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HARDWARE/SOFTWARE COMPLEX FOR CREW'S SERVICE OF INTEGRATED LIFE SUPPORT SYSTEM OPERATION IN LONG-TERM GROUND EXPERIMENT UNDER MARS-500 PROJECT

Abstract

The paper deals with development of the hardware/software complex for crew's service of integrated life support system operation (HSCSO) in long-term ground experiment under MARS-500 project.

One of the basic problems, which restrict implementation of interplanetary flights, is a guar-antee of reliability and safety of the onboard system operation and, first of all, Integrated Life Support Systems (ILSS) in conditions autonomous manned spaceflight. "Mars-500" is the project, which allows compiling materials about human behavior in long-term spaceflight, his mental condition and in-flight performance.

Mars-500" project is being conducted by the State scientific center of the Russian Federation – Institute for Bio-Medical Problems of RAS under the aegis of Roscosmos and European Space Agency.

The project "Mars-500" includes a series of experiments simulating many aspects of an inter-planetary manned flight. The main part is a series of experiments on long-term isolation of the crew in conditions of the specially built ground-based experiment facility. Project consists of three stages:

- Four-day isolation (it was completed in November 2007);
- One hundred and five-day isolation (it was completed in July 2009);
- Five hundred and twenty-day isolation (tentative date of beginning is March 2010).

Real participation of test subjects in the real system service is extremely complicated and economically unprofitable. More rational approach is the virtual simulator application of sep-arate systems incorporated in the uniform HSCSO.

The basic opportunity and economic feasibility of the HSCSO development and application model are resulted. The structure of virtual simulators, which describe functioning ILSS and parts of an environment interacting with system, is examined.

The structure HSCSO includes: virtual simulators of separate systems, the main routine, which simulates changing controllable parameters of a crew's environment, the subroutine forming the mass and energy loads of crew, additional procedures setting and identifying of the probable off-normal situations and estimating efficiency of operator's actions at its local-ization and the oxygen generation system's training device.

Principles of the formation and the formalized descriptions for virtual simulators and parts of an environment, program implementation of the HSCSO, and also data of the experimental verification resulting on a basis of computing tests and operators' work with given software are discussed.

Results of the "Mars-500" completed stages (14-days and 105-days) are analyzed. Questions of the HSCSO hardware design are also considered.