

27th IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)
Human Exploration of Mars (2)

Author: Dr. Andrew Abercromby
National Aeronautics and Space Administration (NASA), United States

Mr. David Baumann
National Aeronautics and Space Administration (NASA), Johnson Space Center, United States
Ms. Debbie Berdich
National Aeronautics and Space Administration (NASA), United States
Mr. James Broyan
National Aeronautics and Space Administration (NASA), United States
Mr. Torin McCoy
National Aeronautics and Space Administration (NASA), Johnson Space Center, United States
Dr. Sharmi Watkins
National Aeronautics and Space Administration (NASA), United States
Dr. Neal Zapp
National Aeronautics and Space Administration (NASA), United States

NASA'S TOP HUMAN SYSTEM RESEARCH AND TECHNOLOGY NEEDS FOR MARS

Abstract

NASA is working with industry and international partners to return humans to the moon and eventually enable a human Mars mission. Within NASA, several organizations work together to identify, prioritize, fund, execute, and operationalize the crew health and performance (CHP) research and technology development (RD) necessary to enable these future missions. These organizations include flight programs as well as other organizations such as the Health and Medical Technical Authority (HMTA), Human Research Program, Space Technology Mission Directorate, and System Capability Leadership Teams, each of which existed for several years prior to the creation of the Moon-to-Mars (M2M) Program Office in 2023. A variety of constructs, vocabularies, and processes exist for the management of risks and strategic planning across these organizations. For example, M2M objectives, program risks, human system risks, human research gaps, capability gaps, and envisioned futures are all constructs currently used within NASA for identifying and prioritizing RD needs.

Alignment and evolution of these strategic planning constructs is ongoing and will allow for alignment and traceability between M2M objectives and RD investments at a detailed level. While this reorganization is ongoing, and even after it is established, there is a recognized need among stakeholder organizations to identify and communicate the highest CHP RD priorities in a unified and digestible way that synthesizes the considerations and perspectives of the CHP community across NASA.

To achieve this, the HMTA facilitated a series of group discussions with representatives of NASA's CHP community, which culminated in a product identifying the eight highest priority mission-enabling CHP capabilities for human missions to Mars, referred to as the "Top Human System Capability Needs for Mars". The list includes Earth-Independent Human Operations; Mars Duration Food System; Mars Duration Effects on Human Physiology; Risks Mitigations for Vehicle Atmospheres; Computational Injury Anthropometric Models; Exploration Exercise Countermeasures; Individual Variability in Responses to Spaceflight; and Sensorimotor Countermeasures.

Existing strategic planning and risk management tools and processes were considered, as well as practicalities of technical, cost, and schedule feasibility associated with potential RD risk mitigations and

technology solutions. The product is not owned by any one organization and does not replace existing strategic or program planning processes; rather it aims to complement and inform them with a unified set of community generated priorities. It is anticipated that this list will be re-evaluated periodically based on RD progress and the evolving M2M architecture.