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

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ASTER: DEVELOPING A PLATFORM TO ACHIEVE MICROGRAVITY FOR LOW-COST EXPERIMENTS

Abstract

Microgravity is an important field of research, which is vital for the efficient future utilisation of space. It is possible to undertake microgravity experiments on-orbit, however, this is often well outside the available funding range of low-cost experiments. Microgravity experiments undertaken on sounding rockets are more accessible to low-budget institutions and students, and provide longer periods of sustained microgravity than drop towers and parabolic flights. However, unless stabilised, such experiments cannot achieve true microgravity conditions due to residual external forces, such as the centrifugal force of the rocket's spin, acting on the experiment. Thus, projects that want to carry out experiments in microgravity conditions would first need to design the platform required to achieve true microgravity, making these projects more complex and time intensive.

Project ASTER (Attitude STabilised free falling ExpeRiment) is designing and testing such a platform for microgravity research. ASTER is taking advantage of the extended microgravity period of a sounding rocket flight to test a high performance, low-cost Attitude Control System (ACS) solution capable of providing microgravity conditions for experiments. This would greatly benefit both future satellite projects and sounding rocket experiments which require highly accurate stabilisation and pointing capabilities.

The design utilises three reaction wheels controlled by a closed loop system to stabilise a Free Falling Unit - ejected from a sounding rocket - within seconds. The platform will be able to perform slewing manoeuvres and accommodate future experiments on easily adaptable mounting points which allow for on-board sensors and cameras. ASTER will be launched on-board REXUS 30 in March 2022, after which it will be recovered and the obtained results will be published on an open source basis to ensure its future availability to student and other low budget research projects, thereby allowing further improvement, optimisation, and customisation. ASTER is aiming to establish a platform which simplifies the development of microgravity experiments, especially for student projects which often face tight schedules and limited resources. ASTER is being developed as part of the 13th Cycle of the German-Swedish student programme REXUS/BEXUS by students of Luleå University of Technology (LTU) at the Kiruna Space Campus.