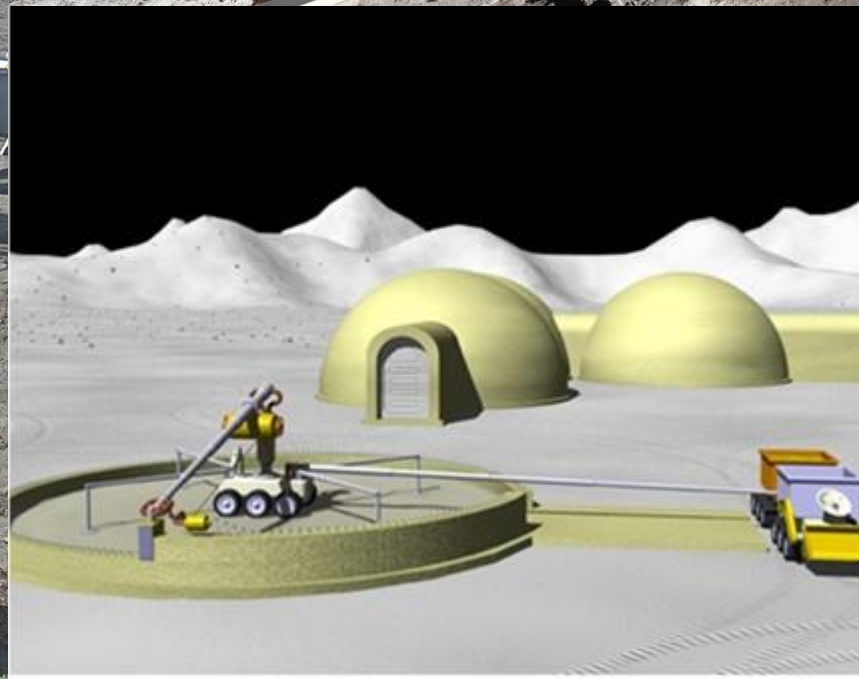
In Space Resource Utilization



In Space Resource Utilization

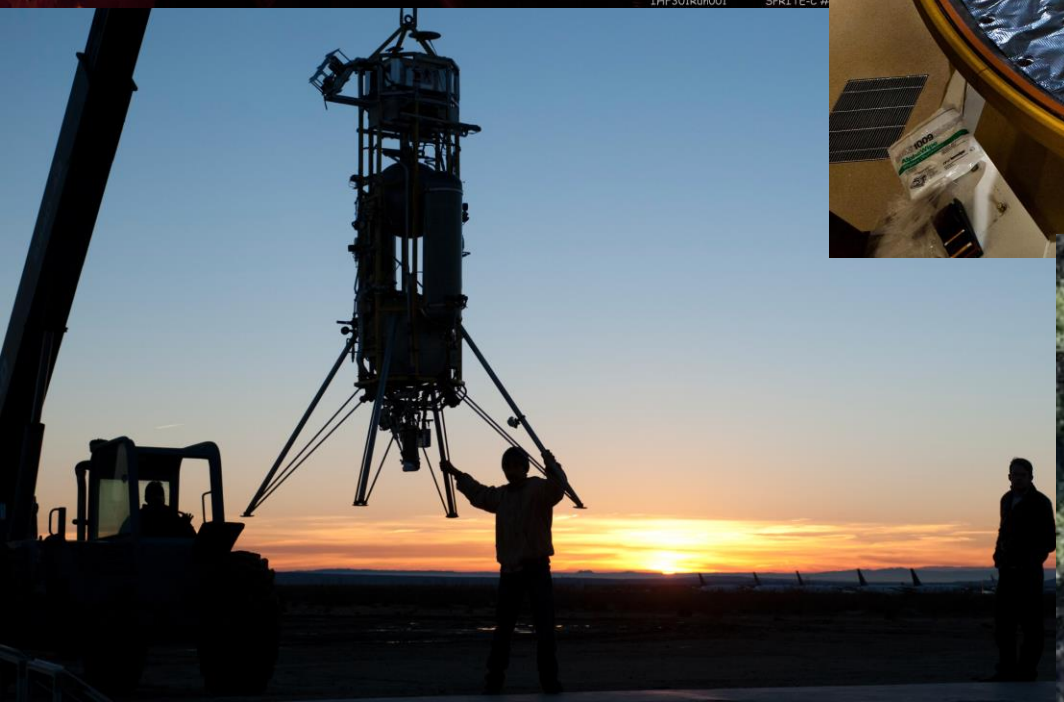






Surface Power and Mobility

Ascent and Descent



How to get involved?

Check for NASA solicitations: https://nspires.nasaprs.com

NASA Research
- Solicitations

View Solicitations
- Future
- Open
- Closed/Past Selected

Solicitations

Open Solicitations

NOTE: Click on the Solicitation # link for information on a specific solicitation. You may refine this list or change its scope by entering keywords corresponding to the listed columns.

