SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

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REVERSIBLE FIGURES: DEVELOPING AN ISS LIFE SCIENCES PAYLOAD

Abstract

Reversible Figures is a life science European Space Agency payload aboard the International Space Station (ISS). This experiment is a project of the International Space University to investigate the adaptive nature of the neuro-vestibular system in the processing of gravitational information related to 3D visual perception. In addition to ground-based training preflight sessions, our team has facilitated and developed every deliverable from request through post-flight analysis. With flight trials beginning March 2012 with Expedition 32, subjects aboard ISS will be shown a series of ambiguous, perspective-reversible images using a laptop running a custom-scripted program. Six crewmembers will participate in 6 sessions each, with 10 figures tested twice per session. Inversions between perceptions will be recorded subjectively and the data transmitted back to Earth for analysis. Subjects will communicate which image they saw first and any subsequent changes in image perception. The primary end points will include number and rate of reversals. Data will be compared across pre-flight, in-flight and post-flight conditions. We hypothesize that, compared to baseline trials in 1 g, there will be a decreased rate of reversal between image perceptions in 0 g, and a return to baseline after the flight. This result would further emphasize the importance of gravity in the integration of various sensory inputs to generate a perception of three-dimensional space. The premise of this experiment has been supported by previous ISS payloads and parabolic flight trials.

This paper will present the payload development process of a life science payload for the ISS with respect to lessons learned during the design of Reversible Figures including: software design, efficient crew and hardware utilization, informed consent and payload safety briefings, crew experiment interfaces and operational procedures, baseline data collection and analysis, and remote team logistics. In addition to the scientific importance of this experiment, we believe that such processes could further aid institutions and groups to take full advantage of ISS Utilization in the future. A better understanding of the relationship between microgravity and perception of visual stimuli could contribute to the development of flight training software and countermeasures for space habitation to mitigate significant errors and costs.