IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medical Care for Humans in Space (3)

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CONCEPTUALIZATION OF A MEDICAL SUPPORT UNIT DESIGNED TO SUSTAIN CREW HEALTH DURING DEEP SPACE TRANSIT

Abstract

Wherever humanity shall go in the future of space exploration, one must consider the medical support that is required for any mission of great endeavor. Despite the resiliency of the human body, it has rarely faced the difficulty of adapting to the harsh conditions found in the deep space environment; some of these conditions include microgravity, radiation, isolation, and others whose effects are not fully understood. Due to the constant barrage of physical strain on an astronaut's body, a medical solution must be designed, as comprehensively as possible, for deep space transit. Thus, for the 2019 NASA eXploration Systems and Habitation (X-Hab) Academic Innovation Challenge, the Michigan Bioastronautics and Life Support Systems (BLiSS) team conceptually devised a medical support system and prototyped its layout using virtual reality (VR). This medical workstation will sustain four crew members, including at least one medically-trained physician, for an 1100-day mission to, on, and from the surface of Mars. A mission to Mars presents unique challenges due to the lack of resupply and return to Earth, as well as unknowns regarding how the body reacts to long durations in space or on Mars's surface. Regardless, understanding human health in space should start with what is already known; past space mission medical records, derived from shuttle flights and the International Space Station (ISS), were analyzed to determine which conditions were most likely to occur, indicating which primary health issues the unit would be tasked with mitigating. These conditions then directed what medical equipment (diagnostic, operational, general, etc.) were prioritized to be included in this workstation. Inspiration for the overall unit layout was drawn from looking at arrangements of an emergency room, a Michigan Medicine Survival Flight helicopter, and an ambulance designed by Ferno EMS. Certain details of the medical unit design were

driven by concerns regarding tangential functionality, such as sterilization, ergonomics, transit-surface commonality, etc. Considering all these factors, the medical workstation largely takes advantage of a modular configuration that allows for customizability in both equipment placement and patient or physician orientation, providing a significant amount of control to the individuals utilizing the workspace. Following its conceptualization, the medical workstation was visualized through virtual models, allowing interaction with the design, for iterative improvement. Overall, this project displays a deep space transit medical prototype driven by functionality, while incorporating modularity and organization, that aims to bring the medical support conversation to the forefront of space exploration research.