Development of Testing and Verification Procedures for MEMESat-1's Subsystems

***M**ission for **E**ducation and **M**ultimedia **E**ngagement*
The University of Georgia Small Satellite Research Laboratory

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Overview

MEMESat-1 is a 2U repeater crafted by the UGA Small Satellite Research Lab. It's geared towards inspiring the next generation of students to work in aerospace. MEMESat-1 is entering the stage of testing our satellite to ensure it will be prepared for its mission. These tests will be the responsibility of MEMESat-1's Mission Operations team. MOPs will employ a series of ground tests to validate the satellite's subsystems, including its flight software via the **DitL** testing, communication via the **Simulated Communication** testing, power supply via the **Charge Cycle** testing, ADCS via the **ADCS Verification** testing, and command system via the **Command and Execution** testing.

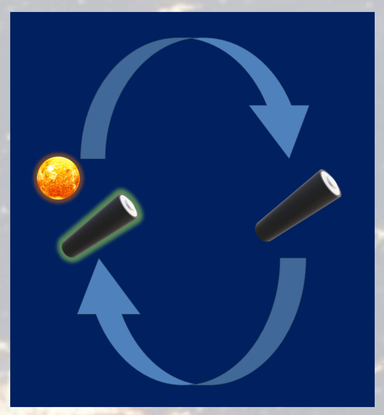
Purpose

The overarching goal of this research is to **refine** our subsystems using our tests and to give an outlook on the growth and correction we've been able to achieve with said tests. Each of these tests is critical to the mission success of **MEMESat-1**. Therefore, we are prioritizing precision and depth in our testing to avoid and be prepared for any anomaly that might be thrown our way during the mission. Through these testing procedures, we will ensure the **reliability**, **functionality**, and **operational readiness** of our satellite for its educational mission of giving students access to space and paving the way for the next generation of space engineers.

Testing Procedures

Simulated Communications: Requires us to verify that our satellite can receive and transmit via UHF. By looking at the received signal strength and antenna response patterns, the **Mission Operations** & **Ground Station** team, COSMO, will assess the effectiveness of the satellite's communication subsystems for the best data transmission reliability.

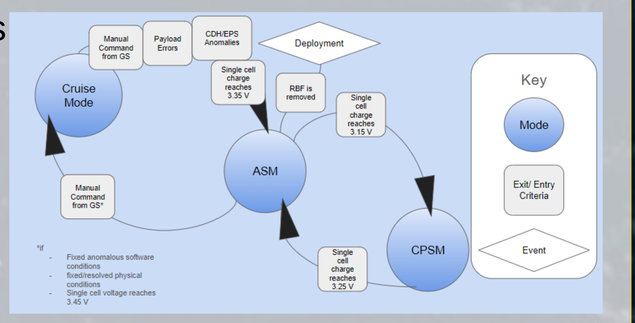
ADCS Verification: Requires us to utilize our **Helmholtz cage** to the performance of our passive magnetic attitude determination control system. By analyzing the data from this test, we will be able to ensure that our satellite will **detumble** in a timely and proper manner based on our pointing requirements.



Charge Cycle: Assesses the performance and endurance of MEMESat-1's power systems under simulated operating conditions. The **Mission Operations** & **Hardware** team will subject MEMESat-1's batteries to repeated charge and discharge cycles to evaluate their capacity, efficiency, and longevity over the mission lifespan.

Command and Execution: Requires us to ensure that commands are executed as intended and that the satellite responds correctly to each command.

Day-in-the-Life: This is an intensive test procedures that will simulate an **operational day** for MEMESat-1 to validate its performance under normal and abnormal conditions. The team conducts DitL by executing a predefined sequence of operations, including deployment, 3 operational modes (Cruise, Safe, and Critical Safe), downlinking, uplinking, battery charge, and end-of-life.

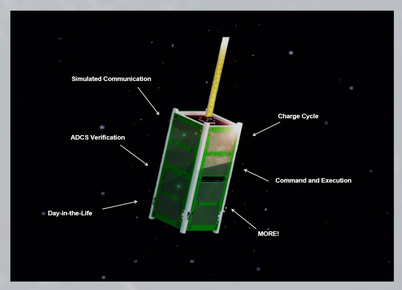


Progress

We have been able to make progress on our ADCS Verification Testing by working with our Helmholtz cage to measure how our PMAC system will act in-orbit. We've also been able to draft the test procedures for all the tests that we currently plan to pursue for the satellite. We are in the process of making drafts and study guides for future operator exams reduce the amount of human error-based anomalies.
However, much is still to be done.

Future Steps

We plan to investigate the option of adding more testing procedures to our satellite that were not before considered. These include **systems testing** which will encompass us seeing how each subsystem performs when they must work together. We can test our FSW's data dandling and our radios separately but, how much more can we optimize our satellite if we test these **together**. Similarly, we also need to work on **operator testing** for our student operators. These tests will include basic information of telemetry, data handling, and basic info about our satellite's subsystems.
(diagram of all the test coming together to make MEMESat-1.



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