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TASKS OF PROFESSIONAL ACTIVITIES OF COSMONAUTS ON THE MOON AND IN DEEP SPACE: WORKING OUT METHODS AND TECHNOLOGIES

Abstract

To date, the extensive practical experience in performing various tasks of cosmonauts' professional activities in near-earth orbits has been gained. The tasks and features of cosmonauts' professional activities on the Moon and in deep space will be determined by the new goals and scenarios of planned missions, by the impact of adverse factors and conditions on a human, by the high autonomy of expeditions, as well as by the structural and technological specifications of new manned spacecraft. In turn, this will lead to the emergence of new functions and types of cosmonauts' activities, both when performing flights on different orbits of planets, and when implementing on-planet activities. The report provides the predictive assessments of the functions and types of the planned professional activities of cosmonauts in the exploration of the Moon and Mars, in the following two key directions: 1) assembly and operation of the planetary infrastructure, 2) implementation of the expedition scientific program by the space crew. The paper considers the priorities of on-planet scientific research in comparison with similar work on the ISS. As the previous experience of manned spaceflights shows, their success is largely determined by the quality of working out models of crew activities, while on Earth. Therefore, among the priority areas of research, the setting of full-scale experiments with the use of several ground-based simulation facilities is considered: the facilities for simulated weightlessness of cosmonauts in spacesuits for extravehicular activity; the training facilities to exercise rendezvous and docking of manned spacecraft; the centrifuges and the centrifuge-based simulators with operating models of landing modules; the stands with virtual models of the Moon and Mars Rovers. The main focus is on the following technologies of cosmonauts' professional activities: manual controlled descent of manned spacecraft landing on the planet; manual control of rendezvous and docking of the spacecraft; typical operations of extravehicular activity; control of the virtual models of the Moon and Mars Rovers. All technologies are worked out with the cosmonauts' participation before and after their flights to the ISS (after a long stay in weightlessness as part of the main expeditions lasting from six months to a year). The research schemes and preliminary experimental results are presented. The future works on the study of robotic missions are planned, since their implementation seems to be a potential for successful exploration of the Moon, and subsequently of Mars.