

# Critical Design Review

GoGreenSAT



The University of Northern Colorado

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# Mission Overview

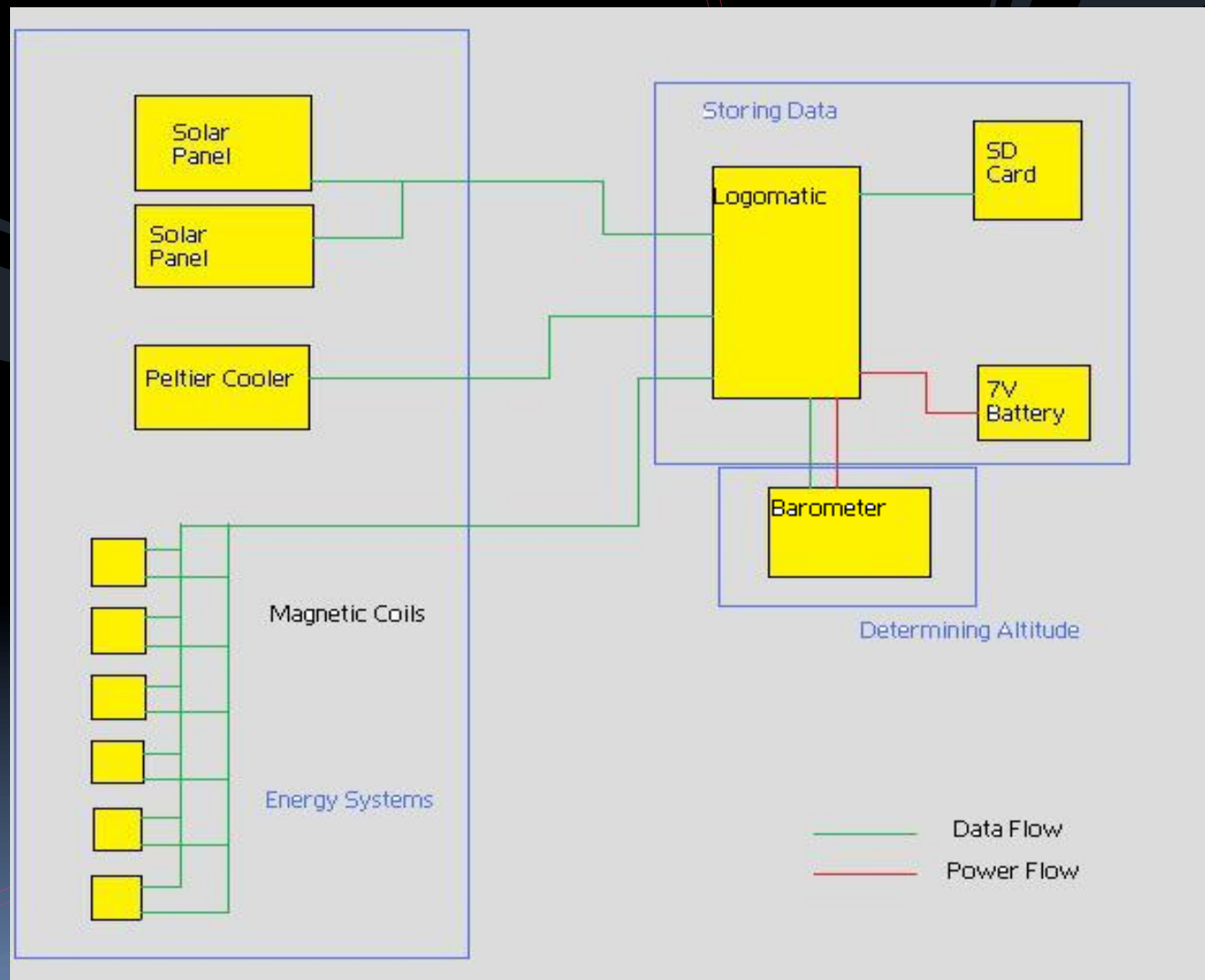
- The goal of GoGreen SAT is to observe the most effective materials and conditions in which a payload can generate energy to be used and stored.
- GoGreen SAT will determine the maximum energy output of different onboard systems throughout the flight.
- The three energy systems are:
  - Pendulum: Capturing the swinging motion of the flight line
  - Solar Power: Capturing energy from the sun
  - Peltier Cooler: Using the differences in temperature inside and outside the box to produce energy