Keywords: Display 25 records per page

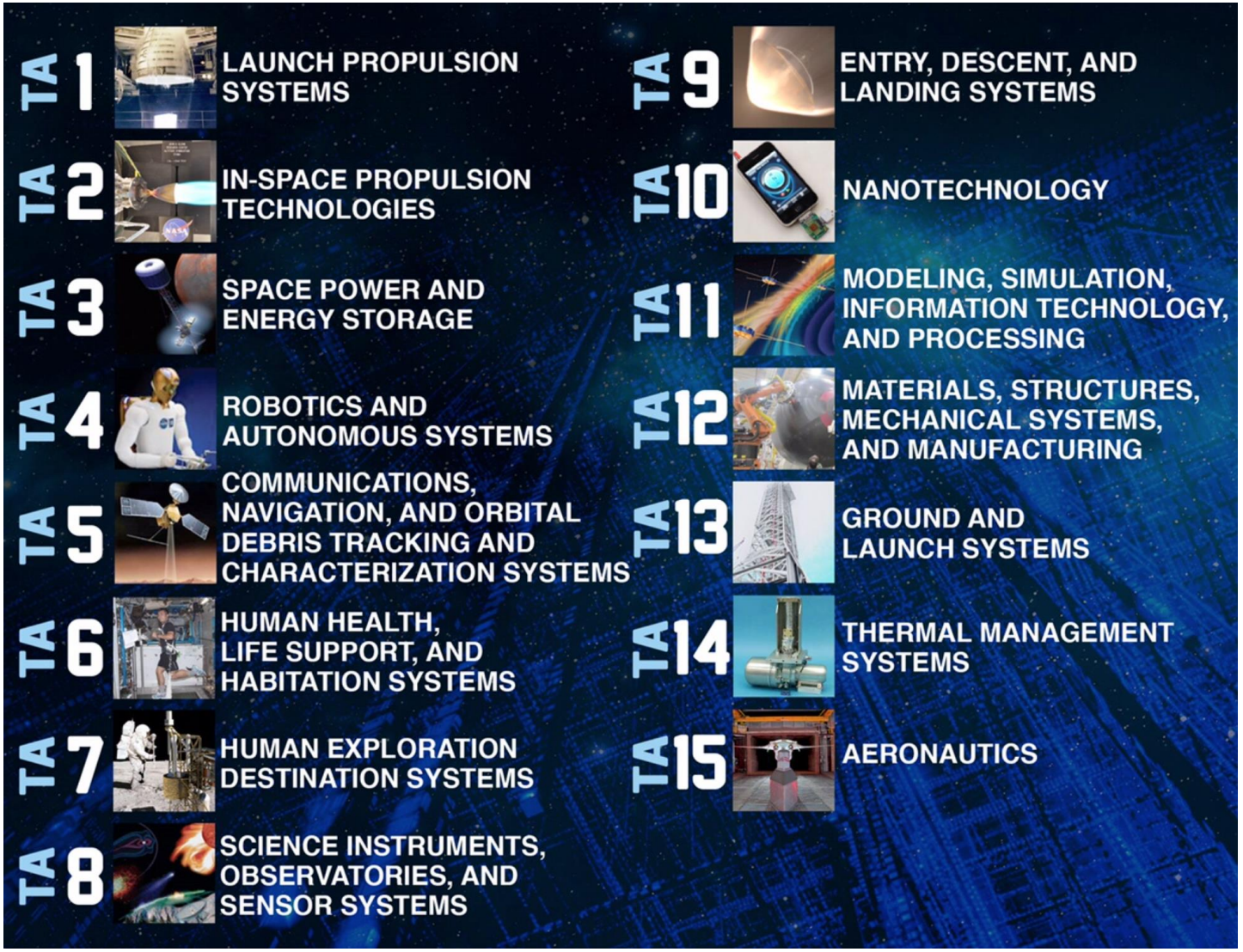
First Previous 1 2 3 Next Last

Showing 1 to 25 of 72 records

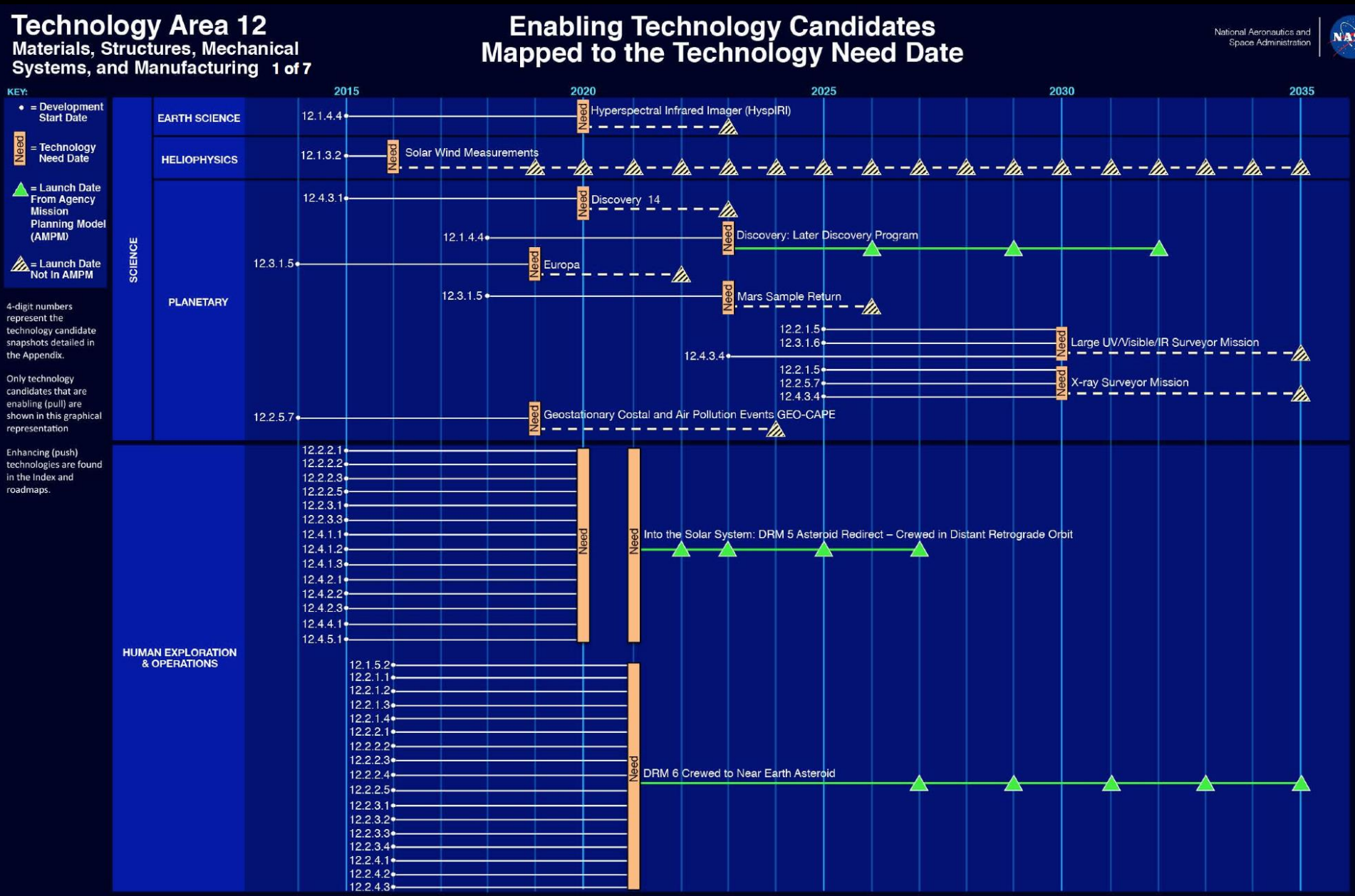
Solicitation Title	Solicitation #	Released	NOI Due	Proposal Due
2016 Dual Use Technology Development Cooperative Agreement Notice (CAN) at NASA George C. Marshall Space Flight Center	NNM16567212C	10/09/2015	--	--
2016 Experimental Program to Stimulate Competitive Research (EPSCoR)	NNH16ZHA001C	12/11/2015	01/25/2016	03/21/2016
Advanced Component Technology	NNH15ZDA001N-ACT	02/13/2015	--	--
Advanced Information Systems Technology	NNH15ZDA001N-AIST	02/13/2015	--	--
Airborne Instrument Technology Transition	NNH15ZDA001N-AITT	02/13/2015	--	--
