ASSESSMENT OF PROFICIENCY DURING SIMULATED ROVER OPERATIONS FOLLOWING LONG-DURATION SPACEFLIGHT

E. J. Beltran [1], S. J. Wood [2], and S. T. Moore [3]
[1] Wyle Integrated Science and Engineering Group, Houston, TX, [2] Azusa Pacific University, Azusa, CA and [3] Mt Sinai School of Medicine, New York, NY

INTRODUCTION

Following long-duration space travel, pressurized rovers will enhance crew mobility to explore Mars and other planetary surfaces. Adaptive changes in sensorimotor function may limit the crew's proficiency when performing some rover operations shortly after transition to the new gravitoinertial environment. The primary goal of this investigation is to quantify postflight decrements in operational proficiency in a motion-based rover simulation after International Space Station (ISS) expeditions.

METHODS

The rover simulation consists of a serial presentation of tasks to be completed as quickly and accurately as possible. Each task consists of 1) perspective-taking, using a map that defines a docking target, 2) navigation toward the target over simulated Martian terrain, and 3) docking a side hatch of the rover to a visually guided target. The simulator utilizes a Stewart-type motion base (CKAS, Australia), single-seat cabin with triple scene projection covering 150° horizontal by 50° vertical, and joystick controller. The dependent variables for each task include accuracy toward the target and time to completion. The total time the crewmember can complete four docking tasks will determine the overall operator proficiency for the rover simulation.

This rover simulation has been incorporated into Steven Moore's study titled "Assessment of operator proficiency following long-duration spaceflight." Eight crewmembers returning from 6-month stays on board the ISS will be tested during 4 preflight and 3 postflight sessions 1, 4, and 8 days after landing. Changes in performance in the rover simulation will also be correlated with changes in a sensorimotor and cognitive test battery to be conducted during Dr. Moore's study. For the flight study, some changes in proficiency are expected as a function of time independent of the effects of microgravity. There are typically about 8 months between the last preflight and first postflight sessions. One of our ground control studies will examine the changes in operator proficiency following an 8-month gap between the preflight and postflight sessions as a control for this recency effect.

PRELIMINARY RESULTS

Six of eight crewmembers have completed the study to date. Data collection is ongoing for the ground control study on 12 subjects. Performance on the perspective taking and navigation tasks does not appear to be impaired postflight. However, there have been increased errors and variability in the alignment of the rover during the docking task in the initial postflight testing. There is generally a return to baseline performance by R+8 days. The overall time required for the four tasks did not change on R+0, and then improved during later postflight testing. Continued learning effect on this novel simulation will be addressed in ground control study.

DISCUSSION

This simulation will provide functionally relevant evidence relating to the impact of sensorimotor adaptation on early surface rover operations and what countermeasures are needed. Decrements in the postflight rover performance due to vestibular impairment may be compensated by the visual references that the rover simulation provides.

ACKNOWLEDGEMENTS

Support was provided by the Human Health Countermeasures Element.