IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Utilization & Exploitation of Human Spaceflight Systems (3)

Author: Dr. Julie A. Robinson
National Aeronautics and Space Administration (NASA), United States, julie.a.robinson@nasa.gov

Dr. Thu Jennifer Ngo-Anh
European Space Agency (ESA), The Netherlands, jennifer.ngo-anh@esa.int
Dr. Isabelle Marcil
Canadian Space Agency, Canada, isabelle.marcil@canada.ca
Mr. Boris Shishkov
State Space Corporation ROSCOSMOS, Russian Federation, Shishkov.BE@roscosmos.ru
Dr. Keiji Murakami
Japan Aerospace Exploration Agency (JAXA), Japan, murakami.keiji@jaxa.jp
Dr. Katrin Stang
DLR (German Aerospace Center), Germany, katrin.stang@dlr.de
Mr. Kotov Oleg
Institute of Biomedical Problems (IBMP), Russian Academy of Sciences (RAS), Russian Federation, kotov2710@gmail.com
Dr. Vittorio Cotronei
Italian Space Agency (ASI), Italy, vittorio.cotronei@asi.it
Prof. Livio Narici
University of Rome - Tor Vergata, Italy, narici@roma2.infn.it
Mr. Vasily Savinkov
State Space Corporation ROSCOSMOS, Russian Federation, savinkov.vv@roscosmos.ru
Dr. Michaela Girgenrath
German Aerospace Center (DLR), Germany, michaela.girgenrath@dlr.de
Mr. Michael C. Waid
National Aeronautics and Space Administration (NASA), Johnson Space Center, United States, michael.c.waid@nasa.gov
Dr. Kavin Sato
National Aeronautics and Space Administration (NASA)/Ames Research Center, United States, kevin.y.sato@nasa.gov
Mr. Sam Scimemi
National Aeronautics and Space Administration (NASA), United States, Sam.scimemi@nasa.gov
Ms. Robyn Gatens
NASA, United States, robyn.gatens@nasa.gov

NOVEL WAYS TO USE THE INTERNATIONAL SPACE STATION AS AN EXPLORATION ANALOG: INTERNATIONAL PROGRESS IN PLANNING "ISS4MARS"

Abstract

In October 2020, International Space Station (ISS) International Partner Agencies held a set of international workshops to solicit and develop creative and forward-looking ideas for using the ISS as an

analog for preparation for Mars missions during its 3rd decade of operations. The workshops brought together participants from nine international space agencies or organizations, with stakeholders consisting of research managers, discipline experts, technology developers, flight physicians, flight operators, and astronauts. Breakout meetings and brainstorming sessions were conducted focusing on the following topics: Critical hazards and countermeasures for the transit to Mars; gravity transitions and early surface operations; environmental control and life support systems; food systems; human microbiome, microbial monitoring, and planetary protection; medical operations for Mars missions; isolation and confinement; autonomous systems and crew-centered autonomy; and communications delay effects on operations.

In many cases the scenarios and approaches identified were compelling but challenging to implement under the current utilization structure used to manage use of the ISS for experiments. Following the series of workshops, a team of utilization leaders across the ISS partnership worked to compile the workshop recommendations and extract a set of use-cases with their prerequisites and constraints. The work considered the following aspects: what can be effectively done on ISS, which new technologies, approaches and scenarios are feasible, what alternatives could be considered, and what steps should be taken to enable integrated testing and future use of ISS as an analog for Mars missions. The final report was produced and presented to the participants in April 2021. The report was published so that it could be considered in each agency's strategic planning processes.

This paper will cover the process of international assessment in detail and how this process has influenced and broadened the vision of ISS utilization beyond single experiments to integrated testing for future Mars missions. This approach to international collaboration informs both the next decade of international exploration research on the ISS and advancement of its utilization as an analog for deep space missions. For many of the participating partners, it also helps to frame the strategy for human research in Artemis as we begin planning for human missions to the moon. We will conclude with a summary of the progress on the actions in the reports and the additional implementation discussions that have occurred across the ISS partnership.