Application of Virtual Reality and Neutral Buoyancy to train Suborbital Scientists

Erik Seedhouse, PhD

Applied Aviation Sciences, Embry-Riddle Aeronautical University, 1 Aerospace Blvd, Daytona Beach, FL, 32114

Abstract

Manned suborbital spaceflights are a reality. *SpaceShipTwo*, operated by Virgin Galactic and *New Shepard*, operated by Blue Origin, have flown fare-paying passengers in 2021 and 2022. With each passenger paying at least $450,000 and with just four minutes (240 seconds) of actual microgravity time, that equates to almost $2000/second. For *spaceflight participants* (SFPs) a category which will include scientists, the cost of incorrectly performing even simple tasks will be extremely costly. To reduce errors this study evaluated two spaceflight analogous training systems specific to suborbital spaceflight: one that took place in a neutral buoyancy environment (NBE) and one that took place in a virtual reality (VR) environment.

Methods

One group (Group #1) of 8 participants trained in a swimming pool using the EasyDive System. This group was taught tasks comparable with those required of a suborbital SFP. The second group (Group #2) of 8 participants (also all scuba-certified) was taught the same tasks as Group #1, but these tasks were taught in a VR-rendered NBE. Following completion of their instruction, half of the Group #1 participants was tested for proficiency of task execution in the actual NBE and half of the Group #1 participants was tested in the VR-rendered NBE. Following completion of their instruction, half of the Group #2 of participants was tested for proficiency of task execution in the actual NBE and half of the Group #2 participants was tested in the VR-rendered NBE.

Results

This study demonstrated the efficacy of NBE and VR training as a means of preparing suborbital SFPs. Following training in the analog environments, participants reduced task completion time by up to 40%.

Conclusion

The outcome of this study may aid in the development of future applications in the realm of suborbital flight training. The findings from this study support the general hypothesis that an analog-based learning environment positively affects the cognitive and affective domains of learners. It is suggested that training in an analog environment may be adopted by the suborbital spaceflight industry as a training tool that could make learning more effective.