Paper ID: 61983
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IAF SPACE OPERATIONS SYMPOSIUM (B6)
Mission Operations, Validation, Simulation and Training (3)

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TRANSFER AND RETENTION OF TRAINING IN ANALOG AND VIRTUAL SPACEFLIGHT ENVIRONMENTS

Abstract

Manned suborbital spaceflights are just around the corner. New Shepard may fly fare-paying passengers in 2021 or 2022. Each passenger will pay $250,000. And, with just 240 seconds of microgravity time, that equates to 1000 per second. For spaceflight participants (SFPs), the cost of incorrectly performing simple tasks will be extremely costly.

Even for trained astronauts, the tactile-kinesthetic and vestibular systems are affected by weightlessness. Of course, astronauts traveling to the International Space Station (ISS) have plenty of time to adapt, but SFPs will have no time at all – the time from rocket ignition to microgravity is less than 5 minutes.

To overcome the aforementioned difficulties this study evaluated two spaceflight analogous training systems specific to suborbital spaceflight: one took place in an actual neutral buoyancy environment (NBE) and one took place in a virtual reality (VR) NBE. To that end, this study sought to achieve three objectives:

1. Measure the effectiveness of neutral buoyancy dive training as a means to train suborbital SFPs in a swimming pool 2. Measure the effectiveness of neutral buoyancy dive training in an underwater-simulated VR environment as a means of improving maneuvering/task performance in microgravity. 3. Based on the results of objectives 1 and 2 a training program for SFPs was devised.

This research compared how effectively suborbital tasks were learned in an actual NBE compared with a VR-rendered NBE. One group (Group 1) of participants trained in a swimming pool. This group was taught a series of tasks comparable with those required of a suborbital SFP. The second group (Group 2) of participants was taught the same tasks as Group 1, but these tasks were performed in a VR-rendered NBE. VR Diver, a VR software program devised by PaleBlue was used to render the VR-render NBE. Following completion of their instruction, half of the Group 1 participants were tested for task proficiency in the actual NBE and half of the Group 1 participants were tested in the VR-rendered NBE. Following completion of instruction, half the Group 2 of participants were tested for proficiency of task execution in the actual NBE and half of the Group 2 participants were tested in the VR-rendered NBE.

This study demonstrated the efficacy of VR and VR-NBE NBE-type training as a means to improve the effectiveness of training suborbital SFPs. The outcome of this study will aid in development of suborbital flight training.