NASA HRP	RECOVERY OF FUNCTIONAL SENSORIMOTOR PERFORMANCE FOLLOWING LONG DURATION SPACE FLIGHT	FIELD TEST

Principal Investigator

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Description

Astronauts experience alterations in multiple physiological systems due to exposure to the microgravity conditions of space flight. These physiological changes include, among others, sensorimotor disturbances, cardiovascular deconditioning and loss of muscle mass and strength. Changes in these systems clearly lead to disruption in the ability to ambulate and perform functional tasks during the initial reintroduction to a gravitational environment following a prolonged weightless transit and may cause significant impairments in performance of operational tasks immediately following landing on a planetary surface. Severe impairments may lead to loss of mission. To date changes in functional performance have been systematically studied for short duration space flights (Arzeno et al. 2012; Bloomberg et al. 2012; Reschke et al. 2011) and has recently begun on the long duration ISS space flights (first data collection delayed until the 2nd day following landing). As important as these observed postflight functional changes have been, responses within an hour following landing and a recovery time constant beginning as near to the time of landing as possible through full functional recovery has never been investigated or established for long duration flights. The objective of this experiment is to address this gap in knowledge, allowing us to understand the impact of functional performance on tasks that are representative of critical mission requirements that the crews of exploratory missions will be expected to perform after an unassisted landing following flights from 6 to 12 months in duration. Findings from this investigation will provide the information needed for planning future Mars, or other deep space missions, with unassisted landings.

Objectives

Aim 1: Quantify functional performance from measurements on long duration crewmembers taken as close in time to landing as possible.
Aim 2: Develop a recovery timeline of functional performance on long duration crewmembers.
Aim 3: Determine the efficacy of U.S. and Russian compression garments to as countermeasures for alleviating orthostatic intolerance.

Relevance

In addition to addressing neurovestibular and sensorimotor risks, this experiment also addresses the risk of orthostatic intolerance during re-exposure to different gravitational environments, and the risk of impaired performance due to reduced muscle mass, strength and endurance.

BDC Summary

Field Test is proposed to begin as temporally close to the landing of the Russian Soyuz spacecraft as physically and logistically possible. The landing of the Soyuz craft is always at a remote location and the crew is considerably more debilitated than subjects we have tested in previous flight experiments. Subjects will have three pre-flight sessions at L-180, L-120, and L-60. Additionally, there will be an L-90 session for fitting of the Gradient Compression Garment. Post-flight testing will occur three times on R+0, and then at R+1, R+4, R+6, R+15, and R+30. R+0 testing will occur either at the landing site or at the Kustanai/Karaganda airport (astronauts and cosmonauts), at Star City (cosmonauts) and the first refueling site, typically Scotland (astronauts), and at JSC (astronauts). Note: It is highly desired that the cosmonauts be tested at Star City for a third time on R+0. Subsequent post-flight tests will occur at either the IBMP Sensorimotor Laboratories, Moscow, or in the training facility in Star City (cosmonauts), and at the JSC Neuroscience Laboratories (astronauts).

In-flight Operations Summary

N/A

Subject Selection/Participation Criteria