Astronaut Performance during Gravitoinertial Force Transitions: a SIRIUS Approach to Suborbital Flight Training

Janna Kaplan[1,2], James R. Lackner[1,2], Paul DiZio[1,2], Heather Panic[1,2], Alexander Panic[1,2], Joel Ventura[1,2]

([1]Ashton Graybiel Spatial Orientation Laboratory/AGSOL, http://www.brandeis.edu/graybiel/, Brandeis University, 415 South Street, Waltham, MA 02454 USA;
[2]SIRIUS Astronaut Training, MS 033, Waltham MA 02454 USA, www.siriusastronauttraining.com)

Summary

SIRIUS Astronaut Training has developed sensorimotor human factors training program for a suborbital spaceflight. Our training protocols address, among other factors, performance in parabolic flight (zero G, high G, and G transitions), motion sickness, spatial orientation and disorientation, sensory illusions, motor control and movement errors, artificial gravity and rotating environments, as well as reentry and post-flight disturbances. Of particular concern for research and/or payload work in suborbital flight is the challenge of utilizing G (gravitoinertial force) transitions, i.e. time periods immediately before and after zero-G exposure. SIRIUS possesses unique facilities and expertise enabling us to train individuals to maximize usage of G transitions to achieve zero-G performance readiness and landing readiness in flight.

Introduction

To maximize performance efficiency, industrial payload or scientific research astronauts in suborbital flight will be faced with the challenges of achieving readiness to perform their tasks in weightlessness immediately upon its onset and utilizing all available zero-G time. In cases when research or industrial hardware may need to be stowed for takeoff and landing, valuable zero-G time would have to be used and will reduce the time for experiments or tasks. SIRIUS training is designed to prepare prospective astronauts to utilize high G phase and G transitions to deploy and to stow equipment. Our training will address impediments likely to arise, such as motion sickness and motor control disturbances, and it will include recognition of symptoms, possible desensitization, recommendations for behavioral modification, and other countermeasures.

Training to Perform Tasks during G Transitions

Motion sickness is often elicited when head or full body movements are made in non 1-G or any changing gravitoinertial force environments [1, 2]. Motion sickness will be of particular concern if it occurs prior to the zero-G phase when astronauts need to perform their tasks. Time pressure is also a concern, as G transition times are relatively brief [3, 4]. We will utilize our unique hardware to train individuals to perform tasks during usable G transitions.

Participants will ride on board our fully enclosed, 22 ft in diameter Rotating Room/Artificial Gravity facility. It will be employed to induce motion sickness and other disturbances elicited during head or whole body movements in a changing gravitoinertial force field. Ride profiles will incorporate suborbital flight timelines [4], controlled motion sickness and movement errors, and other stressors such as task complexity, hardware troubleshooting, and/or combinations of factors. Protocols will consist of training to recognize motion sickness symptoms, sensitivity and adaptation testing, and will proceed with possible desensitization and task performance training.

Conclusion

The Rotating Room is only one of the facilities employed in our training program. Others are: Multi-Axis Rotation and Tilt device, and Optokinetic Drum/Vection chamber. Performance training and motion sickness pre-adaptation are key to mission success. At SIRIUS Astronaut Training, we design our training protocols to address general issues of sensorimotor human factors in spaceflight, as well as issues specific to astronauts' mission tasks. Utilizing G transitions may greatly enhance the efficiency of suborbital spaceflight.

References

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