34th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Simulating Space Habitation: Habitats, Design and Simulation Missions (6)

Author: Agaptseva Tatyana
Institute of Biomedical Problems (IBMP), Russian Academy of Sciences (RAS), Russian Federation

Dr. Anna Kussmaul
Institute of Biomedical Problems (IBMP), Russian Academy of Sciences (RAS), Russian Federation
Dr. Mark Belakovsky
SSC RF-Institute of Biomedical Problems RAS, Russian Federation
Prof. Oleg Orlov
Institute of Biomedical Problems (IBMP), Russian Academy of Sciences (RAS), Russian Federation

OPPORTUNITIES FOR VALIDATION OF TECHNOLOGIES AND PRODUCTS INTENDED FOR LONG-TERM SPACEFLIGHT IN ANALOG ISOLATION STUDIES

Abstract

The study of the functional capabilities and the mechanisms of adaptation to various environmental effects and the characteristics of the human body response to the long-term impact of negative space factors is one of the priority tasks of the Institute of Biomedical Problems of the Russian Academy of Sciences (IBMP). However, it is not always possible to implement it in real space flight conditions, which is due to different restrictions. Such problems can be solved by conducting analog studies with simulating specific unfavorable space flight conditions. In particular, the effects of spaceflight factors such as isolation, artificial monotonous environments, and crowding are studied in isolation experiments with artificially created and monitored environment.

To carry out such experiments, the Ground Experimental Facility (NEC) was built in IBMP. NEC is a unique facility for the most realistic simulation of a flight to Mars and other extra-long manned space missions. The facility was completely modernized before the Mars-500 experiment, conducted in 2010-2011, and in 2017 the SIRIUS (Scientific International Research In Unique terrestrial Station) project was launched in NEC.

Simulation experiments conducted at NEC present a unique platform for testing various technologies and products developed to support long-term interplanetary flights, and many institutions from Russia and other countries have already taken advantage of this opportunity to validate their products.

Thus, deep space flights will require a new approach to the means of medical control and support, which should be more autonomous than those used in orbital stations. These means can be based on technologies for intelligent processing and analysis of medical data and represent various gadgets (bracelets, glasses, watches, etc.), clothes with built-in sensors, devices for remote measurement of various health indicators, etc.

An important element of the life support system is the food supply system, which should include technologies for cooking food directly in space, as well as the use of food products with a long shelf life. An assessment of the suitability of products for use in flight conditions can also be carried out in isolation projects.

In addition to the above areas, products / technologies developed for water / air purification, personal hygiene products, personal protective equipment (for example, breathing masks, protective suits), simulators for the crew physical training, medicines and bioadditives, and much more are tested.

Thus, analog experiments provide an excellent opportunity to test a range of technologies and products created for future space flights.