



WANTED: New Technologies for NASA's Journey to Mars

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Huntsville, Alabama

January 24, 2016

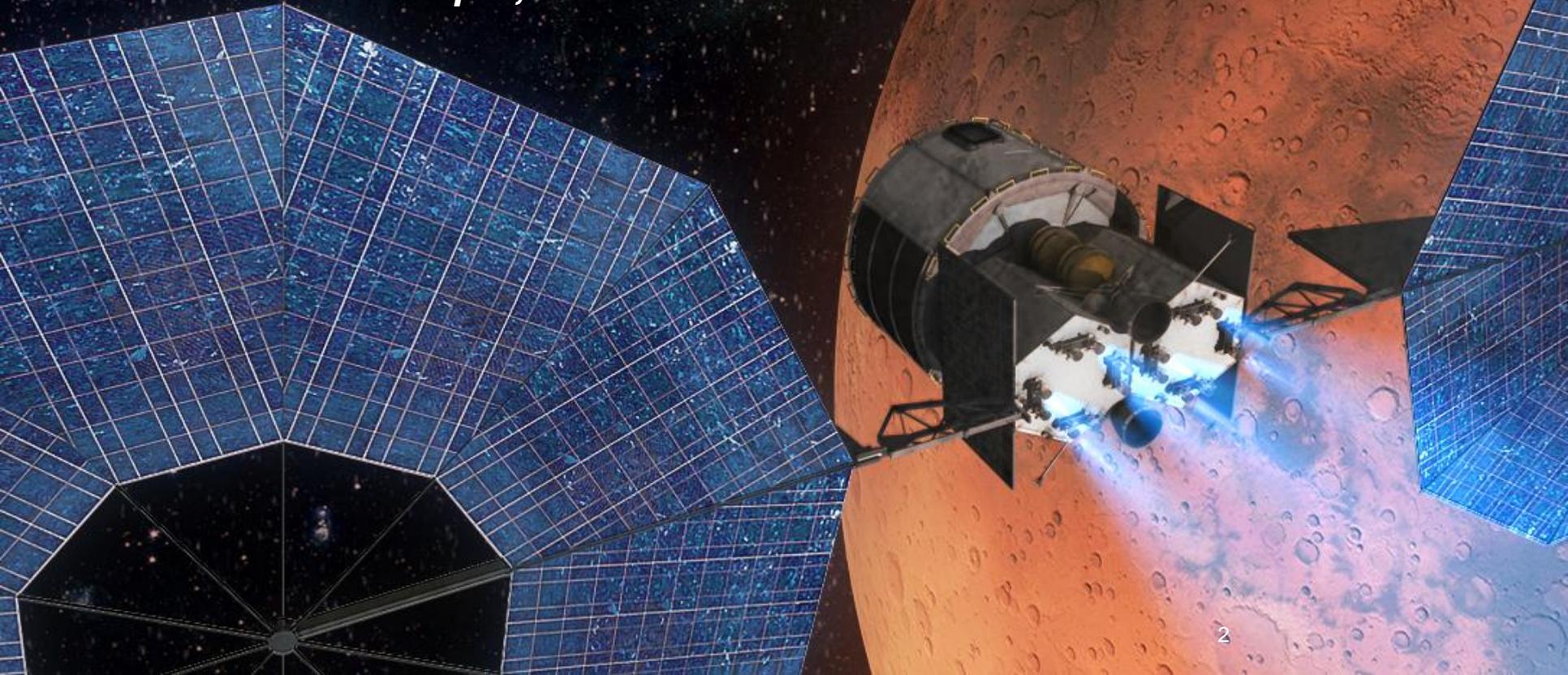




Pioneering Space - Goals

“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

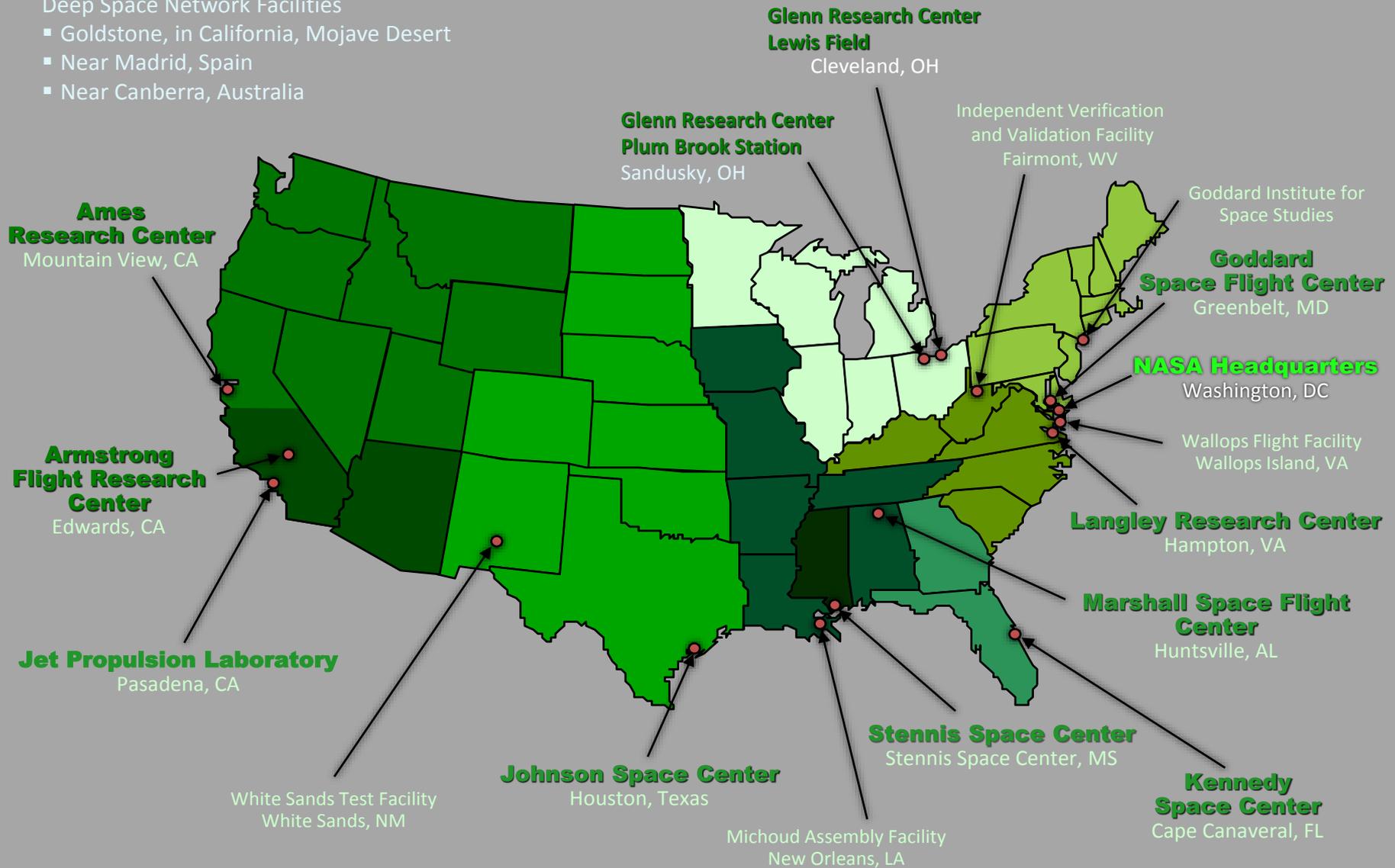


NASA Centers and Installations



Deep Space Network Facilities

- Goldstone, in California, Mojave Desert
- Near Madrid, Spain
- Near Canberra, Australia



