SPACE OPERATIONS SYMPOSIUM (B6)
Training Relevant for Operations, including Human Spaceflight (3)

Author: Mr. Jeffrey S. Osterlund
United Space Alliance, United States, jeffrey.s.osterlund@usa-spaceops.com

Mr. Brad Lawrence
United Space Alliance, United States, brad.a.lawrence@nasa.gov

VIRTUAL REALITY: AVATARS IN HUMAN SPACEFLIGHT TRAINING

Abstract

With the advancements in high spatial and temporal resolution graphics, along with advancements in 3D display capabilities to model, simulate, and analyze human-to-machine interfaces and interactions, the world of virtual environments is being used to develop everything from movie animations to design of automobiles. The use of multiple object motion capture technology and digital human tools in aerospace has demonstrated to be a more cost effective alternative to the cost of physical prototypes, provides a more efficient, flexible and responsive environment to changes in design and training, and provides early human factors considerations concerning the operation of complex launch vehicle or spacecraft. USA has deployed this technique and tool under Research and Development activities on both spacecraft assembly and ground processing operations design and training on the Orion Crew Module. Utilizing specialized products that were chosen based on functionality, including software and fixed based hardware (infrared and visible red cameras), along with cyber gloves to ensure fine motor dexterity of the hands. The key findings of the effort were: mockups should be built to not obstruct cameras from markers being tracked; markers should be placed in accurate positions on humans and flight hardware to help with tracking; 3D models used in the virtual environment be striped of non-essential data; high computational capable workstations are required to handle the large model data sets; and Technology Interchange Meetings with vendors and other industries also utilizing virtual reality applications need to occur on a continual basis enabling us to maintain our leading edge within this technology. This paper will review the considerations of simulation training that employs virtual reality technologies to familiarize and assess operational processes, allowing the ability to train virtually, experiment with "what if" scenarios, and expedite immediate changes to validate the design implementation. Training benefits encompass providing 3D animation for post-training assessment, placement of avatars within 3D replicated work environments in assembling or processing hardware, offering various viewpoints of processes assessed giving the evaluators the ability to determine task feasibility and identify potential support equipment needs; and provide human factors determinations, such as reach, visibility and accessibility. Results and lessons learned will provide evidence that the multiple object motion capture technology provides an effective tool to train, assess ergonomic risks, determine negative interactions between technicians and their proposed workspaces, and evaluation of spaceflight systems prior to, and as part of, the design process to contain costs and reduce schedule delays.