Assessment of Spatial Navigation and Docking Performance During Simulated Rover Tasks

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INTRODUCTION. Following long-duration exploration transits, pressurized rovers will enhance surface mobility to explore multiple sites across Mars and other planetary bodies. Multiple rovers with docking capabilities are envisioned to expand the range of exploration. However, adaptive changes in sensorimotor and cognitive function may impair the crew's ability to safely navigate and perform docking tasks shortly after transition to the new gravitoinertial environment. The primary goal of this investigation is to quantify post-flight decrements in spatial navigation and docking performance during a rover simulation. METHODS. Eight crewmembers returning from the International Space Station will be tested on a motion simulator during four pre-flight and three post-flight sessions over the first 8 days following landing. The rover simulation consists of a serial presentation of discrete tasks to be completed within a scheduled 10 min block. The tasks are based on navigating around a Martian outpost spread over a 970 m^2 terrain. Each task is subdivided into three components to be performed as quickly and accurately as possible: (1) Perspective taking: Subjects use a joystick to indicate direction of target after presentation of a map detailing current orientation and location of the rover with the task to be performed. (2) Navigation: Subjects drive the rover to the desired location while avoiding obstacles. (3) Docking: Fine positioning of the rover is required to dock with another object or align a camera view. Overall operator proficiency will be based on how many tasks the crewmember can complete during the 10 min time block. EXPECTED RESULTS: Functionally relevant testing early post-flight will develop evidence regarding the limitations to early surface operations and what countermeasures are needed. This approach can be easily adapted to a wide variety of simulated vehicle designs to provide sensorimotor assessments for other operational and civilian populations.

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