JOURNEY TO MARS



HUBBLE SPACE TELESCOPE



INTERNATIONAL SPACE STATION



SPACE LAUNCH SYSTEM



ORBITERS



LANDERS



DEIMOS

PHOBOS

MARS TRANSFER HABITAT



SOLAR ELECTRIC PROPULSION



ASTEROID REDIRECT MISSION

ORION CREWED SPACECRAFT



COMMERCIAL CARGO AND CREW



TECHNOLOGY
EXPLORATION
SCIENCE

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

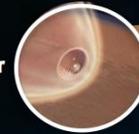
105+ MT SLS



Advanced Propulsion



EDL Pathfinder



Mars Surface

EDL/Lander



Long Duration Surface Systems



Transportation

130+ MT SLS



Long Duration Habitat

Working In Space



Exploration Augmentation Module

Staying Healthy



ISRU



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

All Paths Through Mars Orbit

ISS Deep Space & Mars Risk Reduction

Deep Space Mars Preparation



Mars Moon Missions



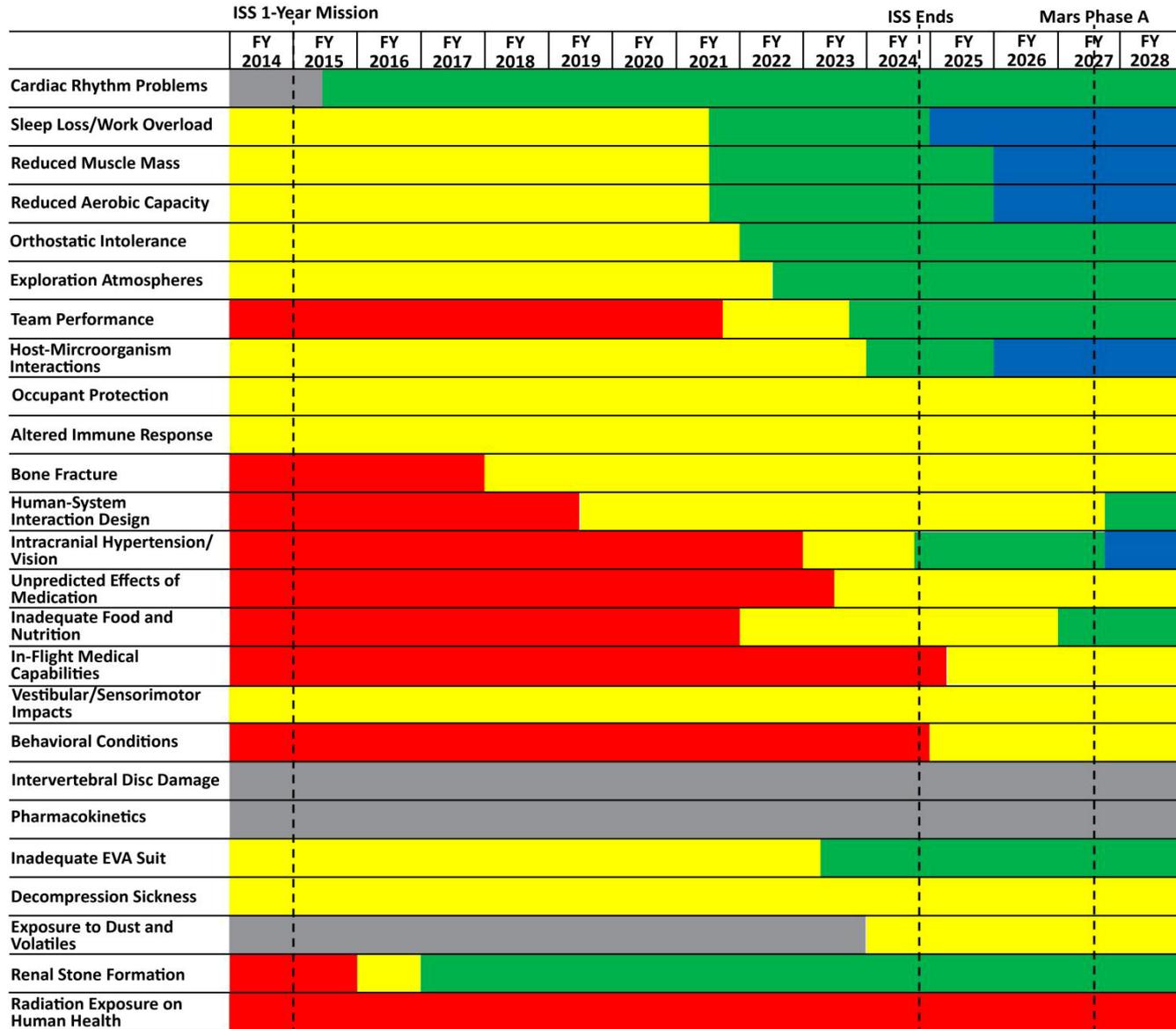
First Human Mission to Mars Surface



Long Duration Human Missions

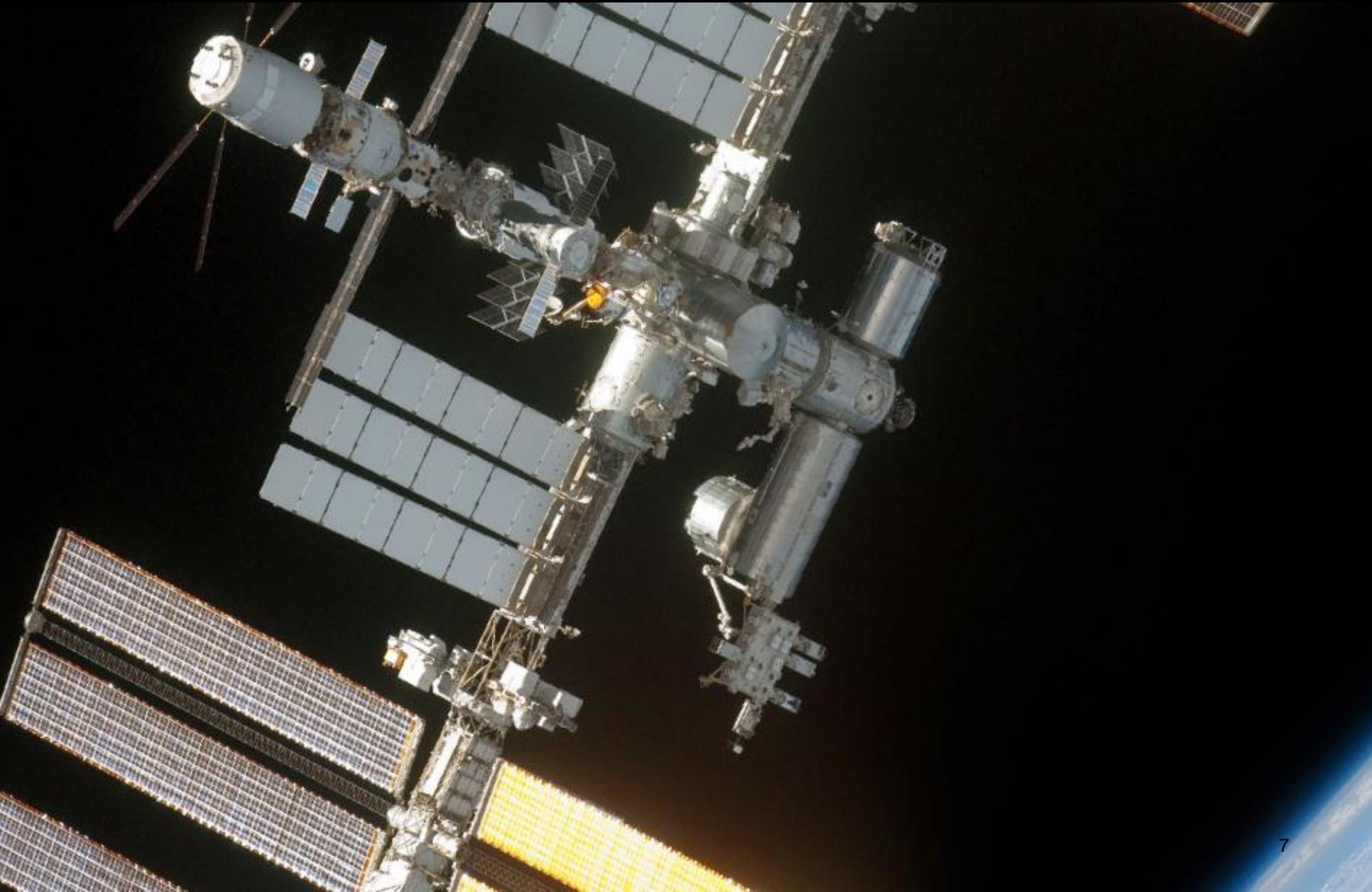
Missions

Solving Risks with Technology Development

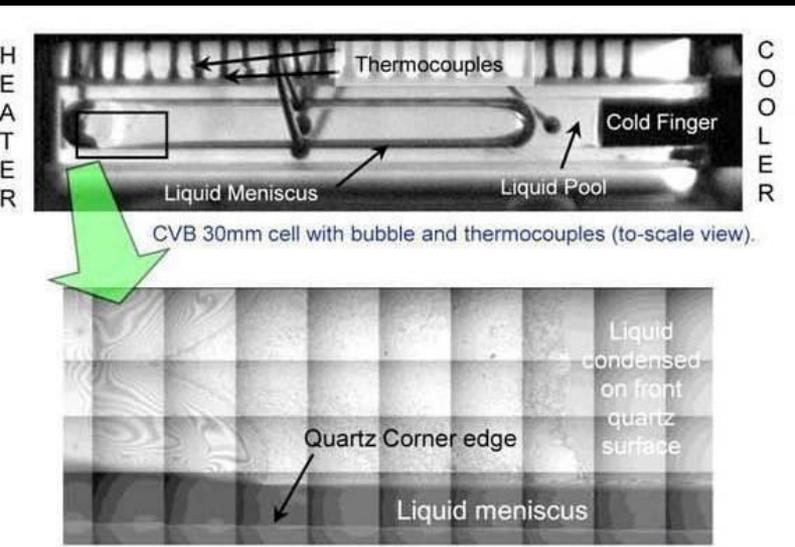
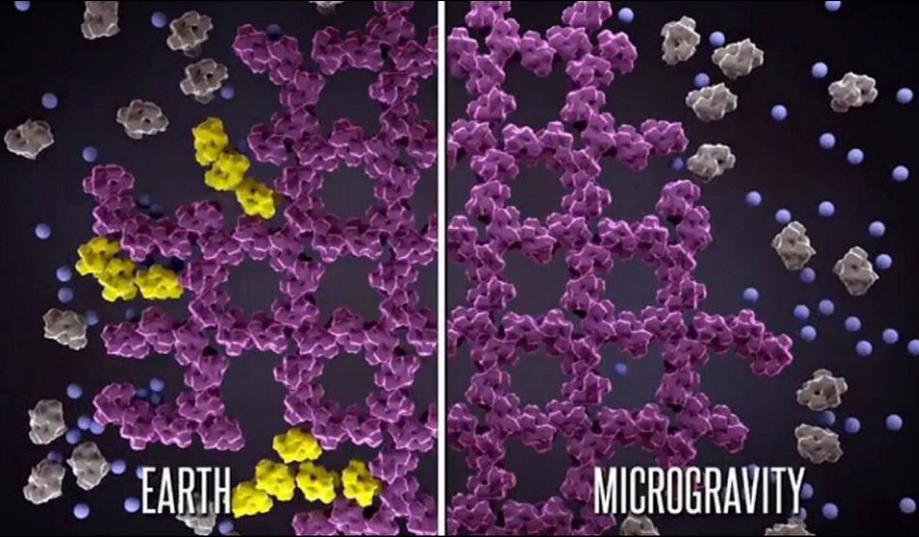


Research Rating: ■ Uncontrolled ■ Partially Controlled ■ Controlled ■ Optimized ■ Insufficient Data