# Mission Requirements

Requierment	Method	Status
The payload must not exceed a weight of 1.5 kg.	Design, Test	Green
The flight line should go through the payload's center of gravity.	Design, Analysis	Green
The payload must be able to survive an impact of at least 16m/s.	Design, Test, Analysis	Green
Components in payload must be able to survive a temperture of -80°C.	Design, Test	Yellow
Payload must not "cut" through the flight line.	Design, Test	Green
Payload must survive the "shaking" of balloon burst.	Design, Test	Yellow

Green: Compliant, Yellow: Partially Compliant, Red: Not Compliant

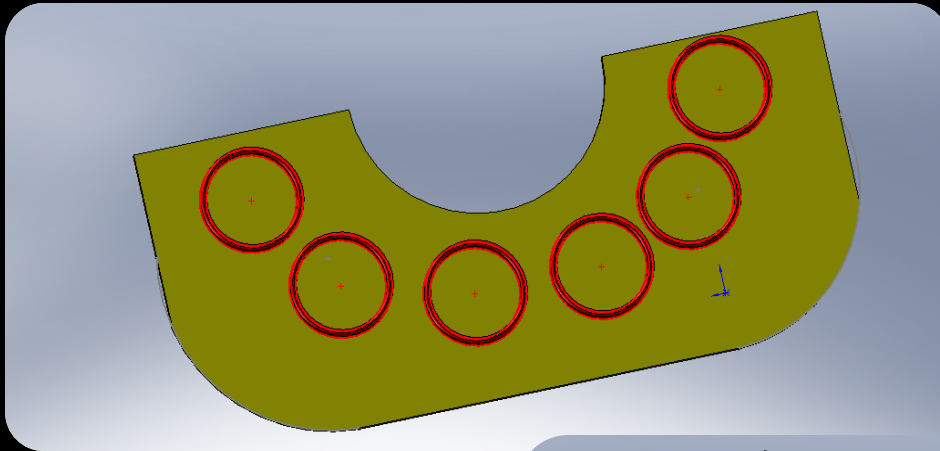
# Fundamental Block Diagram



# Concept of Operations

Before the launch of the balloon, the payload will be activated via an external switch to provide power to the *Logmatic* recording software. During the ascent, the software will gather current readings from the solar panels, the Peltier cooler, and the pendulum system. The solar cells will gather light energy from the sun depending on the payload's orientation (an increase in altitude is expected to produce an increase in energy output). The Peltier cooler will produce a current as the outside of the payload is cooled by decreasing atmospheric temperatures, and the inside of the payload maintains a reasonably warmer climate. The pendulum system is expected to produce a current as the turbulence of the payload causes the pendulum to swing the attached magnet over a series of six copper coils.

