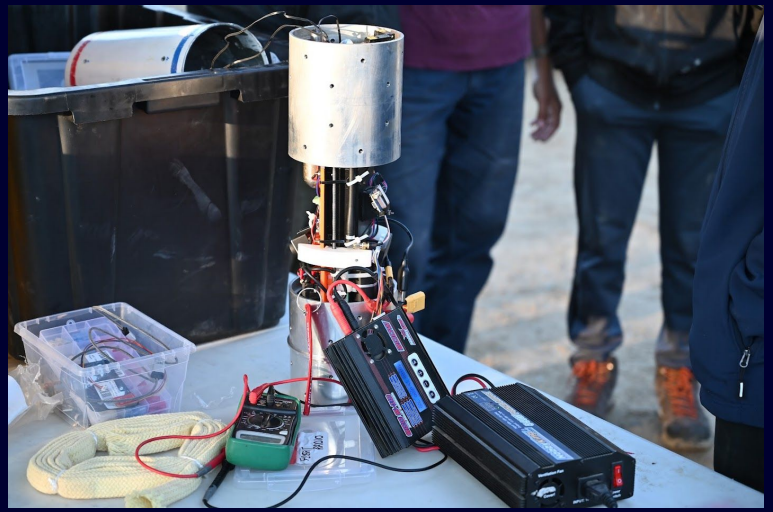
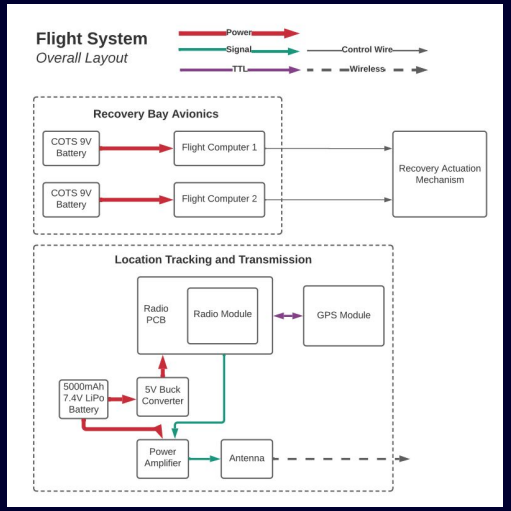
Engineering Design Portfolio

Will Taylor

Flight Bay and Microcontroller Design

May 2022 - Present





Description

Actuates recovery mechanism, transmits GPS coordinates, and collects flight data. Composed of two COTS flight computers,GPS transceiver module, and GoPro. Transmits at 433MHz through a monopole antenna. Runs on two 9V batteries and a LiPo.

Previous Role

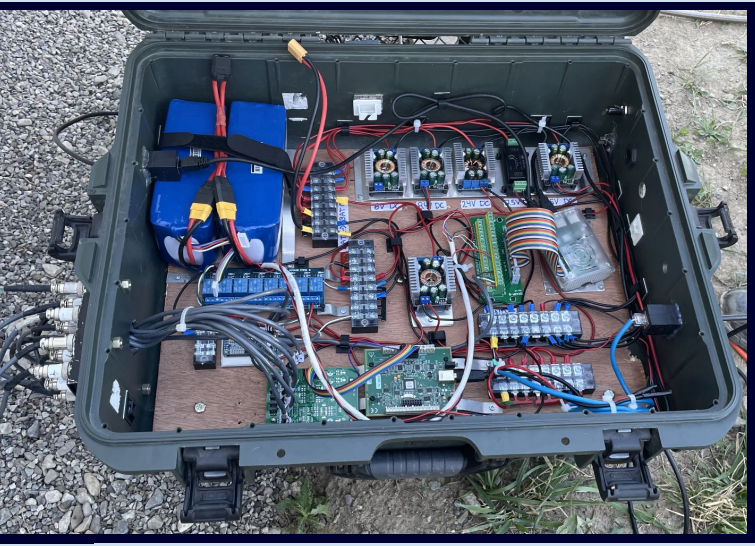
Fabricated, tested, and operated flight bay in preparation for and during launch. Credit: Original design and part sourcing was performed by previous members.