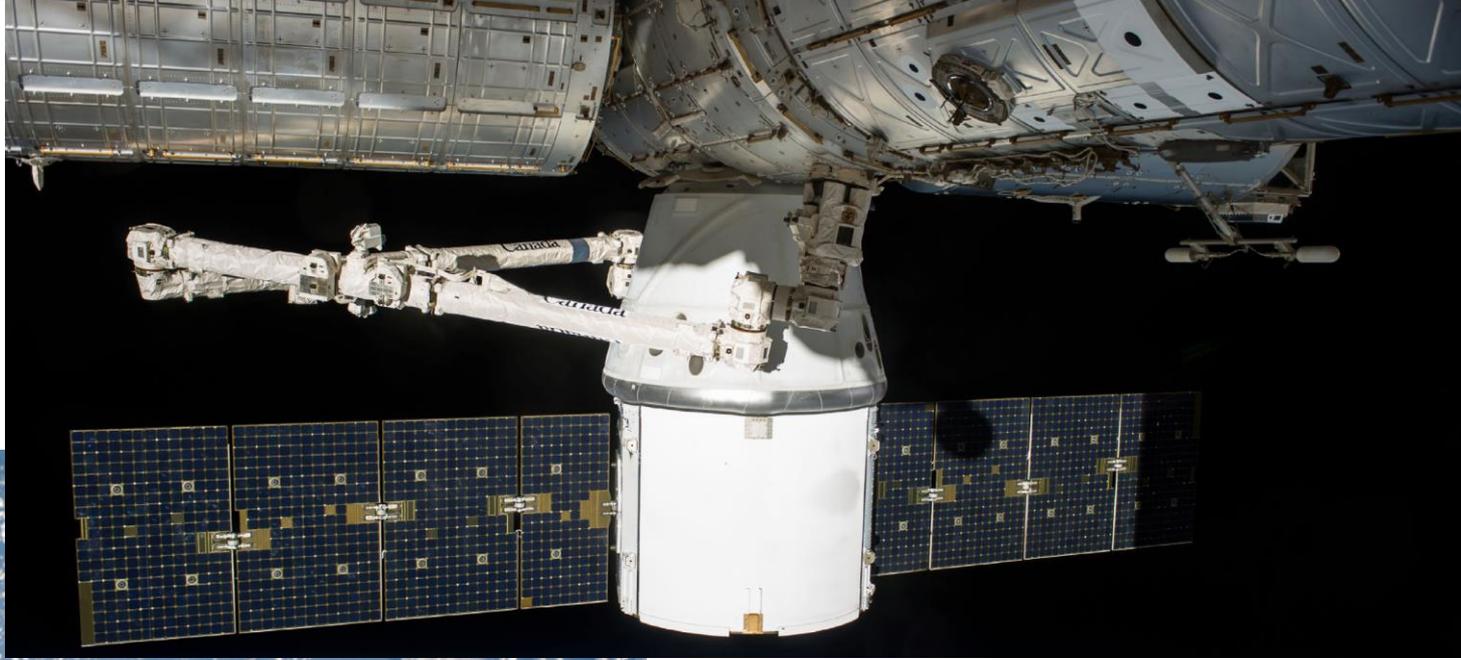
Earth Reliant Phase – Working on ISS



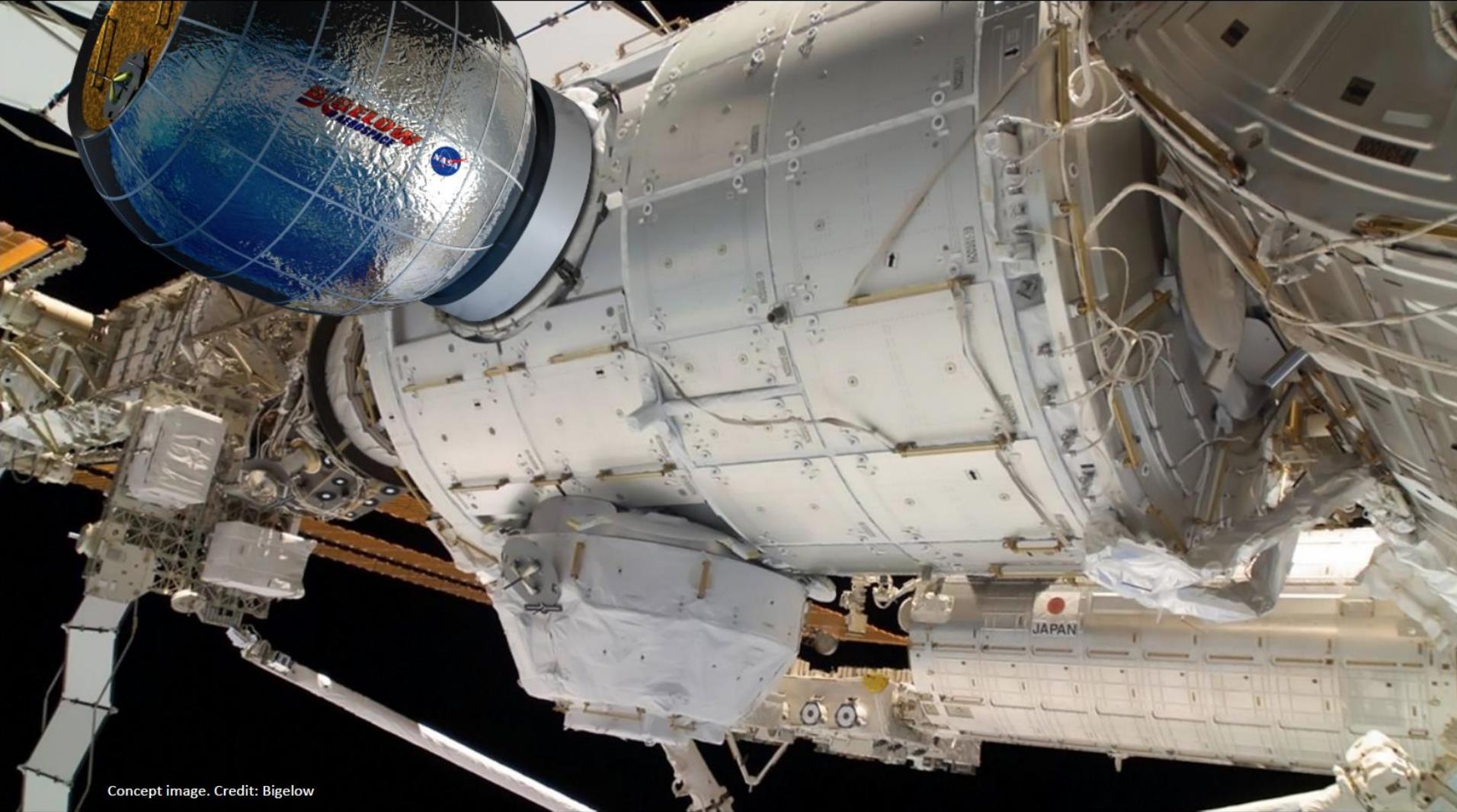
ISS Research



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:

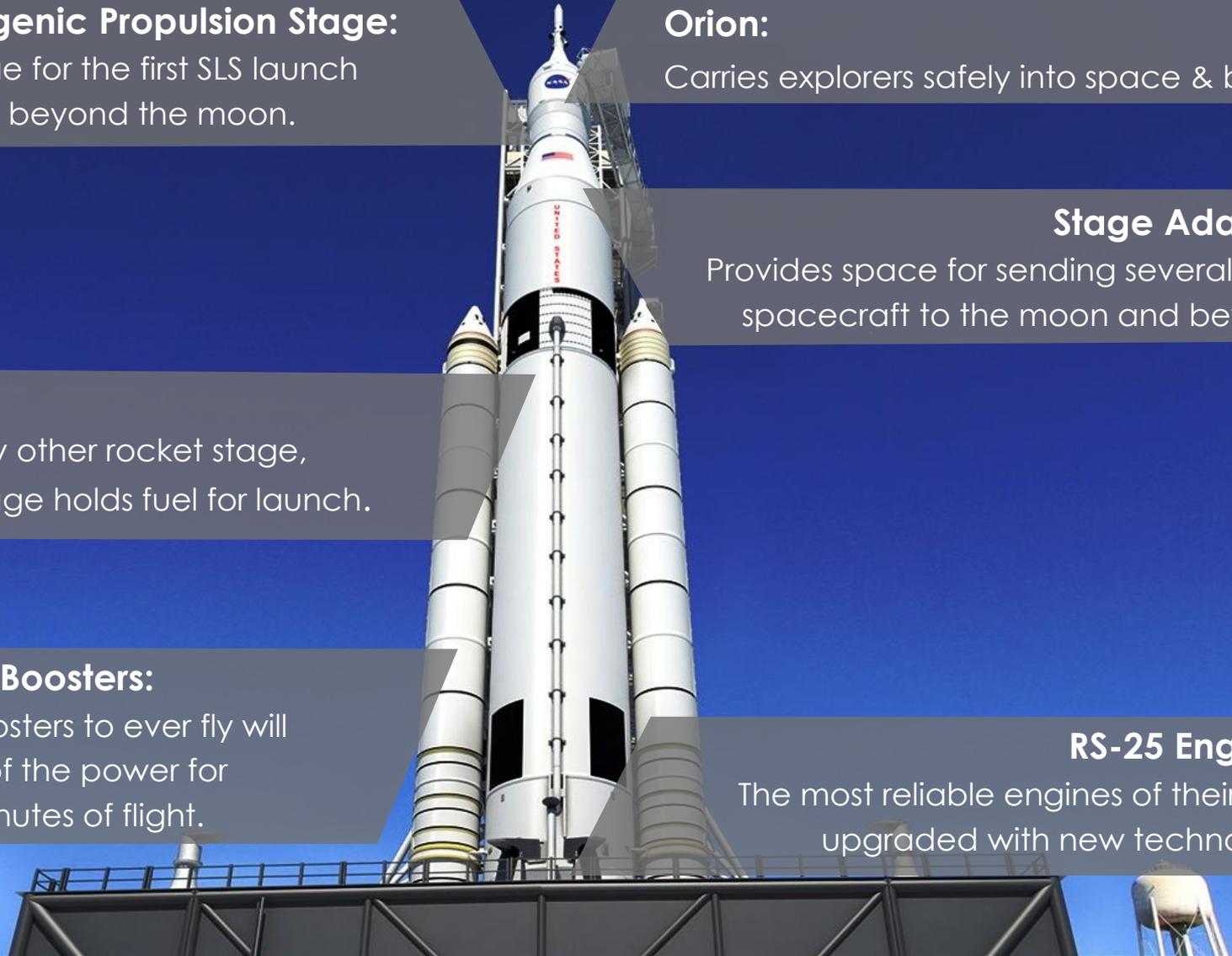
Larger than any other rocket stage, the SLS core stage holds fuel for launch.

