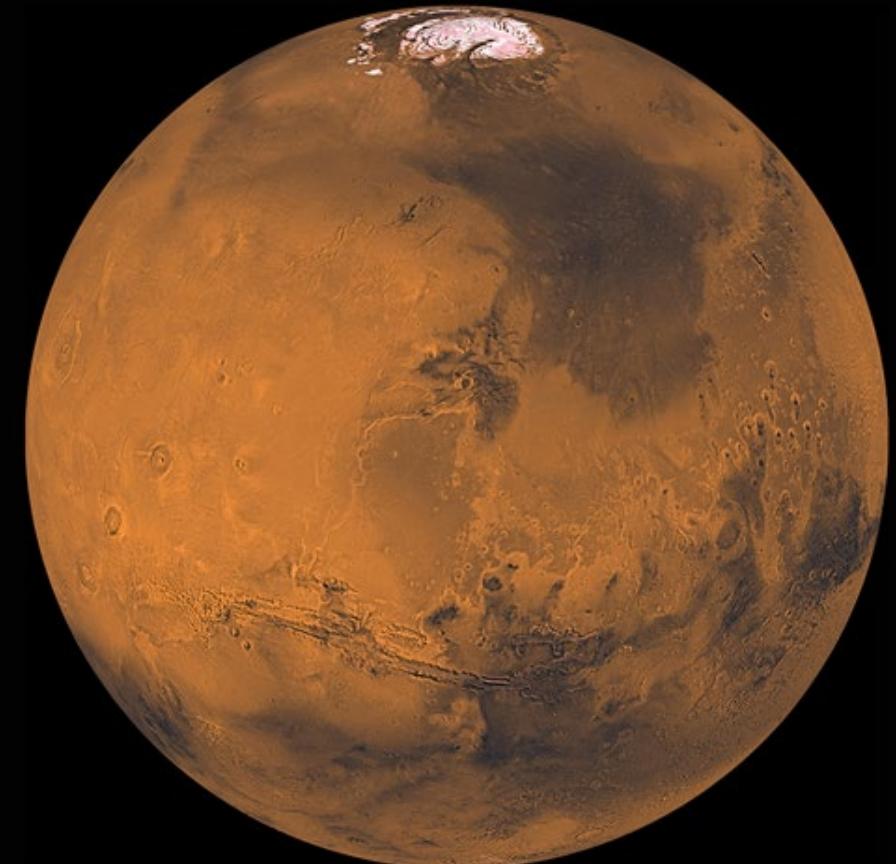




Human Research Program Mission Statement

To enable space exploration beyond Low Earth Orbit by reducing the risks to human health & performance



Hazards of Human Spaceflight

1

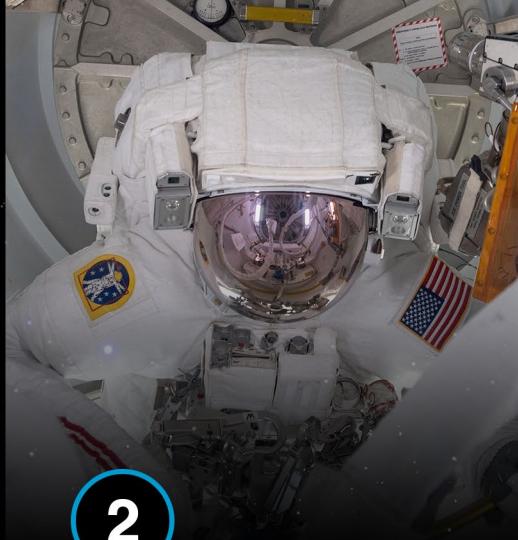
Space Radiation

Invisible to the human eye, radiation increases cancer risk, damages the central nervous system, and can alter cognitive function, reduce motor function and prompt behavioral changes.

2

Isolation and Confinement

Sleep loss, circadian desynchronization, and work overload may lead to performance reductions, adverse health outcomes, and compromised mission objectives.



3

Distance from Earth

Planning and self-sufficiency are essential keys to a successful mission. Communication delays, the possibility of equipment failures and medical emergencies are some situations the astronauts must be capable of confronting.



4

Gravity (or lack thereof)

Astronauts encounter a variance of gravity during missions. Traveling to and from their destinations, they will be in microgravity and will have to acclimate to one-sixth of Earth's gravity on the Moon or three-eighths of Earth's gravity on Mars.



5

Hostile/Closed Environments

The ecosystem inside a vehicle plays a big role in everyday astronaut life. Important habitability factors include temperature, pressure, lighting, noise, and quantity of space. It's essential that astronauts stay healthy and happy in such an environment.





HRP Looks to NASA's Health and Medical Technical Authority for Human Health Risk Prioritizations





Top Crew Health and Performance System Capability Challenges for Mars v1.0



Earth-Independent Human Operations



Computational Injury & Anthropometric Models



Mars Duration Food System



Exploration Exercise Countermeasures



Mars Duration Effects on Human Physiology



Understanding Individual Variability in Spaceflight



Risk Mitigations for Vehicle Atmospheres



Sensorimotor Countermeasures

Notional Human Spaceflight Strategy for Integrated Research and Testing for Mars Mission Readiness



FIRST MISSIONS
TO MARS



OPERATIONAL VALIDATED
CREW HEALTH &
PERFORMANCE

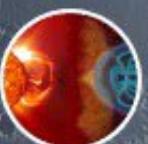
Mission Verification & Validation



ARTEMIS LUNAR-
BASED ANALOGS



MICROGRAVITY /
PARTIAL
GRAVITY



DEEP
SPACE
RADIATION



EXPLORATION
MEDICAL
CAPABILITY



EXTENDED
MISSIONS

Human systems validation



LOW-EARTH ORBIT
RISK REDUCTION



MICROGRAVITY /
1G TRANSITIONS



GENE /
MICROGRAVITY
INTERACTIONS



CROP
PRODUCTION



TEST NEW
SYSTEMS

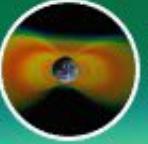


INTEGRATED
SIMULATIONS

Risk mitigation of integrated and simulated hazards



GROUND-BASED
RESEARCH



SPACE
RADIATION
SIMULATION



BEDREST



ISOLATION
ANALOGS



ANALOG FIELD
TESTS



CREW HEALTH
AND PERFORMANCE
SYSTEM
FORMULATION

TIME →

GROUND & ISS

LEO COMMERCIALIZATION

ARTEMIS BASECAMP

FIRST MISSION TO MARS