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# PITCH RESOLVING SPECTROSCOPY FOR ELECTRON TRANSPORT (PRESET): A 3U CUBESAT MISSION

**Abstract**

The McMaster Interdisciplinary Satellite Team (MIST) is working on a 3U CubeSat as part of the CubeSats Initiative in Canada for STEM (CUBICS) program led by the Canadian Space Agency (CSA). This paper discusses the Pitch REsolving Spectroscopy for Electron Transport (PRESET) mission, which aims to measure the time-dependent electron pitch-angle density in the outer Van Allen Belt. Specifically, electrons with energies between 0.3-5 MeV will be observed, as there are currently no medium energy (2-7 MeV) electron spectrometers in Low Earth Orbit (LEO). Understanding the physics that govern the electron flux variation is of great importance since electrons with correct velocities are absorbed by the atmosphere producing nitric and hydrogen oxides. This depletes the ozone at high latitudes. This mission aims to i) improve the understanding of the electron flux variation with magnetic storms, ii) train the next generation of students in the space sector, and iii) contribute to the amateur radio community. This paper will present an overview of the spacecraft design, explore risk mitigation techniques within the development plan, and cover lessons learned from MIST's previous mission, NEUDOSE. PRESET is in the preliminary

design stages and all subsystems are discussed. The custom Payloads include an Electron Spectrometer Telescope (EST) and Magnetometer (MAG). The custom Communication System includes an antenna module and communication module. The custom Mechanical System consists of a structure, 1 metre deployable boom to hold the MAG, EST enclosure, deployable for the antenna, and a passive thermal system. Command and Data Handling (CDH) is performed through a Commercial Off-The-Shelf (COTS) On-Board Computer (OBC). The Attitude, Determination and Control System (ADCS) uses COTS Magnetorquers and Magnetometers, and a Secondary On-Board Computer (SOBC) for ADC algorithms. The Electrical Power System (EPS) is made of a COTS Power Distribution Module (PDM), battery, and solar cells tightly packed on a custom in-house designed solar panel. The payloads, communication system, mechanical systems, and solar panels are innovative and their technical capabilities in LEO shall be demonstrated through PRESET. In addition to the science and technological demonstration objectives, the team takes part in community outreach activities and provides learning opportunities to over 100 students throughout this mission. Opportunities include obtaining amateur radio operator licenses under the Radio Amateurs of Canada (RAC). This paper discusses the PRESET mission and its primary objectives in science, education, and outreach, and describes the CubeSat's architecture and subsystem designs.