Announcement of Opportunity soliciting for proposals using the Human Spaceflight Analogue "Bedrest" non-US proposers only)	ESA_AO_16_BR	02/01/2016	--	03/15/2016
Appendix G: Physiological and Behavioral Responses in Humans to Intermittent Artificial Gravity during Bed Rest	NNJ15ZSA001N-AGBR	12/01/2015	--	(See Announcement)
Astrophysics Research and Analysis	NNH15ZDA001N-APRA	02/13/2015	01/22/2016	03/18/2016
Astrophysics Theory	NNH15ZDA001N-ATP	02/13/2015	--	--
Atmospheric Composition: Modeling and Analysis	NNH15ZDA001N-ACMAP	02/13/2015	--	--
Biodiversity	NNH15ZDA001N-BIO	02/14/2015	01/15/2016	03/18/2016
Carbon Cycle Science	NNH15ZDA001N-CARBON	02/13/2015	--	--
Carbon Monitoring System	NNH15ZDA001N-CMS	02/14/2015	01/29/2016	03/29/2016
Computational Modeling Algorithms and Cyberinfrastructure	NNH15ZDA001N-CMAC	02/13/2015	--	--
Cooperative Agreement Notice (CAN) 2016 at NASA John C. Stennis Space Center	NNS16ZDA002C	01/27/2016	--	--
D.2 Leading Edge Aeronautics Research for NASA Project (LEARN3)	NNH15ZEA001N-LEARN3	10/20/2015	--	(See Announcement)
DRAFT Heliophysics Guest Investigator ROSES 2016	NNH16ZDAHGIDRAFT	01/15/2016	--	--
DRAFT Solar System Exploration Research Virtual Institute (SSERVI) Cooperative Agreement Notice	NNH16ZDA002J	01/15/2016	--	--
Earth Science Applications: Socioeconomic Benefits	NNH15ZDA001N-SEB	02/14/2015	01/22/2016	03/24/2016
Earth Science U.S. Participating Investigator	NNH15ZDA001N-ESUSPI	02/13/2015	--	--

How to get involved?

