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SIMULATING LONG DURACTION DEEP SPACE MISSIONS

Abstract

As both private companies and governmental agencies lay future plans to send humans to Mars and near Earth asteroids, many challenges lie ahead on such journeys. Some of the biggest hurdles in attaining this goal will be ensuring that the human body and mind can cope with various physiological and psychological effects of long duration spaceflight which place astronauts in jeopardy for both short and long term health risks. In this paper, human factors such as mental and physical health are presented and their limitations discussed and incorporated within the examination of historical and present day Earth-based and space-based simulations to determine their ability to accurately portray a long duration deep space mission. The limitations inherent with these types of simulations support the findings that there has yet to be a simulation of a long duration deep space mission that incorporates both microgravity and the accurate long-term isolation of its crewmembers. One of the ideal possibilities for a simulation method would be to conduct a space-based study aboard a pre-existing facility, such as the ISS. The plan would be to isolate part of the ISS for the duration of the simulation. However, due to the size of the ISS, this would severely cut down on the amount of space for current research. Therefore, a better option would be to attach another capsule(s) onto the ISS for the specific purpose of such a simulation. While the recent launch of Bigelow Aerospace's Bigelow Expandable Activity Module is a step in the right direction, its limited size makes such a simulation unrealistic. Instead, a suggested simulation method of utilizing Bigelow's larger BA 330 inflatable space habitat with the ISS, combined with a simulated surface period on Earth is discussed along with factors and variables that would need to be accounted for and controlled during such an experiment. With the useful lifespan of the ISS coming to an end in 2024, and plans to launch humans to Mars as early as 2026 (for the first Mars One manned mission), it is crucial that such a mission simulation be attempted in the very near future. The data gained from this method of improved simulation could very well go a long way towards not only alleviating some of the hazards to human health, but also towards defining the selection process for future crewmembers and helping to identify and mitigate the risks to future deep space missions.