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ENVIRONMENTAL MONITORING EXPERIMENT (EM-EX) ONBOARD RYETUBESAT

Abstract

Over the years, Cubesats have evolved from purely educational tools to a platform for technology demonstration and qualifying scientific instruments with the use of commercial off-the-shelf components. Further, small satellites will be important for future space missions due to their low cost and self-decaying orbits, which aid in the prevention of space debris. For the last 10 years, Ryerson University has been conducting research on the design and development of miniature satellites. These miniature satellites include 350 gram Can-sized satellites (RyeCanSat), 1000 gram pico-sized satellites (RyePicoSat), 750 gram TubeSats (RyeTubeSat) and 100 gram femto-sized satellites (RyeFemSat). This project will build on Ryerson University's TubeSat initiative. RyeTubeSat - launch provided by Interorbital Systems - is a small tubular-shaped satellite with an outside diameter of 8.94 cm, a length of 12.7 cm and a maximum mass of 750 gram. It consists of Command and Data Handling, Communication and Power subsystems. The development, testing, and implementation of the software for payload subsystem will be one of the vital tasks of the project as it will be used to analyze sensor data gathered over the mission cycle. The payload subsystem will include multiple PbS (Lead Sulphide), PbSe (Lead Selenide), and InSb (Indium Antimonide) IDA (Integrated Detector Assembly) infrared detectors along with an IMU unit with highly sensitive geomagnetic sensors to estimate the RyeTubeSat's attitude and orbital position. The goal of this research project will be to conduct a feasibility study of using small satellites to conduct emission monitoring experiments using a low cost, compact, and integrated infrared detector assembly. The preliminary studies show that the proposed payload is within the mass and power budgets (less than 100 gram and 1 Watt) available onboard RyeTubeSat and its application is unique and may provide promising results for environmental monitoring from space. The gathered data from RyeTubeSat will be used to estimate the mass of greenhouse gases generated by auto and aviation emissions, forest fires and volcanic eruptions.