

Enabling Near-term Artemis Missions



ORION

- Cabin imagery system
- Flywheel exercise device collaborations
- WMS requirements validation



GATEWAY

- Crew Health and Performance Integrated Data Architecture (CHP-IDA) – collaboration with MCD/Exploration Capabilities
- Exercise Time Efficiencies



HUMAN LANDING SYSTEM

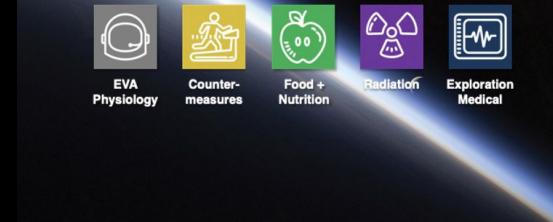
- Caloric deficiency risk for EVA
- Autonomy Standards
- Acceleration requirements
- Motion Sickness Countermeasures
- Manual Control Countermeasure

EVA AND HABITATION SYSTEMS



- Emergency CO₂ limits
- In-suit Nutrition Requirements
- Acceleration/Vibration Requirements
- Autonomy Standards
- Egress Assessments

EXPLORATION CAPABILITIES



- Food System Trade Study
- No-Treadmill ISS study Integration
- CHAPEA one-year analog support and research collaborations



- Tech Brief support
- SPARC tool – tracking of NASA-STD-3001 across Programs
- NASA-STD-3001 updates

HRP Addressing Challenges to Enable Artemis and Mars Missions

HMTA High Priority
Mitigation needed

Artemis

Medical Conditions

Dynamic Loads

Sensorimotor/Manual Control

EVA

HSI

HMTA = Health and Medical Technical Authority

What are the **most likely medical conditions** to occur in Artemis missions?

Lack of a model to **integrate** commercial **vehicle** provider's seat model with another commercial provider's **EVA suit**

Lack of countermeasures to aid crews in **manually controlling** lunar landers when needed

How do we improve performance and **reduce injuries in EVA suits** that will be worn more than ever?

How do we perform **Human System Integration** (training, systems, procedures, etc.) across many programs and vehicles



Mars

Pharm

Medical Conditions

EVA

Dynamic Loads

Food & Nutrition

Team

BMed

HSI

Cardiovascular (LTH)

SANS

How do we **store medications** to be efficacious in spaceflight for 5 years +?

What are the **most likely medical conditions** to occur in Mars missions?

How do we improve performance and **reduce injuries in EVA suits** that will be worn more than ever?

Lack of a model to **integrate** commercial **vehicle** provider's seat model with another commercial provider's **EVA suit**

How do we **ensure a food system for 5 years +** that is nutritious and something that crews want to eat?

What are the top indicators of **Team performance in an isolated environment** and how do we proactively address decrements?

What are the top indicators of **psychological performance in an isolated environment** and how do we proactively address decrements?

How do we perform **Human System Integration** (training, systems, procedures, etc.) across many programs and vehicles

How do we protect for the **Long-Term Health** effects of spaceflight and radiation on the cardiovascular system?

How do we protect against the Space flight-associated neuro-ocular syndrome (SANS)?



Using ISS for Key Studies that Enable Artemis and Mars

ISS4Mars Analog Studies



Lower-body Negative Pressure Countermeasure



Earth-independent Medical Operations



Post-landing Surface Fitness



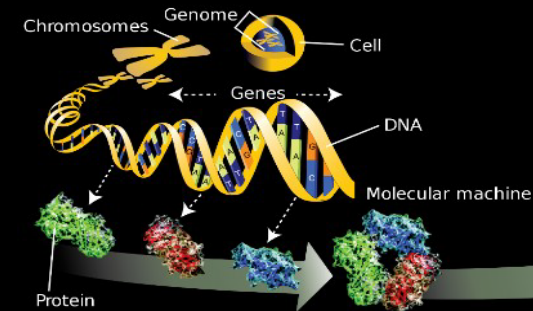
SANS (Vision changes) Countermeasure Testing



Sensorimotor & manual control countermeasures



CIPHER – Comprehensive human physiology and psychology in space (17 integrated investigations)



"Omics" Data Archive For risk assessment and Countermeasures