

Development of a Microgravity Environment Testbed for Validation of CubeSats (METVOC) in Parabolic Flight

Brien Posey¹, Kausiksankar Das³, Michael Gallagher¹, David Wassell¹, Jason Reimuller¹, Aaron Persad^{1,2}

¹ Association of Spaceflight Professionals Inc., Physical Sciences Working Group, Tampa, Florida, United States

² University of Toronto, Department of Mechanical Engineering, Toronto, Ontario, Canada

³ University of Maryland Eastern Shore, Princess Anne, Maryland, United States

Abstract

CubeSats have become a popular platform for testing small scale experiments in space or space analog environments due to their low cost and compact size. Testing CubeSat payloads however, is not without risks. A poorly designed payload could interfere with other CubeSats that are also being flown. The METVOC seeks to substantially reduce these risks by providing a fully contained and standardized testing platform for microgravity environments.

METVOC Hardware

The METVOC is a 20 x 20 CM device that is designed to test 1U sized CubeSats weighing up to 2 KG. Currently at TRL-5, this device is equipped with an integrated GoPro camera and an Arduino controller attached to a sensor array that will be configured to control the experiment, and to record the resulting data.

The Arduino also records basic measurements about the box itself, namely acceleration, temperature, and humidity. Acceleration is measured using the MMA8452 accelerometer. Temperature and humidity are logged using a DHT sensor, and the resulting data is recorded onto an SD card.

Flight Testing

The METVOC can test any 1U sized CubeSat, and is designed to allow CubeSats to be rapidly loaded or unloaded, which will allow multiple CubeSats to be tested within the time constraints of a parabolic flight or a suborbital spaceflight.

To demonstrate the METVOC's versatility, the Association of Spaceflight Professionals submitted a NASA grant proposal that, if accepted, will allow for the testing of three different CubeSat payloads on a series of parabolic flights. The payloads to be tested include a capillary action in microgravity experiment, a rigid body rotation in microgravity experiment, and a pendulum motion experiment.

These experiments were chosen both for their diversity and because each will yield useful scientific data. The flights will not only demonstrate the METVOC's ability to test CubeSat payloads, but also the ease with which payloads can be inserted and removed by a researcher who is wearing spacesuit gloves.

Conclusions

The METVOC will reduce the risks associated with testing CubeSats in microgravity by providing a contained environment and a standardized sensor array.

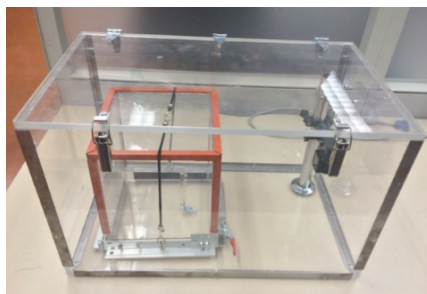


Figure Insert: The METVOC provides a standardized platform for testing CubeSats in microgravity.