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ANALOG SELECTION TOOL: CHARACTERIZING THE CHALLENGES OF MIMICKING THE SPACEFLIGHT ENVIRONMENT ON EARTH

Abstract

Planning and testing are essential steps before launching for space. The current trends of human spaceflight are long-term exploration missions (e.g. moon, Mars) which come with not only additional dangers of the space environment such as radiation and prolonged microgravity, but also stressors on human psyche. Indeed behavior, performance and psychosocial issues are critical to the success or failure of a space mission. Stressors such as the effect of confinement, isolation, uncertainty and danger of the situation need to be researched closely in order to plan and test mitigation measures. Earth-based analogs are used to help prepare for the inevitable challenges of the unforgiving space environment by testing operational countermeasures and analyzing the effects they have on the individual and on the team. Analogs are limited and cannot exactly model the space environment; therefore, choosing an appropriate analog relative to the space mission objectives is crucial. In response to this research requirement, an earth-based analog selection tool was created in order to compare multiple analogs. This paper explains how the analog selection tool works. A complete documentation and international database cataloguing existing analog missions was put together. Their validity was assessed in respect to the target space mission and their fidelity to theoretical space mission constraints. The algorithm ranks analogs relative to their fidelity by using a system for which each characteristic was weighted. The fidelity of an analog was dependent on two criteria: similarity to the chosen mission characteristic (i.e. ISS, moon, Mars) that the investigator has selected and of fidelity to the specific Behavioral Health and Performance (BHP) risk that is examined. The BHP elements were divided into three main categories, which were isolation, confinement and sleep. For every given analog, the characteristics of the analog were given a fidelity score with respect to each sub-element of one BHP risk. Additionally, the analog characteristics were scored according to their similarity to the studied mission. Then the ranking of the analogs was calculated following the selection criteria of the investigator depending on whether they are researching one specific BHP risk, wish to imitate as closely as possible one mission or take both criteria is account. This tool revealed that understanding the research gap is just as critical as having an analog of high fidelity to the specific mission investigated