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



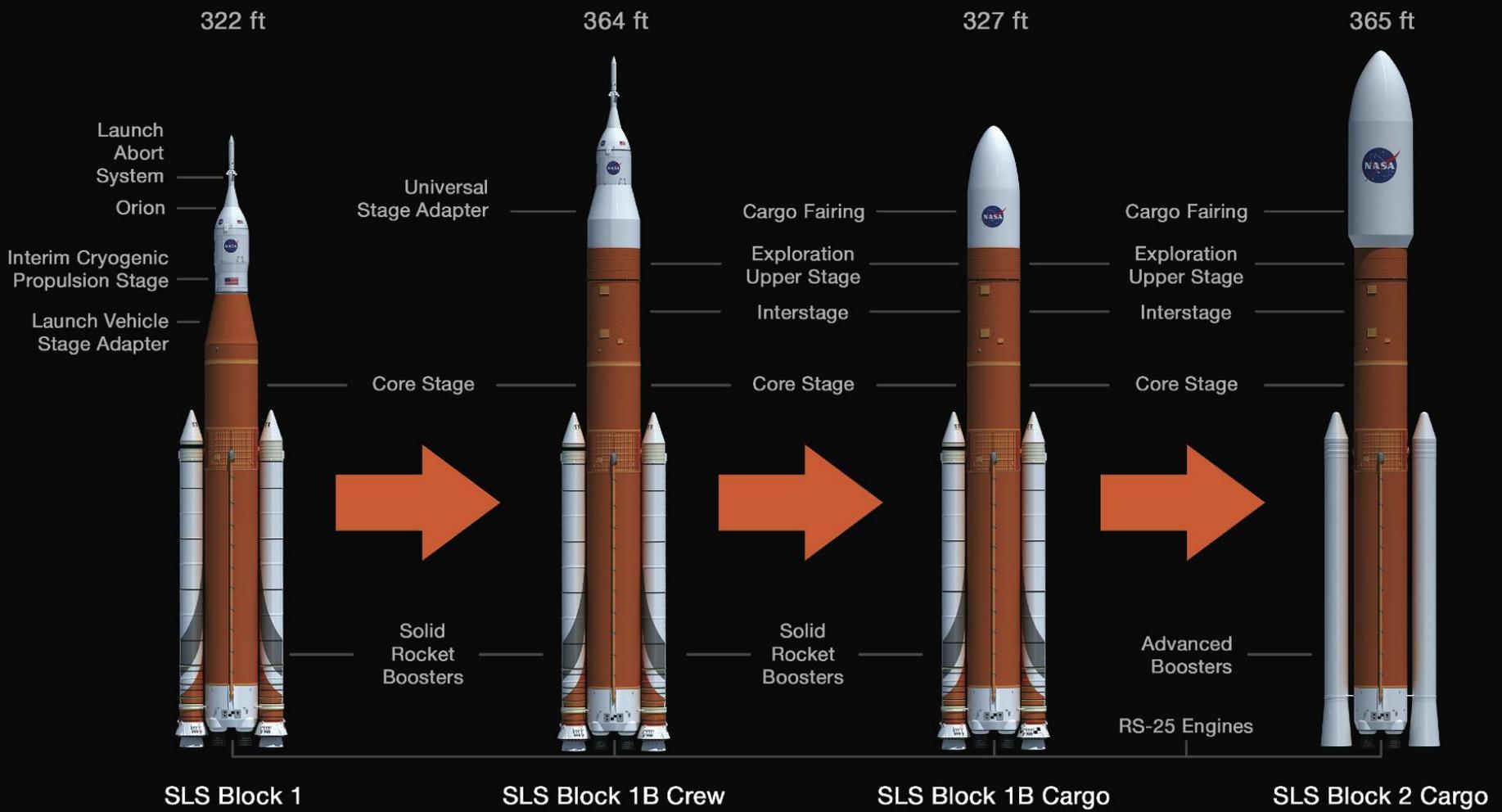
Each of the two SLS solid rocket boosters weighs 1.6 million pounds, or as much as four blue whales. Each booster generates 3.6 million pounds of thrust.



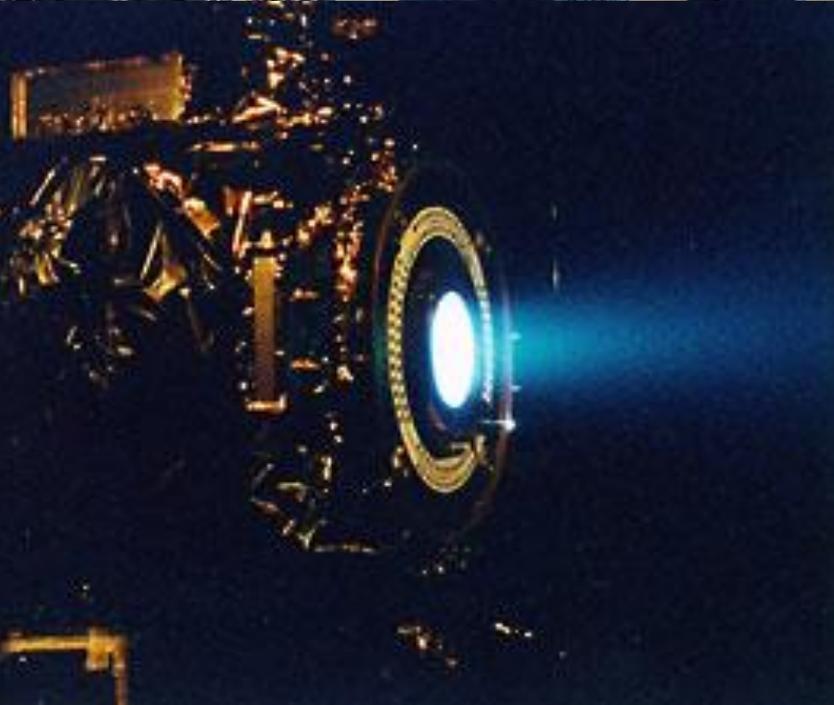
DESIGNED FOR PERFORMANCE

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

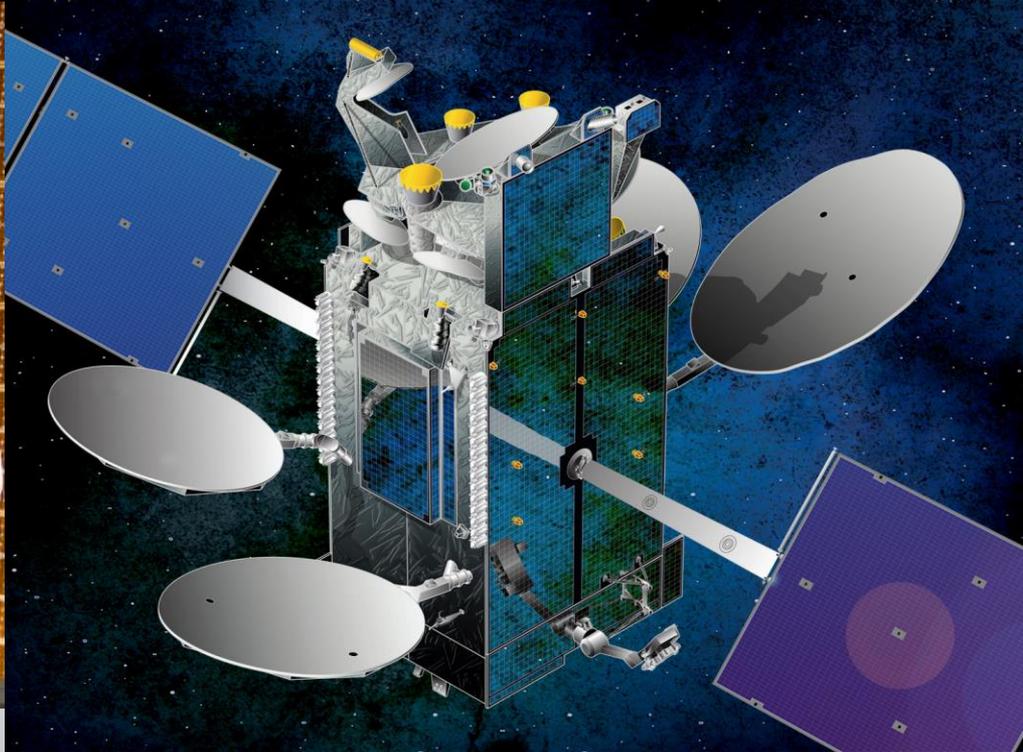
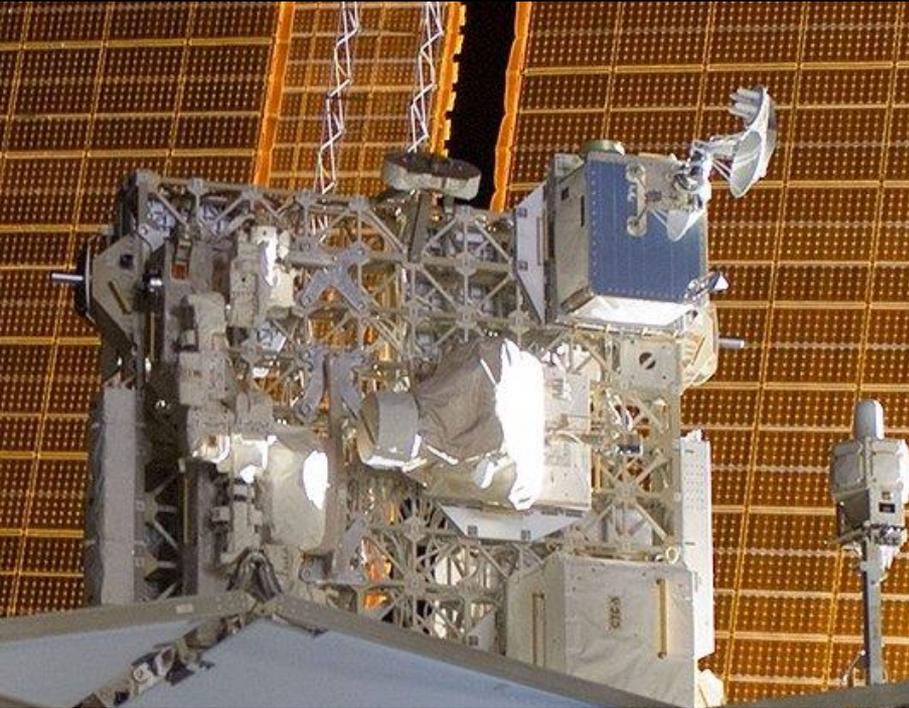
Future Evolution Plans for Space Launch System (SLS)



