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INVESTIGATION OF TETHERED ARTIFICIAL GRAVITY VEHICLE CONCEPTS FOR MANNED MARS EXPLORATION

Abstract

If humans are to ever step foot on Mars, an effective and safe countermeasure for weightlessness must first be developed. Prolonged weightlessness adversely influences a number of physiological systems such as: introducing intracranial pressure, bone demineralization, muscular atrophy, immune deficiencies and vision degradation among other conditions. Current Mars human exploration missions envision one of two trajectories: a short-term stay or a long-term stay. With the current deficiencies in effective weightlessness countermeasures, a long-term stay trajectory is essentially ruled out leaving the challenge to explore the Martian surface in a mere 30 to 60 days.

This paper discusses a variety of artificial gravity concepts and develops system design parameters for early architecture studies. With the advances in materials engineering, new and developing materials may be effective solutions to common pitfalls in artificial gravity designs. Carbon nanotubes have garnered attention in the last decade for their projected mechanical properties with research being conducted to further characterize and manipulate these properties. A thorough investigation of artificial gravity concepts and emerging material technologies could enable longer and more effective human exploration missions of Mars.