UMN RockSat
Conceptual Design Review

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Goal:

• To observe the effect of Radiation on Flash Memory on a suborbital Rocket flight.
Section 1:
Mission Overview
Mission Statement

- There will be a payload ready for launch on RocksatX that follows all the design restrictions on the User guide that will measure radiation damage to Flash memory
Theory and Concepts:

- As ionizing radiation impacts Semiconductor devices it damages the semiconductor until the device eventually becomes unusable. This damaging radiation is present in space and current spacecraft design tries to harden spacecraft against this damage via shielding and changing the substrate the circuit is on. This experiment is to determine the
Mission requirements:

- The mission is to observe the characteristics of a standard semiconductor flash memory before, (during?) and after a Spaceflight to see how much damage is caused to the memory when in flight.
Concept of operation:

- When in flight the Flash is constantly being bombarded with radiation as it flies this radiation will damage the semiconductor by slowly degrading the Gate oxide layer as the damage accumulates. A noticeable change in the flash memory should be observed.

- When in flight the computer will constantly be polling some of the Flash memory to see the memory errors as they accumulate. The rest of the flash memory will be observed when the payload is recovered.
Expected Results:

- Flash is a convenient structure to observe that is fairly robust in radiation environments some errors will occur in the flash and they are easy to find when reading the memory. The expected result is that after flight the error in the flash will be far greater than prior to flight.

- For the observed flash memory the error rate should be proportional to the amount of radiation striking the semiconductor
Section 2: Design Overview
Design Overview:

- The payload canister will have to projects our project which will be a radiation damage experiment and another X-ray detector that will measure radiation for a different experiment.

- Our experiment will be separated between a shielded computer and a large flash array that will be observed to find the number of errors caused by radiation. The experiment has two portions one observing the errors as they accumulate in the flash memory the other will observe the errors after the flight of the Rocket.
Block Diagram (Computer and Experiment):

- Shielded Portion
  - Computer for observing onboard array
  - Flash array to observe Radiation Damage
  - Radio transmitter
  - Permanent storage

- Unshielded Portion
  - Damaging Radiation
Canister layout:
Section 3: Team Organization
Team Organization:

- Philip Hansen --- Team Lead
- Viet Nguyen --- Aerospace Engineering Lead
- Abdi Jama --- Electrical Engineering Lead
- Yusuf Abdi --- Electrical Engineer
Schedule:

• Currently, Following the Preliminary schedule in the Rocksat user Guide

• With weekly meetings Tuesday
Budget:

- Unknown
Mentors:

- Ted Higman – Faculty adviser
Section 4:
Conclusions
Conclusions:

• Observe the Damage caused by radiation on Flash Memory

• Further research is needed on the damage we can expect and what components are most susceptible to radiation damage