44th STUDENT CONFERENCE (E2)
Educational Pico and Nano Satellites (4)

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AEROGEL INSULATION AND EARTH IMAGING EXPERIMENT (AIEI-EX) ONBOARD A TUBESAT

Abstract

The Aerospace Engineering Department at Ryerson University has a history of successful student design teams in various engineering competitions. One of these teams includes the Ryerson Cansat team which enabled the advancement of satellite engineering at Ryerson. This led to the University's first Tubesat project. The Tubesat, a kit provided by Interorbital Systems, is a small tubular shaped satellite with an outside diameter of 8.94 cm, a length of 12.7cm and a maximum mass of 0.75 kg. The kit consists of pre-manufactured PCB boards where all sensors and electrical components have to be soldered on. The components provided are hardware for main subsystems except payload subsystem, and does not include software for data-handling or communications. The development, testing, and implementation of the software was one of the vital tasks of the project. The kit also comes with a small payload bay that provides the building teams with space to include a student-designed and -built experiment. The experiment proposed here is Aerogel Insulation and Earth Imaging Experiment (AIEI-Ex) onboard the Tubesat. The payload comprises of three units; an aerogel insulation unit, an Earth-imaging unit, and an IMU unit. The aerogel insulation unit determined the environment that a small satellite experiences in a low earth, sun-synchronous polar orbit. A Cold-Junction Compensated Thermocouple Sensor was used to obtain temperature readings for a full orbit. The Earth-imaging unit was installed to confirm the Tubesat's attitude and orbital position. The orbital position was also tracked with a beacon signal. These signals are received by multiple ground stations along its ground track that are collected and published

on a website. Finally, an IMU unit was installed to send information about the Tubesat's attitude in its orbit. The established ground track and the attitude data received from the satellite will be compared with a previously simulated ground-track and satellite attitude using Matlab. The activation of all three unit will be achieved by a command from the ground station.

The goal of this project was to conduct a feasibility study of using small satellites to conduct the AIEI-Ex using low cost electronics. Small satellites will be important for future space mission due to their low cost and space debris prevention. This project significantly increased our knowledge and understanding of small satellite construction and space engineering.