CubeSat NB Hybrid Passive – Active

Attitude Determination Control System

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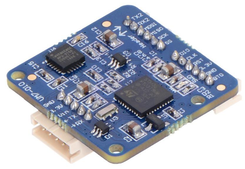
CubeSat NB

The aim of CubeSat NB is to design and build a CubeSat as part of the Canadian Space Agency's Canadian CubeSat Project, to be launched in 2022.

CubeSat VIOLET's mission is to take pictures of the spectral airglow in the ionosphere. SOMETHING ABOUT GRIPS.

A Spectral Airglow Structure Imager subsystem (SASI) will be used to obtain data to research the variations in the ionosphere that can affect the Earth's electrical and communication systems.

To maximize the number of picture-taking locations, while minimizing power consumption a novel hybrid active-passive control system was designed.



UM7 Orientation Sensor

- 3-axis accelerometer, gyroscope, and magnetometer.
- Used to estimate satellite attitude.

TJA1050 CAN Transceiver

- Used to communicate with other VIOLET subsystems.
- Receive start/stop tasks from the OBC.
- Transmit system health data.

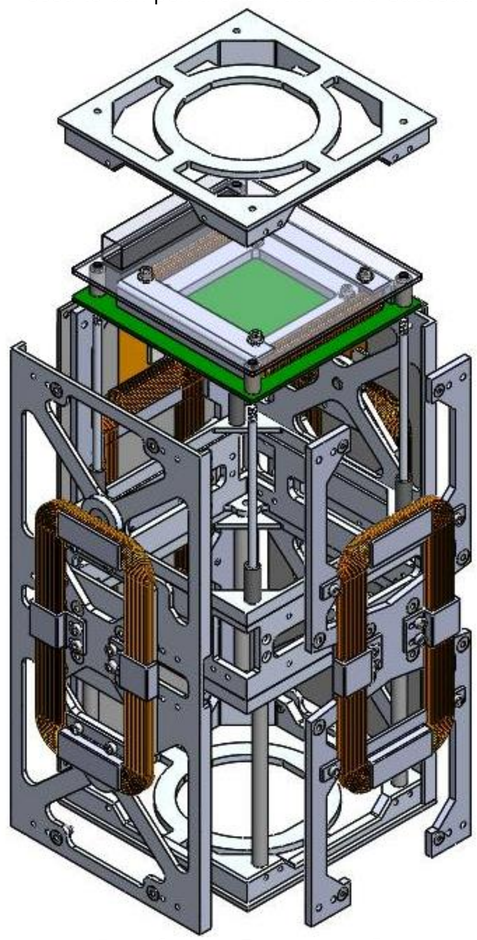
Passive Control

Permanent Magnet

- Permanent magnet with ~0.8 Am^2.
- Aligns CubeSat with the Earth's magnetic field lines without consuming power.

Hy-Mu 80 Hysteresis Rods

- Used to dampen the roll rate of the CubeSat.



AT90CAN128 Microcontroller

- Computes the desired inclination of the satellite.
- Determines the current needed to each magnetic torquer.
- Communicates with the UM7, the H-bridges and with CubeSat subsystems.

DRV8876 H-Bridge

- Controls the strength and direction of the current through the magnetic torquers.

Value Added Projects

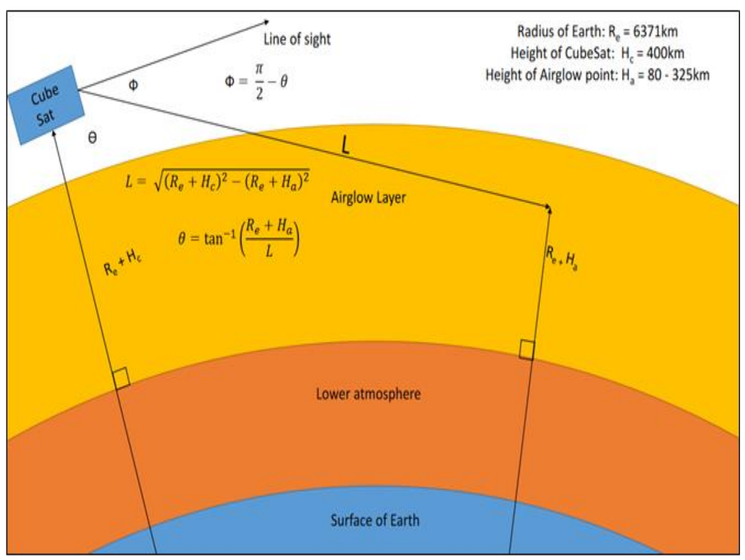
- Bluetooth wireless dashboard interface
- IMU testing
- Helmholtz cage
- Modeling of the magnetic field

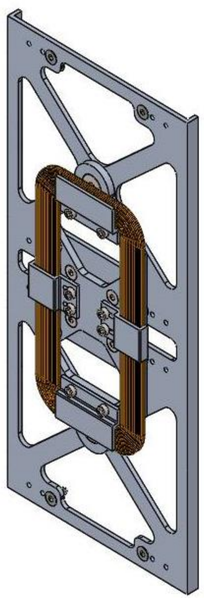
Future Work

- Incorporate GNSS data to attitude determination
- Determine the amount of time (orbits) required to change inclination

Simulations

- MATLAB: Map ideal picture taking locations
- SolidWorks: Random Vibration and load Simulations
- MATLAB SNAP: Analyze ideal permanent magnet strength and hysteresis bar characteristics.

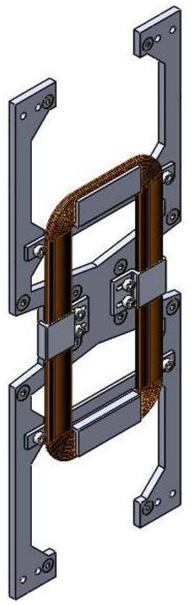


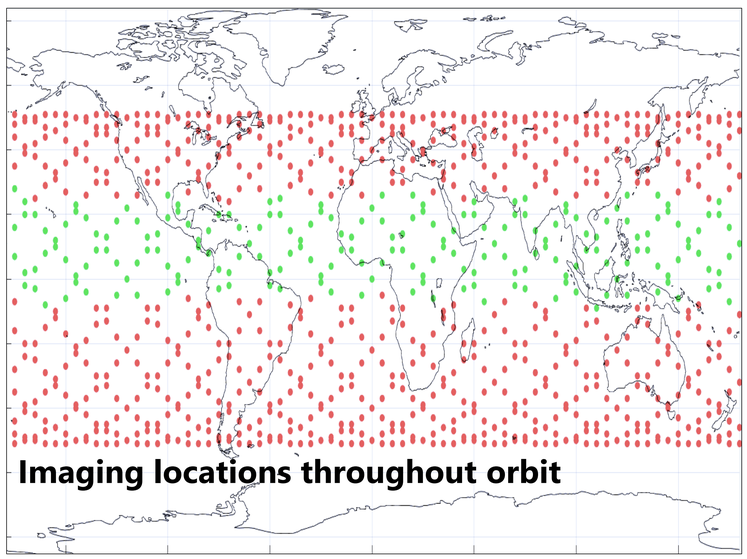


Active Control

3-Axis Magnetic Torquers

- The current passing through a coil is controlled to actively change the attitude of the satellite.





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ENGG4000 Capstone Team 01

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