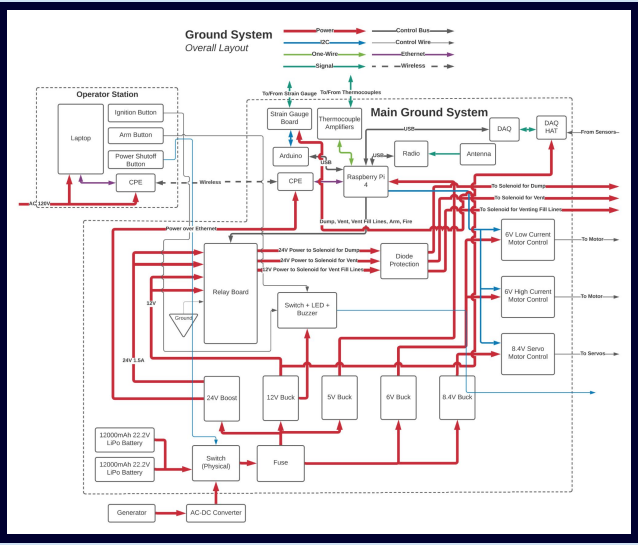
Current Role

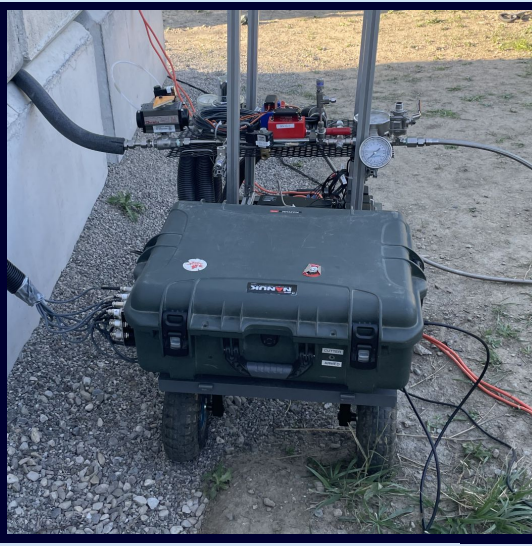
Overseeing the 3-D redesign of bay to allow for modularity. Overseeing live flight data telemetry at 915MHz, RF simulations and testing procedure. Chiefly responsible for systems design and new STM32-series microcontroller failsafes and sensor stack for flight and propulsion data.

Ground Station Sensing and Actuation Hardware

March 2022 - Present







Description

Collects engine-testing and pre-flight data (thermocouples, pressure transducers, load cell integration). Controls NO2 / N2 fill system. Operated by Raspberry-Pi connected to laptop by Wifi/Ethernet link. Powered by LiPo pair or DC generator. Weather-proofed containment.

Previous Role

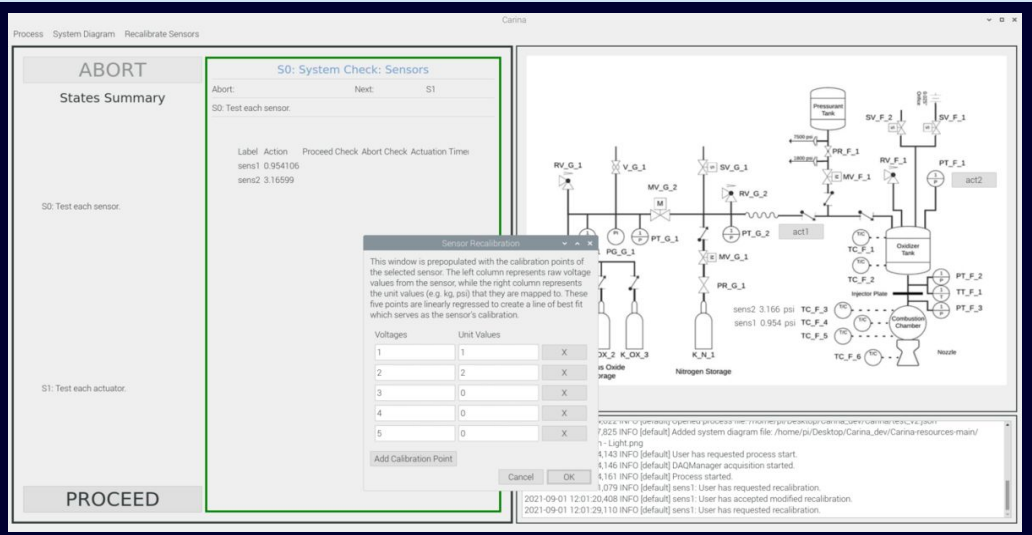
Upscaled and wired DAQ units, sourced power converters. Physically implemented and tested sensor array. Soldered and assembled new components. Modified 25% of system. Credit: initial system design was completed over many years by previous members.

Current Role

Overseeing fault analysis and optimization of component placement. Overseeing cooling/air circulation system addition. Chiefly responsible for designing and building redundant hardwired connection to fill system for aborting and dumping in system failure scenarios.