Propulsion Research



Communications



Next Generation Space Suits



Growing Plants in space



Staying Healthy – Human Research Program (HRP)



BHP



HHC



ExMC

ISS Medical Project

Human Health and Countermeasures

Exploration Medical Capabilities



ISSMP



SHFH



SRPE

Behavioral Health And Performance

Space Human Factors And Habitability

Science Management

Habitat studies



Deep Space Habitat
Concept Demonstrators

330-400
100 Decked
Narrow-track Base

On-Liner 2.0
100 Decked
Block Base

Expanded Station
3.0 Station

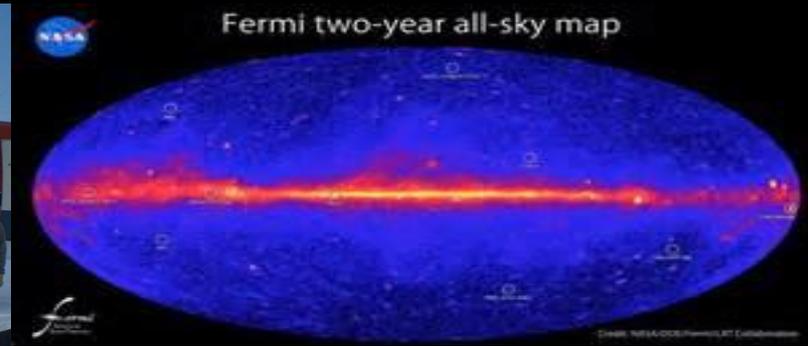
CAUTION
WATCH
YOUR STEP

Designing Low Cost
Physiological Studies

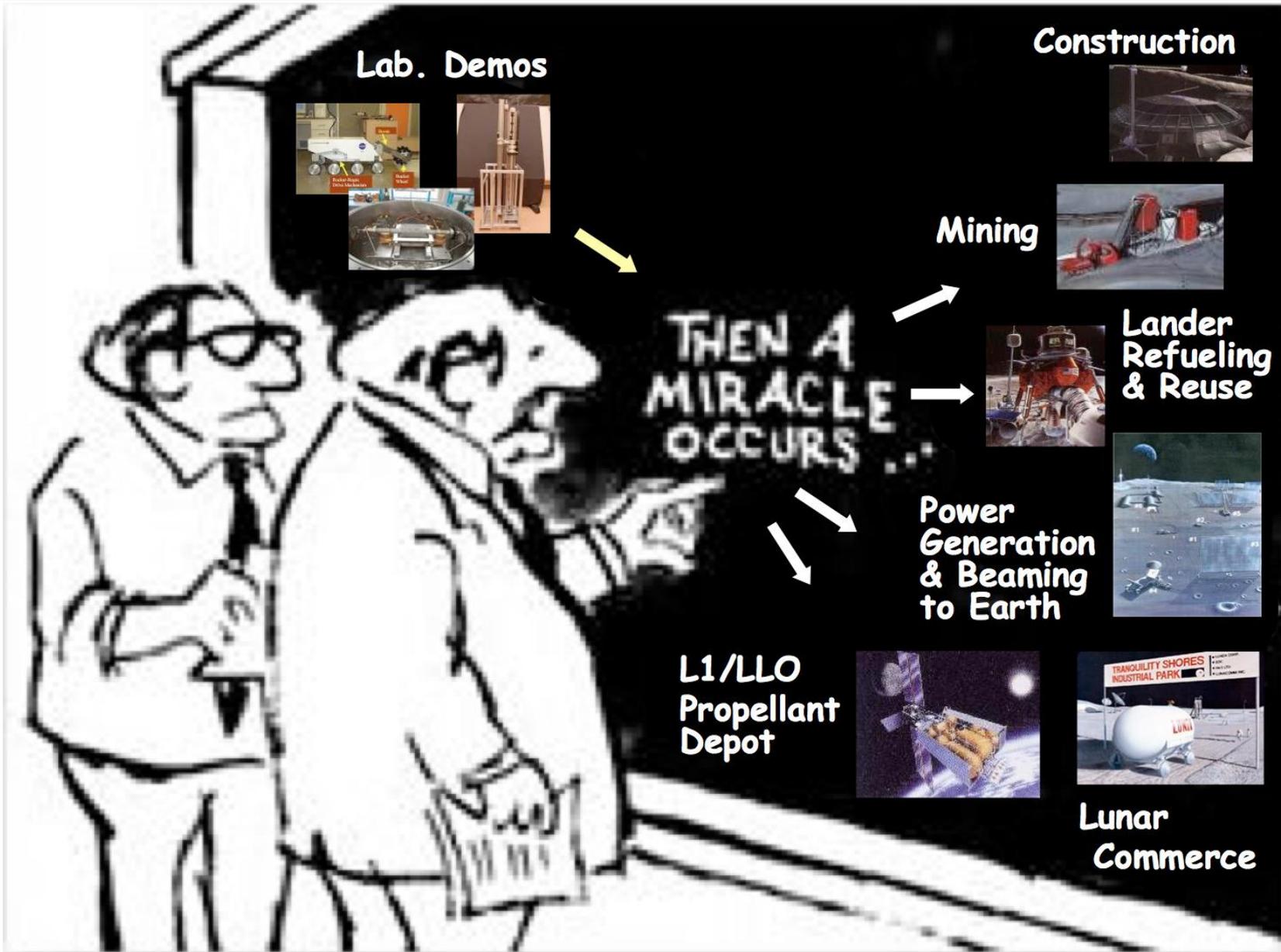
NASA's Deep Space
Habitat

Supporting the next
concept for living and
working in deep space

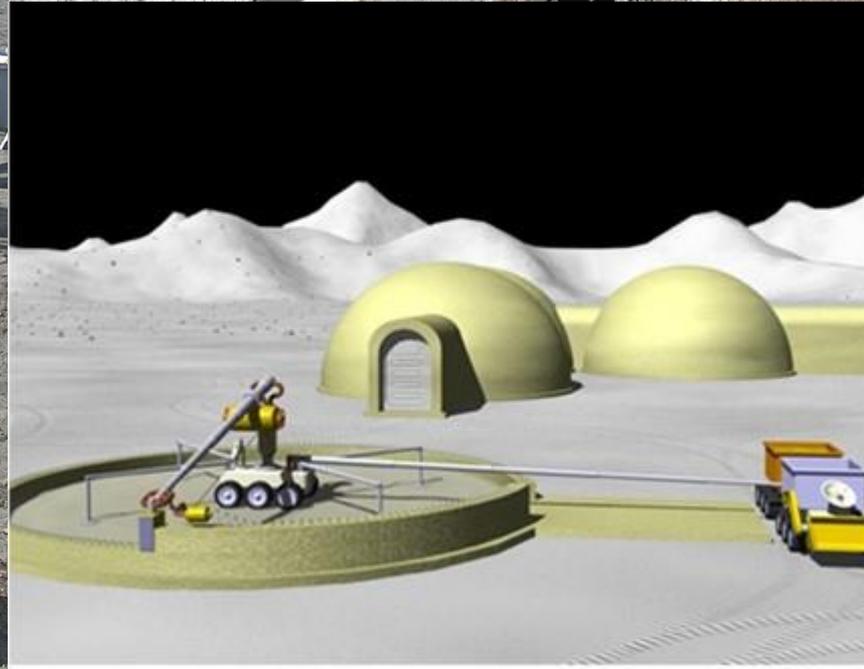
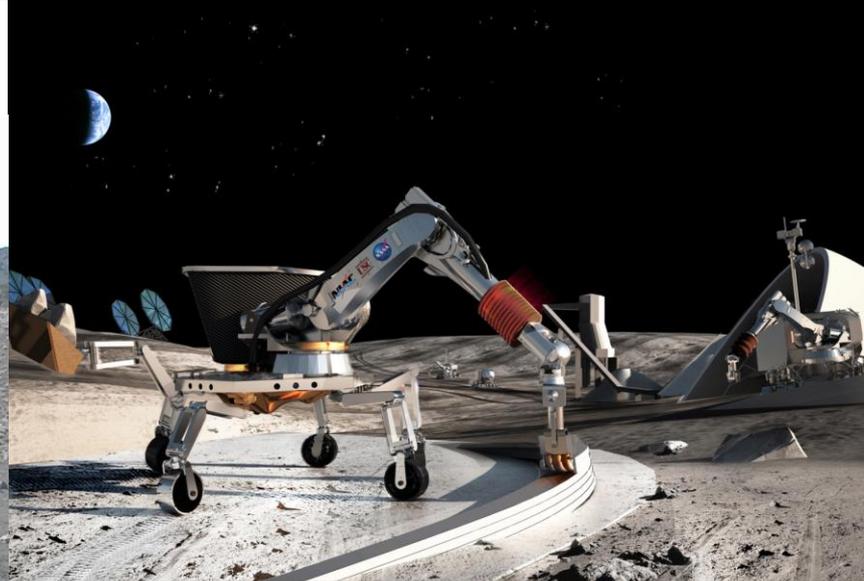
Radiation studies



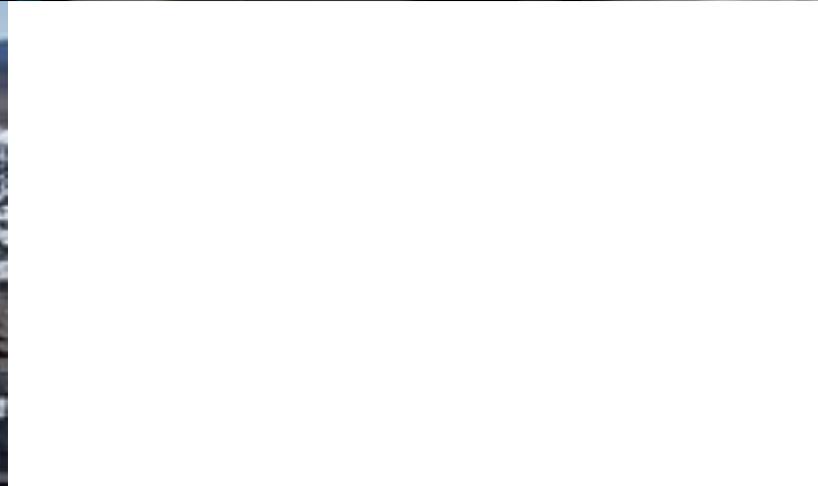
In Space Resource Utilization



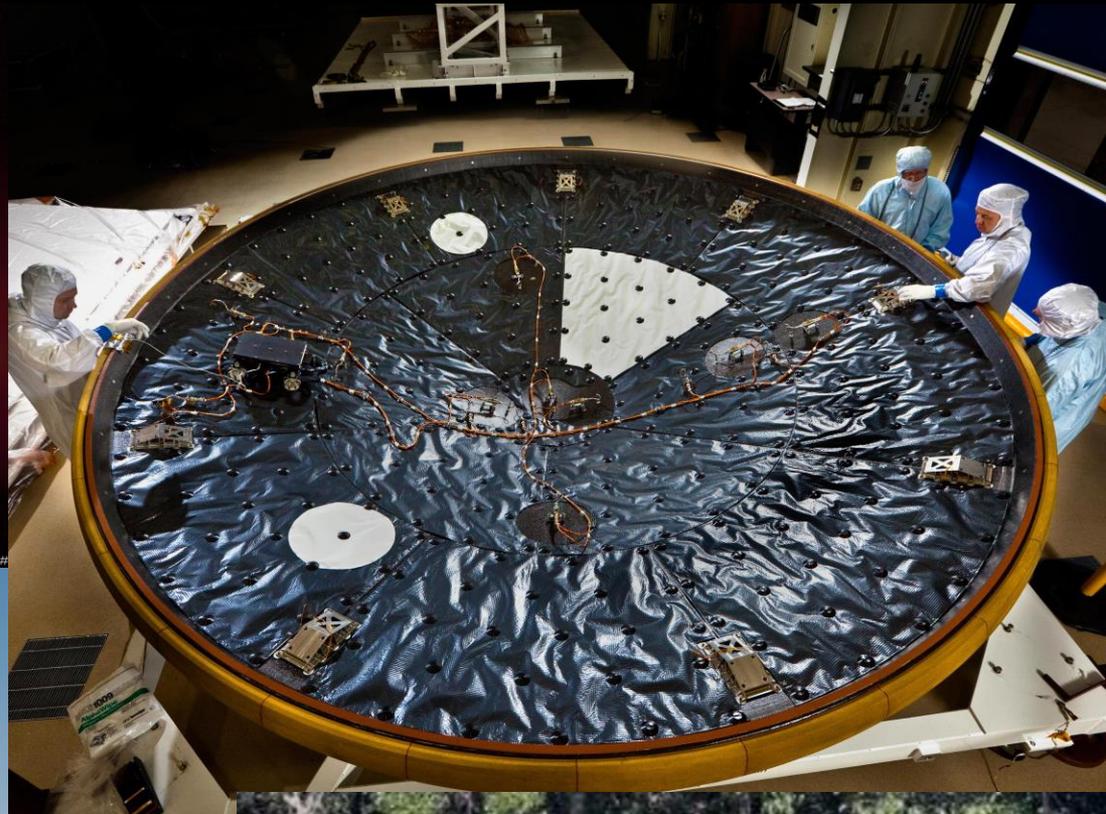
In Space Resource Utilization



Surface Power and Mobility



Ascent and Descent



How to get involved?