Search one of NASA's Technology Roadmaps:
http://www.nasa.gov/offices/oct/home/roadmaps/index.html

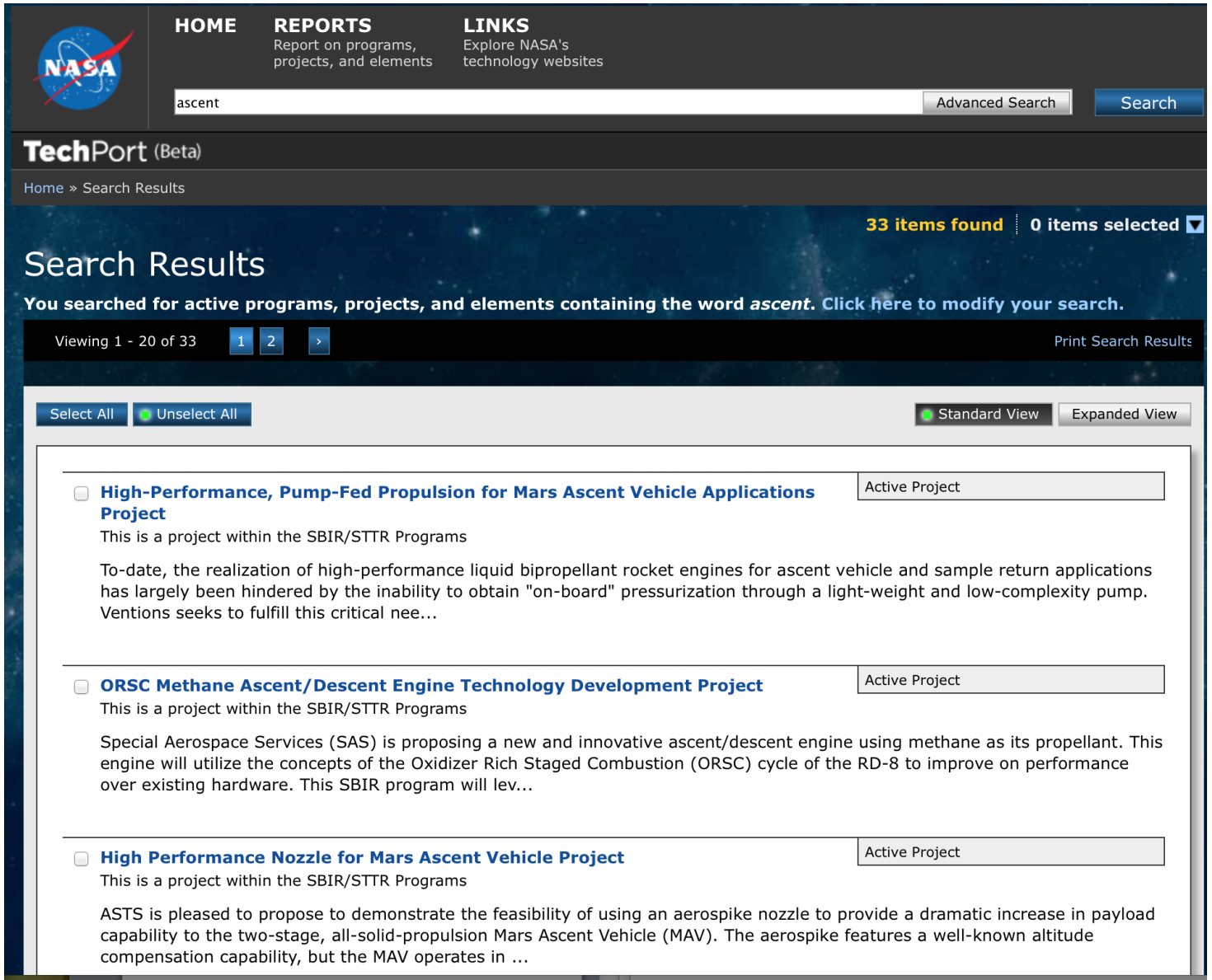


Technology Road Maps



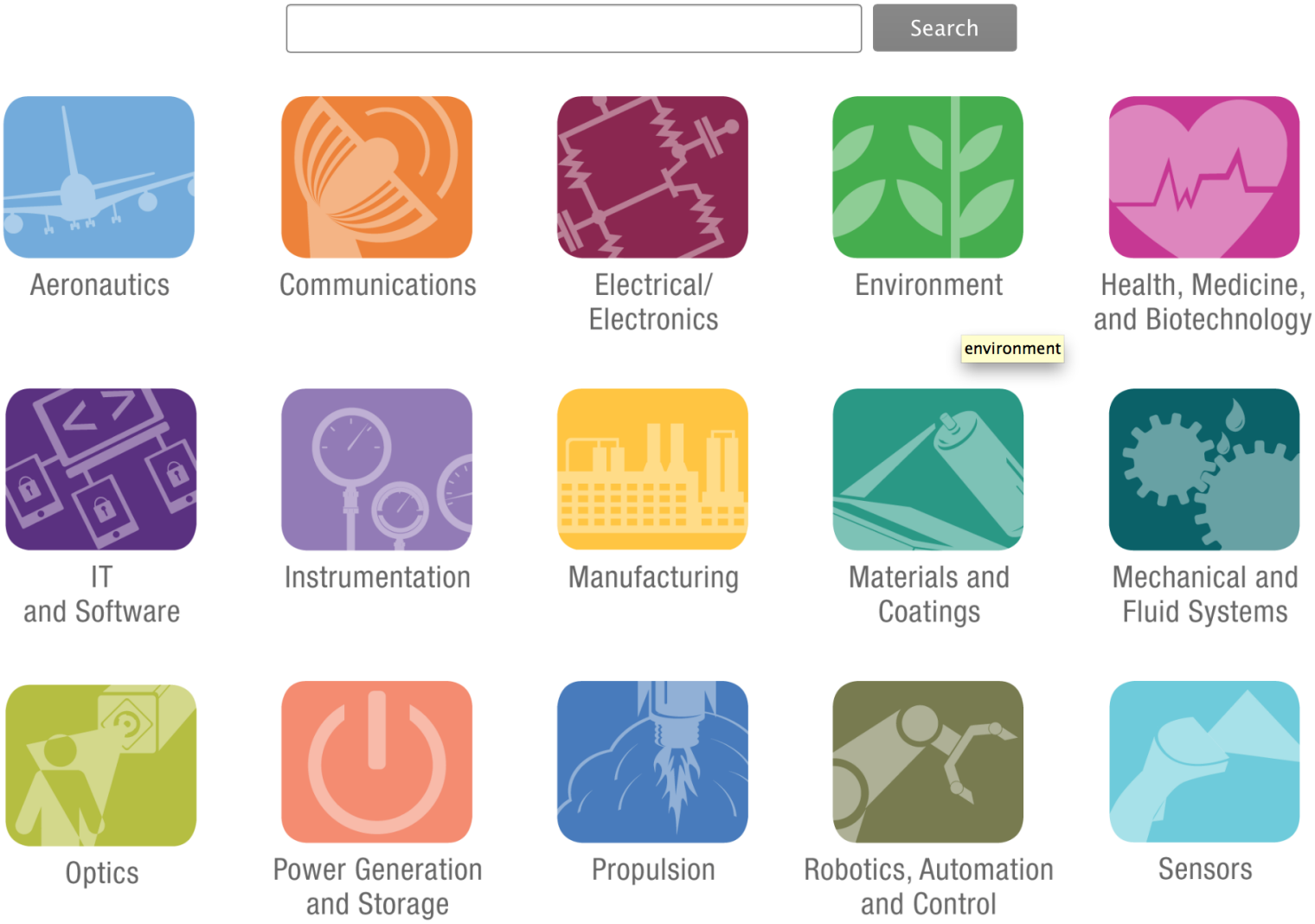
How to get involved?

Search TechPort for current and past technologies: https://techport.nasa.gov



How to get involved?

Search for patents, license opportunities, spinoffs and more: www.technology.nasa.gov



Questions?