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20th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Technologies (2B)

Author: Ms. Tanishka Roy
University of Petroleum and Energy Studies, India, tanishkaroy42@gmail.com

Mr. Manan Malik
University of Petroleum and Energy Studies, India, mananmalik278@gmail.com
Mr. Mrityunjai Verma
Space Generation Advisory Council (SGAC), India, mrityunjaiverma5301@gmail.com
Ms. Spoorthi M.S.
University of Petroleum and Energy Studies, India, spoorthi927@gmail.com

CMG-POWERED ARTIFICIAL GRAVITY AND MAGNETIC LOADING SYSTEM FOR LUNAR SETTLEMENTS

Abstract

Reaching beyond grasp truly spearheaded the growth and evolution of humankind from climbing trees to raising concrete jungles. The quest to raise a utopia has culminated in anticlimactic consequences to the Earth, requiring an exodus to minimize the impact on our home planet. Coupled with the thirst to gain more knowledge and expand our presence in the universe, colonization is the need of the millennium. However, other planets or moons lack even the rudimentary necessities for human survival, requiring engineering ingenuity and technological advancements to develop a habitable ecosystem. The proximity and location of Earth's moon put it on top of the list of celestial bodies for economic colonization. Without atmosphere or water and low gravity, colonization is herculean. Through adaptability and ingenuity, satiation of all these basic requirements is viable today except artificial gravity, the most critical requirement yet to be feasibly solved. Expensive complex power-hungry centrifuges, five-sixth chairs, astronaut propulsion modules, and exercises may help trained personnel but are unsuitable for voluntary long-term settlers.

This work endeavors towards designing a system to utilize precession and regenerative braking to provide controllable vectored force to provide artificial gravity nearly matching the gravity of Earth using modified control moment gyroscopes (CMG) integrated into the settlement architecture, coupled with low force magnetic field systems capable of being incorporated to spacesuit designs, covering sustainability and baselined on existing spacesuit designs and settlement architectures, in this research project. Besides the CMG system, miniaturized weak electromagnetic nodes integrated into the spacesuit allow for perceived pull towards the settlement base and redistributes the force gradient across the human geometry to match the Earth's gravity gradient with precise control and low-magnitude forces to prevent injuries and vestibular side-effects, synchronous to a uniform low-intensity field designed to provide maximum spread and minimal communication or electronics interference, distributed throughout the settlement. The node locations on the suit are decided according to human physiology and performance parameters to make the forces as compliant to real forces experienced in locomotion and other activities on Earth as technologically possible. This technology may also be utilized in applying artificial force on the body for wireless gymnasium, exercise, and training applications with zero heavy equipment involved, with a plethora of spin-off applications. This is also a technology forerunner to future interplanetary missions for being executed economically, making colonization faster, affordable, reliable, and viable for the Solar

System and beyond.