Ground Station Software and UI

February 2022 - Present



Description

Software component of ground station. Controls sensors and actuators. Streams live data and saves to log files. Custom UI for state-machine procedures and P&ID import. Streams and saves data from hardwired cameras. Sensor-calibration functionality.

Previous Role

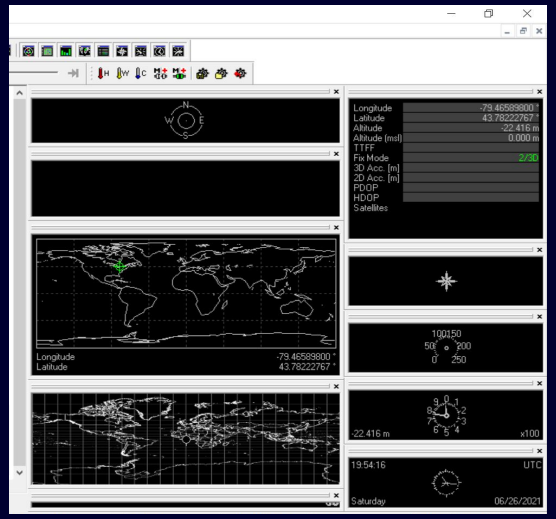
Streamlined and automated sensor calibration process to occur entirely on-device. Previously calibration was performed manually through parsing log files in excel. Added functionality for live computation and graphing of data, revealing useful trends and statistics. Credit: majority of codebase was developed by one team member 2+ years previously.

Current Role

Overseeing the advancement of graphing functionality. Overseeing the full documentation of the software (previously sparsely documented) and the creation of a class diagram. Leading structural changes and reducing unneeded boilerplate code.

Launch Canada Competition

August 2022



Description

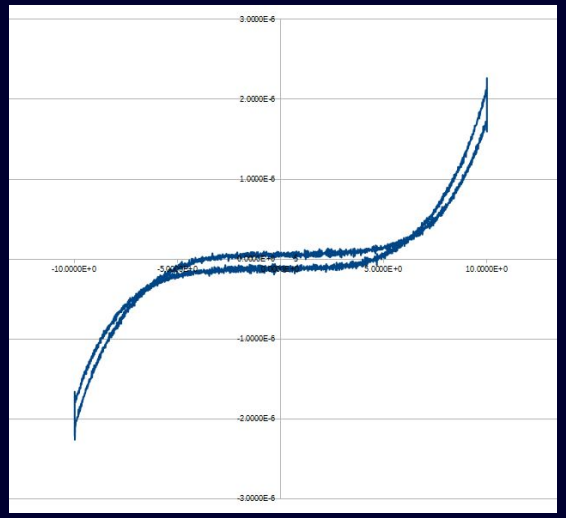
Represented the University of Toronto at the inaugural Launch Canada competition. Flew Canada's first experimental (not COTS) hybrid-propulsion rocket to 23,000'. Placed First in the Advanced Category. Heavy timeline-dependence and quick-moving hands-on work.

