



HUMANS IN SPACE CHALLENGE

CHALLENGE TOPICS EXPLANATION

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Topics Explanation

Humans In Space Challenge calls for ideas that 1) support human life in space (Domain I. Space Exploration) and 2) utilize the space environment to benefit life on Earth (Domain II. Space Utilization). These topics would cover all aspects of human life support, from health to lifestyle and platform as listed below.

For Researchers

Research topics are composed of prioritized space health hazards identified by NASA HRP, categorized into seven human health systems. Below are some of the key health risks experienced during crewed space exploration. Applicants are free to submit research applications beyond the example topics mentioned below as long as they fall within key space health hazards.

- ✓ **Circulatory System**
 - Cardiac rhythm problems
 - Cardiovascular adaptations
 - Reduced aerobic capacity
 - Decompression sickness
 - Hypoxia
- ✓ **Cognitive System**
 - Cognitive and behavioral conditions
 - Psychosocial adaptation within a team
 - Sleep loss
- ✓ **Immune System**
 - Altered immune response
 - Radiation carcinogenesis
- ✓ **Musculoskeletal System**
 - Bone fracture
 - Reduced muscle size
- ✓ **Neuromotor System**
 - Spaceflight-Associated Neuro-Ocular Syndrome (SANS)
 - Orthostatic intolerance
- ✓ **Sensory System**
 - Hearing loss
 - Sensorimotor alteration
- ✓ **Urinary System**
 - Renal stone formation
 - Urinary retention

* Listed in alphabetical order

For Startups

Innovation topics are mainly divided into two domains: Space Exploration and Space Utilization. Applicants are free to submit applications beyond the example topics mentioned below as long as they fall under the sub-categories of Space Exploration and Space Utilization.

- ✓ **Space Utilization** covers Earth-based healthcare challenges that are better solved through the unique environment provided by space.
 - Bio R&D Platform – Includes R&D platforms that aid advanced life science experiments in space. Areas showing great progress include the cell culture platform, protein synthesis platform, organ-on-a-chip, drug manufacturing platform, cell imaging platform, and 3D biofabrication.
 - Molecule & Therapeutics – Includes regenerative medicine, synthetic biology, and drug delivery enhancement that utilize the space environment for manufacturing biomaterials and therapeutics.
 - Biomedical Equipment – Includes medical equipment that utilizes the space environment to test their durability and material behavior for technical improvements such as biological marking tools, biosensors, prostheses, and medical imaging tools.
- ✓ **Space Exploration** covers technologies that support crewed space exploration from health to lifestyle.
 - Human Healthcare Journey – Includes healthcare technologies that help prevent, monitor, diagnose, and treat astronauts in space. Sample topics include:
 - *Prevention* - Space exploration simulation, pre-flight education system, protection devices.
 - *Monitoring & Maintenance* – Personal health devices, telemedicine, wearables, monitoring sensors.
 - *Diagnosis* – Blood testing devices, imaging devices, telemedicine.
 - *Treatment* – Surgical devices, personalized therapeutics, pharmaceuticals.
 - In-Space Lifestyle – Includes technologies that create a favorable environment for human habitation in space, such as habitat support systems and entertainment. Sample topics include:
 - *Responsive Smart System for Habitat* – IoT network, predictive analytics, environment sensors, robotics.
 - *Next Gen Life Support System* – Bioregenerative atmosphere revitalization, water recovery, waste management system.
 - *Entertainment & Joy* – In-space musical instruments (sound & music), sports equipment, in-space VR experience.
 - Advanced Data & Analytics – Includes artificial intelligence / machine learning based systems that collect, store, and/or analyze data to support astronauts in decision-making, and researchers in better understanding human health in space.