

Challenges of Life Support/Medical Support for Human Missions (8)
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HUMAN PERFORMANCE IN SPACE: THE RECENT REPORTS FROM CHINA SHENZHOU-11 AND
TIANGONG-2 MISSIONS

Abstract

It is well known that astronauts play very important roles in manned spaceflights, and it is essential to maintain and improve astronauts' performance and capabilities in space. However, experimental data accumulated from spaceflights have revealed that environmental factors unique to space (such as weightlessness, isolation and confinement, radiation) can have adverse effects on humans, including loss of bone density, decreased muscle strength and endurance, postural instability, reduction in aerobic capacity, and psychological problems. Over time, these effects can result in an increased risk of injury as well as impaired performance. To get a better understanding of the effects of spaceflight on Astronauts' performance, China has conducted a series of experiments in its manned space flights. In this paper, seven experimental studies performed in the Shenzhou-11 and Tiangong-2 space missions in 2016 will be introduced. The first three studies focused on human capability related to on-orbit maintenance operations, and investigated the influence of space flight on human kinematic characteristics, force Characteristic, and characteristics of time resource occupancy. Another three studies focused on human capability related to space manipulation task (such as manual rendezvous and docking, and teleoperation of manipulator), and investigated the influence of space flight on visual function, eye-hand coordination, and mental workload. Another notable study examined the usability of brain-computer interface (BCI) in space and factors influencing BCI performance. Two crew members performed the tests before, during, and after the 33 days' space flight. The testing techniques were validated, and the data of Chinese Astronauts in spaceflight were enriched. Some valuable conclusions were drawn from the studies, for instance, the astronauts' BCI performance of on-orbit experiment was close to or higher than that on ground, so the BCI technology could be a promising HCI (Human Computer Interface) in further manned space mission. As the progressing of China's space station program, more studies will be performed to explore possible changes of human performance and capabilities in long duration spaceflight and their countermeasures, to support adequate human performance in space.