



Artemis Base Camp Overview

Decadal Survey Panel on Mercury and the Moon

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09 April 2021



Artemis Base Camp



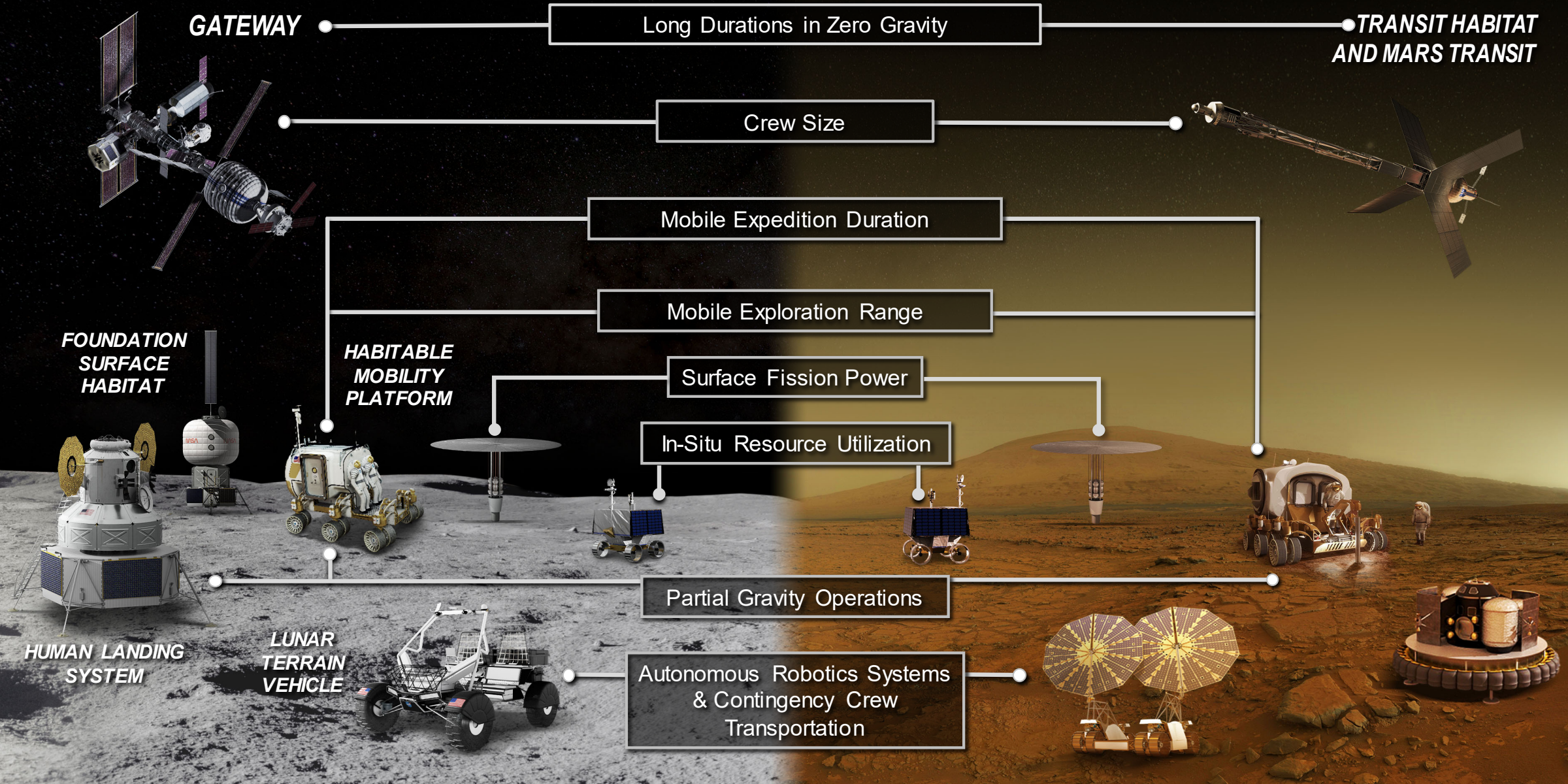
SCIENCE

HUMAN EXPLORATION AND OPERATIONS

SPACE TECHNOLOGY

MOON AND MARS EXPLORATION

Operations on and around the Moon will help prepare for the first human mission to Mars