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

Home NASA Research Help Login

NSPIRES NASA Solicitation and Proposal Integrated Review and Evaluation System

NSPIRES Time: Feb 01, 2016 11:09PM EST

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 records per page

Showing 1 to 25 of 72 records

First Previous **1** 2 3 Next Last

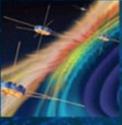
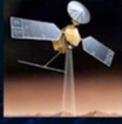
Solicitation Title	Solicitation #	Released	NOI Due	Proposal Due
2016 Dual Use Technology Development Cooperative Agreement Notice (CAN) at NASA George C. Marshall Space Flight Center	NNM16567212C	10/09/2015	--	--
2016 Experimental Program to Stimulate Competitive Research (EPSCoR)	NNH16ZHA001C	12/11/2015	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-ACBR	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	NNH16ZDAHGDRAFT	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>

TA 1		LAUNCH PROPULSION SYSTEMS	TA 9		ENTRY, DESCENT, AND LANDING SYSTEMS
TA 2		IN-SPACE PROPULSION TECHNOLOGIES	TA 10		NANOTECHNOLOGY
TA 3		SPACE POWER AND ENERGY STORAGE	TA 11		MODELING, SIMULATION, INFORMATION TECHNOLOGY, AND PROCESSING
TA 4		ROBOTICS AND AUTONOMOUS SYSTEMS	TA 12		MATERIALS, STRUCTURES, MECHANICAL SYSTEMS, AND MANUFACTURING
TA 5		COMMUNICATIONS, NAVIGATION, AND ORBITAL DEBRIS TRACKING AND CHARACTERIZATION SYSTEMS	TA 13		GROUND AND LAUNCH SYSTEMS
TA 6		HUMAN HEALTH, LIFE SUPPORT, AND HABITATION SYSTEMS	TA 14		THERMAL MANAGEMENT SYSTEMS
TA 7		HUMAN EXPLORATION DESTINATION SYSTEMS	TA 15		AERONAUTICS
TA 8		SCIENCE INSTRUMENTS, OBSERVATORIES, AND SENSOR SYSTEMS			

Technology Road Maps



National Aeronautics and Space Administration



Technology Area 12 Materials, Structures, Mechanical Systems, and Manufacturing 1 of 7

Enabling Technology Candidates Mapped to the Technology Need Date

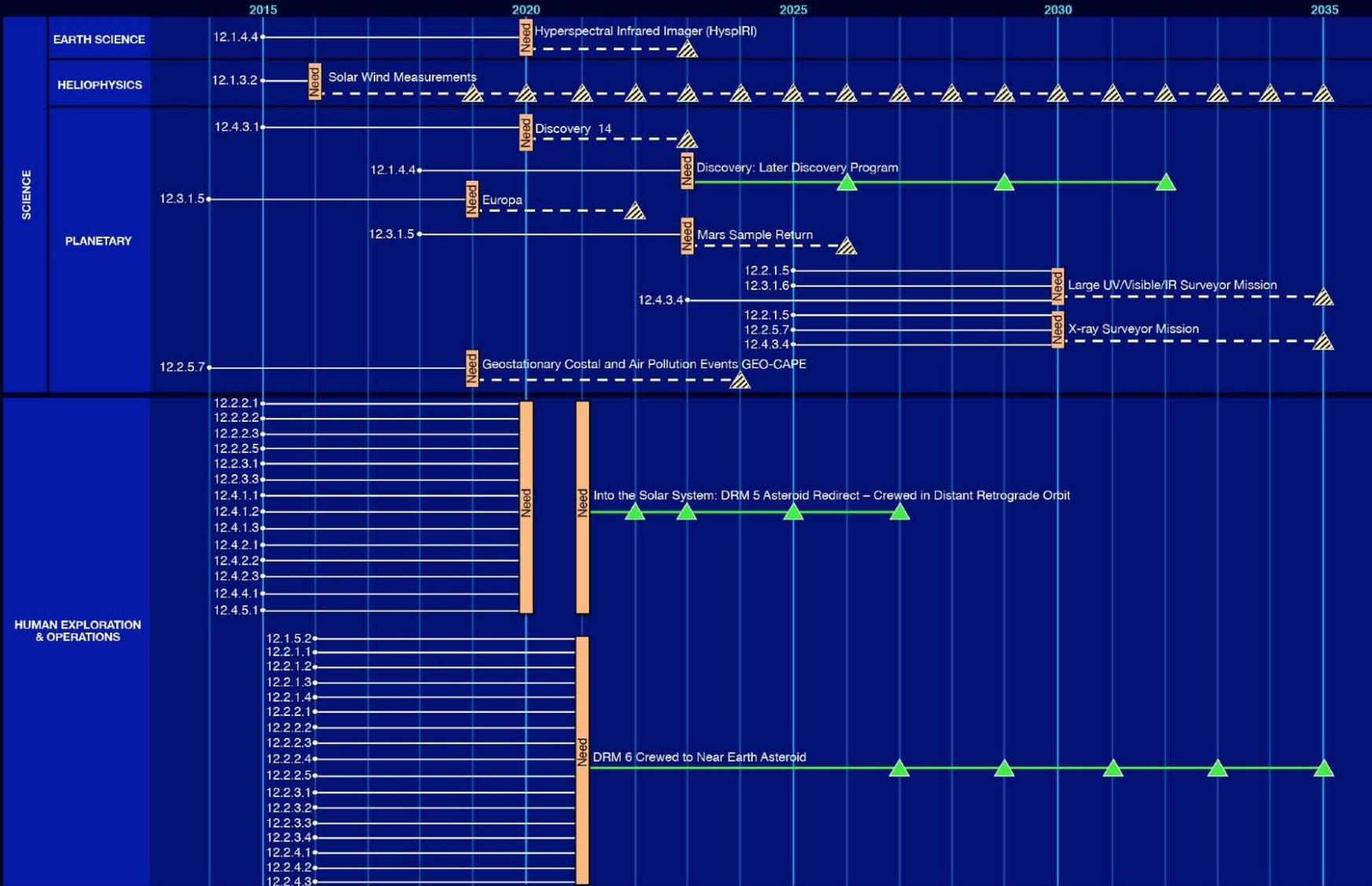
KEY:

- = Development Start Date
- Need = Technology Need Date
- ▲ = Launch Date From Agency Mission Planning Model (AMPMM)
- ▲ = Launch Date Not In AMPMM

4-digit numbers represent the technology candidate snapshots detailed in the Appendix.

Only technology candidates that are enabling (pull) are shown in this graphical representation

Enhancing (push) technologies are found in the Index and roadmaps.



How to get involved?



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

The screenshot shows the TechPort website interface. At the top, there is a navigation bar with the NASA logo, and three main sections: HOME, REPORTS (with subtext 'Report on programs, projects, and elements'), and LINKS (with subtext 'Explore NASA's technology websites'). A search bar contains the text 'ascent', with buttons for 'Advanced Search' and 'Search'. Below the navigation bar, the page title is 'TechPort (Beta)' and the breadcrumb is 'Home » Search Results'. A status bar indicates '33 items found' and '0 items selected'. The main heading is 'Search Results', followed by a sub-heading: 'You searched for active programs, projects, and elements containing the word ascent. Click here to modify your search.' Below this, there are pagination controls showing 'Viewing 1 - 20 of 33' and 'Print Search Results'. At the bottom of the search results area, there are buttons for 'Select All', 'Unselect All', 'Standard View', and 'Expanded View'. The search results list three items, each with a checkbox, a title, a status box, and a description:

- High-Performance, Pump-Fed Propulsion for Mars Ascent Vehicle Applications Project** Active Project
This is a project within the SBIR/STTR Programs
To-date, the realization of high-performance liquid bipropellant rocket engines for ascent vehicle and sample return applications has largely been hindered by the inability to obtain "on-board" pressurization through a light-weight and low-complexity pump. Ventions seeks to fulfill this critical nee...
- ORSC Methane Ascent/Descent Engine Technology Development Project** Active Project
This is a project within the SBIR/STTR Programs
Special Aerospace Services (SAS) is proposing a new and innovative ascent/descent engine using methane as its propellant. This engine will utilize the concepts of the Oxidizer Rich Staged Combustion (ORSC) cycle of the RD-8 to improve on performance over existing hardware. This SBIR program will lev...
- High Performance Nozzle for Mars Ascent Vehicle Project** Active Project
This is a project within the SBIR/STTR Programs
ASTS is pleased to propose to demonstrate the feasibility of using an aerospike nozzle to provide a dramatic increase in payload capability to the two-stage, all-solid-propulsion Mars Ascent Vehicle (MAV). The aerospike features a well-known altitude compensation capability, but the MAV operates in ...

How to get involved?



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

Search



Aeronautics



Communications



Electrical/
Electronics



Environment



Health, Medicine,
and Biotechnology

environment



IT
and Software



Instrumentation



Manufacturing



Materials and
Coatings



Mechanical and
Fluid Systems



Optics



Power Generation
and Storage



Propulsion



Robotics, Automation
and Control



Sensors

Questions?

