Paper ID: 85874
interactive

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

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AMP: AN AUTONOMOUS SUB-ORBITAL MICROGRAVITY PLATFORM MISSION CONCEPT

Abstract

Performing a microgravity experiment relies on using one of the following platforms: drop towers, parabolic flights, sub-orbital rocket, or being on the International Space Station (ISS). Each have their own advantages and disadvantages in terms of microgravity duration and quality, and waiting times that are typically on the order of months to years.

A mission concept for a novel microgravity platform, an Autonomous re-useable fixed wing sub-orbital Microgravity Platform (AMP) to solve the problems of the microgravity platforms is proposed. AMP is a horizontal take-off and landing rocket propelled Unmanned Aerial Vehicle (UAV) that will perform a sub-orbital trajectory, similar to current sub-orbital rocket microgravity platforms. However, the fixed wing configuration allows AMP to glide back to a landing zone for experimental retrieval and quick operational turn around. The ability to fly autonomously permits a single operator to simultaneously control several in-flight experiments and its inherent re-useability reduces the operational costs. AMP also has the possibility to perform different parabolic arcs to simulate the gravitational conditions of the Moon and Mars. Preliminary experimental volumetric and mass constraints, and microgravity performances are presented and compared against existing platforms.

This paper exhibits the complete mission concept for AMP following ground operations to sub-orbital flights. System engineering design decisions are presented with supporting design validation and verification activities conducted using "Bifrost", an in-house designed virtual engineering and model based simulation framework.