Unpressurized Rover



Objective:

- Provide early mobility for suited Artemis astronauts to expand exploration range

Capabilities:

- Reusable and rechargeable for approximate 10 year service life
- Remote operation from HLS, Gateway, Earth
- Ability to traverse from one landing zone to another
- Interface with future science instruments and payloads for utilization or pre-deployment of assets
- Ability to survive eclipse periods

Unpressurized Rover Formulation

Moon-to-Mars Architecture Element Development

PROCESS

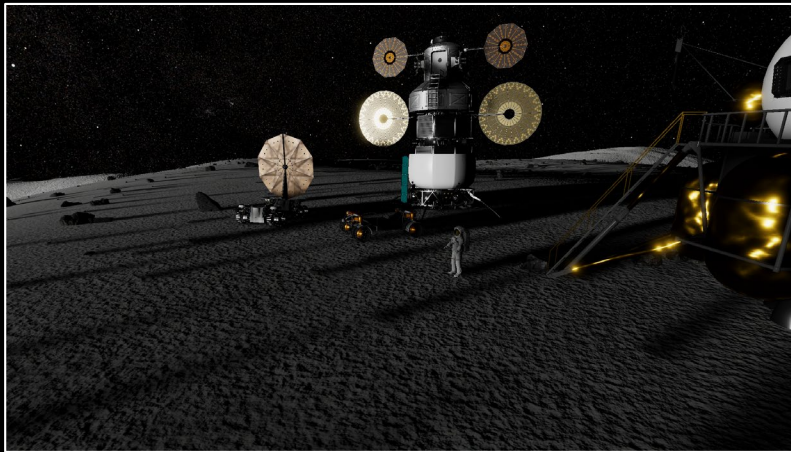
- ✓ Modeling and Simulation
- ✓ Analog Field Tests
- ✓ Industry Collaboration
- ✓ Acquisition Strategy
- Program Authorization

REQUIREMENTS & STANDARDS

- ✓ Avionics
- ✓ Comm systems
- ✓ Power
- ✓ Thermal
- ✓ Software

DECISION MEMORANDA

- ✓ Artemis Mission Durations as Mars Testbeds
- ✓ Lunar Comm Relay



Modeling and Simulation



Analog Field Tests



Artist's Illustration of LTV

Pressurized Rover



Objective:

- Provide pressurized mobile habitation to enable long-range surface exploration in shirtsleeve environment and quick and easy access to surface

Capabilities:

- Habitation for 30 days for 2 crew
- Rear suitport allows astronaut egress and ingress of the vehicle via the spacesuits, leaving the suits outside the pressurized volume
- Provides volume for spares and logistics
- Power generation and energy storage for lunar environment
- Dust and radiation protection
- Reuse for multiple missions of 15-year lifetime

Pressurized Rover Formulation

Moon-to-Mars Architecture Element Development

PROCESS

- ✓ Modeling and Simulation
- ✓ Analog Field Tests
- ✓ International Partner Collaboration
 - Acquisition Strategy
 - Program Formulation

REQUIREMENTS & STANDARDS

- ✓ Avionics
- ✓ Comm systems
- ✓ ECLSS
- ✓ Power
- ✓ Thermal
- ✓ Software

DECISION MEMORANDI

- ✓ Artemis Mission Durations as Mars Testbeds
- ✓ Suitport Study
- ✓ Exploration Atmospheres



Modeling and Simulation



Analog Field Tests



International Partner Collaboration



Foundation Surface Habitat

Objective:

- Foundation Surface Habitat will be a primary asset to achieve a sustained lunar presence and serve as a platform for Mars mission preparations
- NASA is working with industry to develop conceptual designs for the Foundational Surface Habitat

Capabilities:

- 2-4 crew – medical, exercise, galley, crew quarters, stowage
- 30-60 day capable habitat
- EVA capable via air lock with suit maintenance capability
- Power generation, recharge capability for surface assets
- Communication hub for surface assets
- Reuse for multiple missions of 15 year lifetime



Transit Habitation

Objective:

- Keep crew healthy and productive during long duration, deep space stays including:
 - Shakedown missions at Gateway and while free-flying with interim propulsion
 - Lunar-Mars analogs
 - Up to 1100-day Mars transit and orbital stays
- Build on ISS and LEO commercial investment in deep space habitation
- Demonstrate needed capabilities to live for long durations beyond low Earth orbit

Capabilities:

- Habitation volume 4 crew – medical, exercise, galley, crew quarters, stowage
- Up to 1100 day capable habitat
- ~25MT dry mass
- Exploration command module for surface assets
- Reuse for multiple missions of 15-year lifetime



Habitat Formulation

Moon-to-Mars Architecture Element Development

ARCHITECTURE ANALYSIS

- ✓ Modeling and Simulation
- ✓ Analog Field Tests
- ✓ Industry Collaboration
- Acquisition Strategy

REQUIREMENTS & STANDARDS

- ✓ Avionics
- ✓ Comm systems
- ✓ ECLSS
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- ✓ Software

DECISION MEMORANDA

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Modeling and Simulation



Human-in-the-Loop Testing



Interoperability Standards

Lunar Missions Prepare Us for Mars

IN ORBIT



DEEP SPACE AGGREGATION

Assembling a complex ship in deep space



MARS TRANSIT HABITAT

Round the clock, years-long operations of a Mars-class habitat and life support system



ORBIT TO SURFACE OPERATIONS

Operating an orbiting outpost that deploys a lander and its crew to a planetary surface



COMMERCIAL RESUPPLY AND REFUELING

Leveraging the space logistics supply chain for industry provided cargo deliveries



CREW HEALTH & PERFORMANCE

Studying how the human body and mind adapt to deep space hazards

A roundtrip mission to Mars will take about two years—and once the ship's course is set, there's no turning back.

As much as is possible, lunar systems will be designed for dual Moon-Mars operations.

Integrated missions in the lunar vicinity prepare us for successful Mars missions

ON THE SURFACE



SPACESUIT ADVANCEMENTS

Improving spacesuit design across Artemis missions with astronaut input and private sector innovation



MOBILE OPERATIONS

Living and working 'on the go' inside a mobile habitat for weeks at a time



PLANETARY PROTECTION

Mitigating dust transfer and establishing pristine sample curation protocols



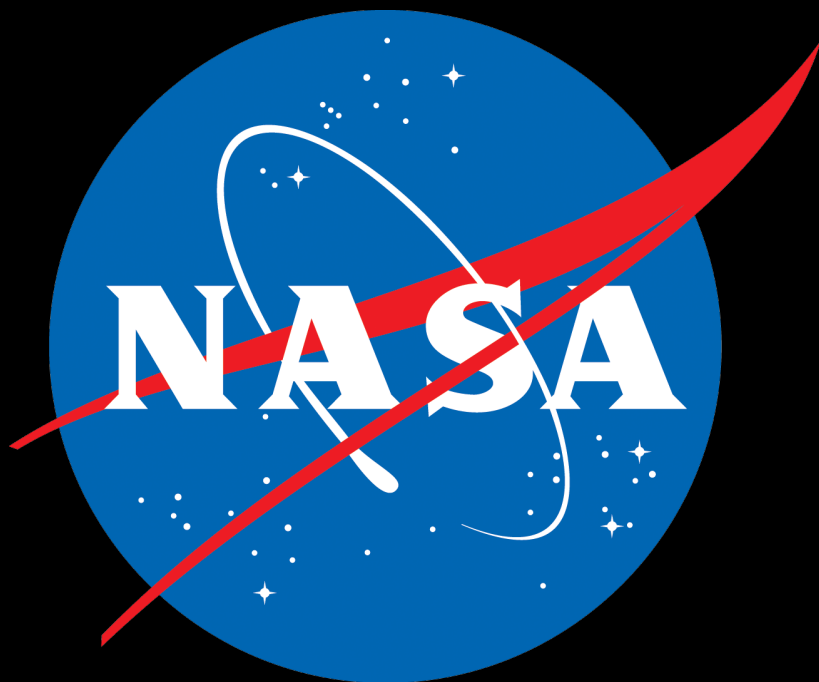
HUMAN ROBOTIC EXPLORATION

Robots pre-positioning surface assets and conducting reconnaissance for astronauts



HUMAN RESILIENCE

Learning how humans can survive and thrive in a partial gravity environment



QUESTIONS