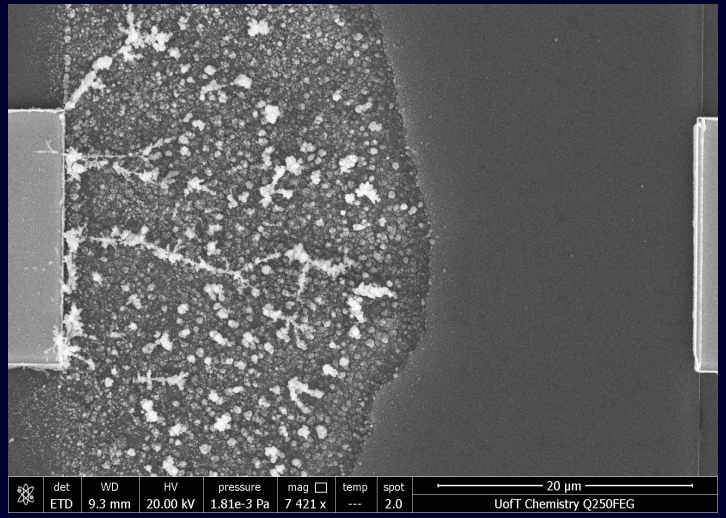
Role

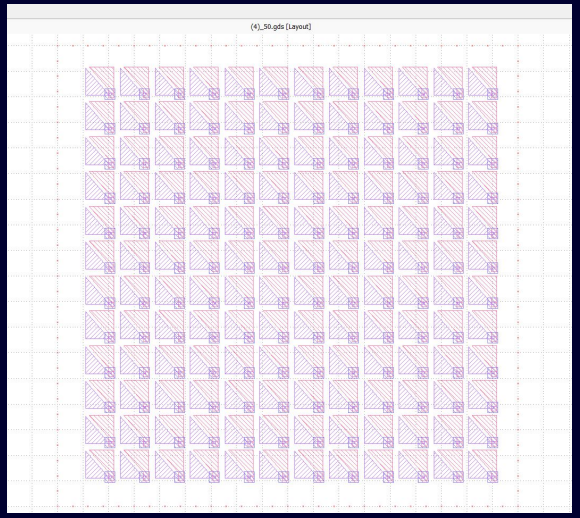
Assembled flight bay and assisted in testing recovery mechanism pre-launch. Set-up ground infrastructure including ground system, antennas, launch rail, and pressure vessels. Operated GPS receiver and compiled flight data post-launch, revealing areas of improvement.

Novel Memristor Architecture and Fabrication Procedure

May 2022 - Present







Description

Building ‘memristors’, electronic devices that have a variable and modifiable resistance value. Potentially useful for deep learning, memory hardware, and neuromorphic computing. Full process from microfabrication to test-bench measurements and characterization.

Previous Role

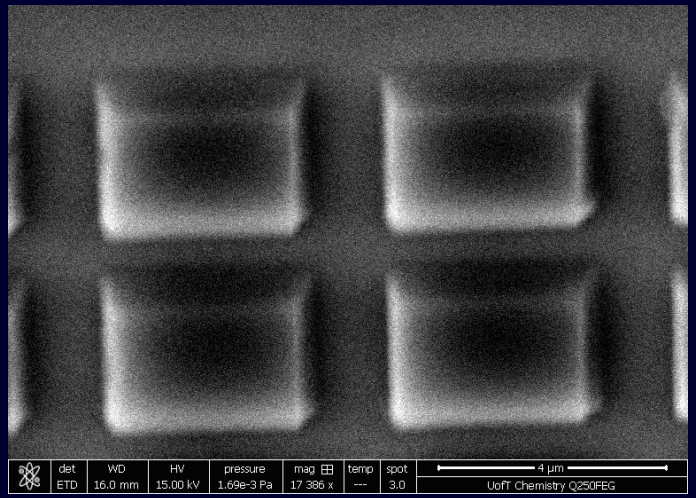
Optimized 2D CAD layout, and used programmatic tools to speed up the design-modification-time of other labmates from hours to seconds. Optimized thin-film stack to remove a deposited layer, reduce experimental noise, and cut cost and fabrication time in half.

Current Role

Leading two undergraduate students in the testing and characterization of existing devices, gathering data to prepare for paper submission.

Metamaterials for Radiative Cooling

May 2022 - August 2022



Description

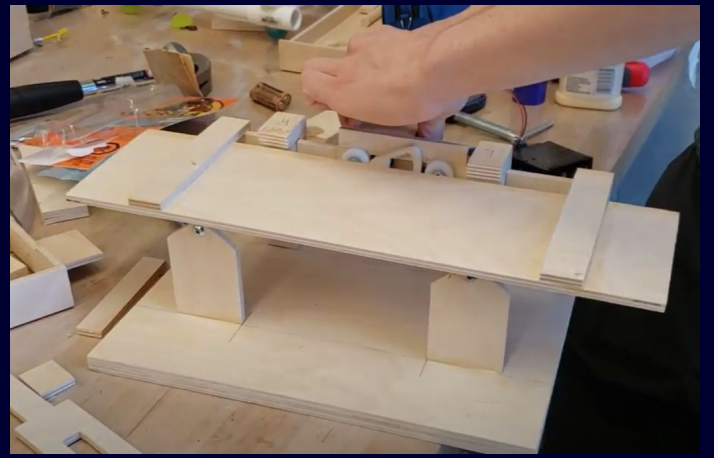
Using scientific advancements in microfabrication and simulation to develop 2-D ‘metamaterials’, a type of material where surface properties are dictated by structure rather than composition. Applying metamaterials to the thermodynamic process of energy-free radiative cooling into space.

Role

Designed vacuum chamber for outdoor experimental measurements; designed experimental process. Fabricated devices and developed lithography protocol to ensure well-defined feature dimensions. Iterated on design multiple times. Unfortunately unable to share photos of the experimental setup before publication.

Beehive Parasite Design Project

January 2022 - March 2022



Description

As part of a design course, we interacted with a local community and developed a requirements model to fit their needs and experience. We iterated on this requirements model and developed candidate designs to solve the problem of beehive infestation with the varroa parasite.

Role

Designed sugar puff system using hand-operated bike pump. Tested and iterated to ensure good dispersion. Designed two-sided cam-and-follower mechanism to convert motor-driven motion into ‘shake-like’ linear motion.