MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Facilities and Operations of Microgravity Experiments (5)

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LOW-COST SCIENCE LABORATORY IN MICROGRAVITY USING A CUBESAT CENTRIFUGE FRAMEWORK

Abstract

Gravity is known to play a critical part in many physical, biological and technological processes that we take for granted on Earth. Long duration human spaceflight has shown the critical importance and dangers to human life, particularly with the irreversible loss of bone calcium and the challenges with growing food and plant-life in microgravity. Long duration human spaceflight can be made feasible by introducing artificial gravity. Concepts for artificial gravity using spinning spacecraft are not new. However previous concepts contained a spinning spacecraft 'attached' to a stationary one such as the ISS which imparts high complexity and cost. In this concept, we propose an open source Cubesat framework as a low-cost centrifuge science platform. As part of our first demonstration mission, we are building AOSAT (Asteroid Origins Satellite) which is 3U centrifuge Cubesat spinning at 1 rev/min along its minor axis to generate milligravity conditions and that will carry fine fragments of common meteorite, using it to build a 'patch of asteroid' in low earth orbit. Our next design and the focus of this paper is a scalable, 6U, 30 W system with the ability deploy and extends its pair of 2U experiment chambers a distance of up to 8 meter using mechanical or inflatable methods, spinning at 10 rev/min to generate one g. The central 2U chamber would house fully redundant spacecraft electronics, deployment mechanism and communication equipment. Our current work focuses on investigating the principal feasibility of this concept, including analyzing the deployment mechanism, thermal and power systems in addition to developing a modular system design framework for integrating user-customized science modules for education, microbiology, fluidics, material sciences and chemistry.