SPACE LIFE SCIENCES SYMPOSIUM (A1)
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# USE OF A FULL MOTION SIMULATOR TO ASSESS OPERATOR PROFICIENCY AFTER LONG-DURATION SPACEFLIGHT

**Abstract**

Data from shuttle landings have indicated performance deficits in astronaut pilots after exposure to microgravity. The transition from microgravity to Earth gravity also introduced a series of sensorimotor deficits to all astronauts in areas of posture, locomotion, oculomotion and perception of motion that may pose risks during exploration class missions (i.e. Mars). The extent of negative impact on the ability of crewmembers to land an exploration vehicle and to perform post-landing surface operations such as controlling a rover are unknown and yet to be quantified. For these reasons, it is prudent to assess crewmember performance in mission relevant tasks in a safe and realistic simulated environment.

A full motion simulator system has been developed using mostly commercial off-the-shelf equipment and software to assess astronaut proficiency in manual control tasks after long-duration spaceflight. The developed simulation system is comprised of a six-degrees-of-freedom Stewart platform with a custom fabricated cabin suitable for single-person occupancy. The triple-projector display offers an immersive visual field of 150 degrees horizontal and 50 degrees vertical. The human interface controls include steering wheel and pedal assemblies as found in performance automobiles, as well as joystick and throttle units as found in jet aircrafts and prototype rovers. This simulator system is part of a ground-based study that aims to directly address the risk of impaired ability to maintain control of vehicles and other complex systems as identified by the NASA Human Research Program. During pre- and post-flight sessions, ISS crewmembers in this study will complete a test battery targeting cognition, visual acuity, fine motor control and vestibular perception. Subsequently, the crewmembers will perform three tasks in simulated scenarios with motion cues: landing the NASA T-38 Talon, driving through mountain passes, and manually operating a Mars Rover. Preliminary testing demonstrated low occurrence of simulator sickness (i.e. 2 out of 21 subjects felt symptoms but none requested to stop).

Three identical systems have been installed at NASA Johnson Space Center (Houston), Mount Sinai School of Medicine (New York) and the University of Sydney. This study was recently assigned to the

schedules of two ISS crewmembers and pre-flight data collection is due to start in the spring of 2012. This simulator system can also benefit research in vestibular maladies and motion sickness as well as contribute to education and public outreach of space activities.