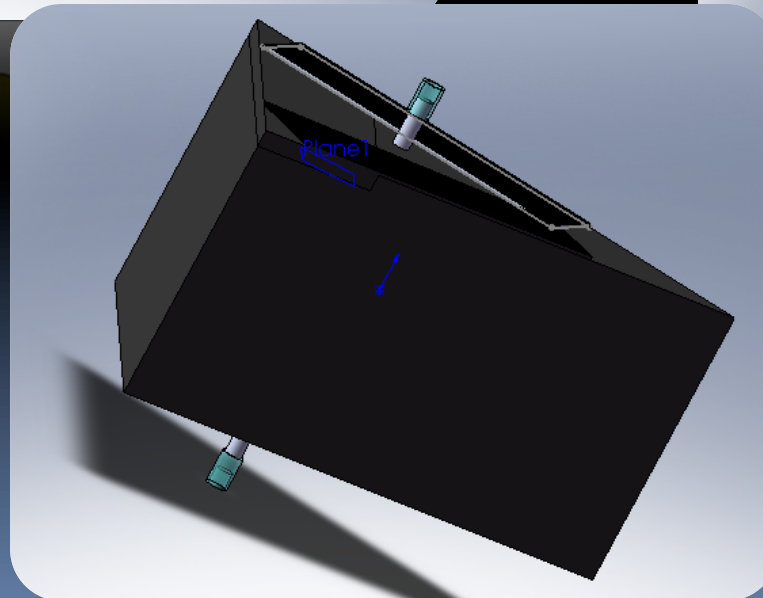
# Structural Drawings



Copper Coils on Board

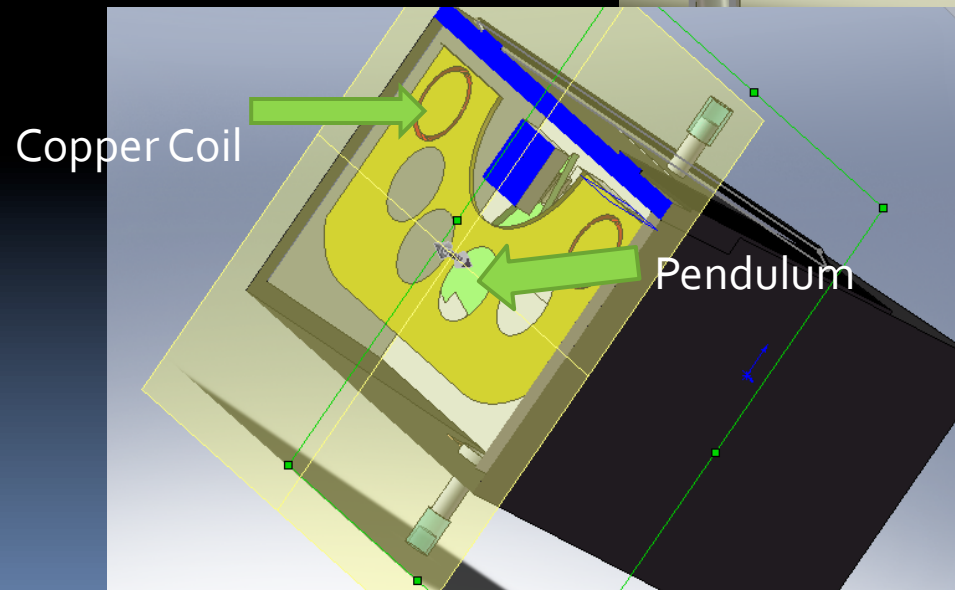
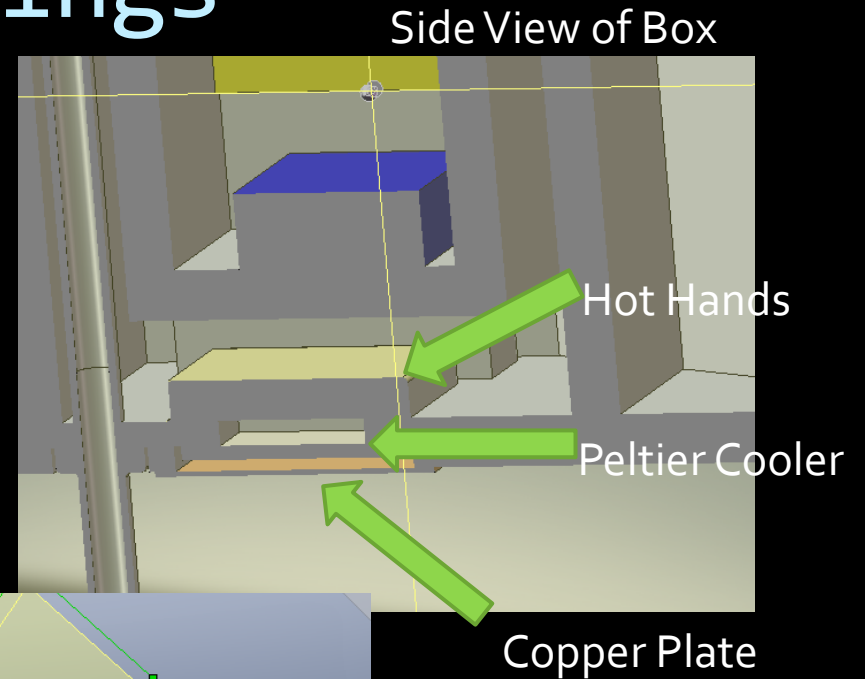
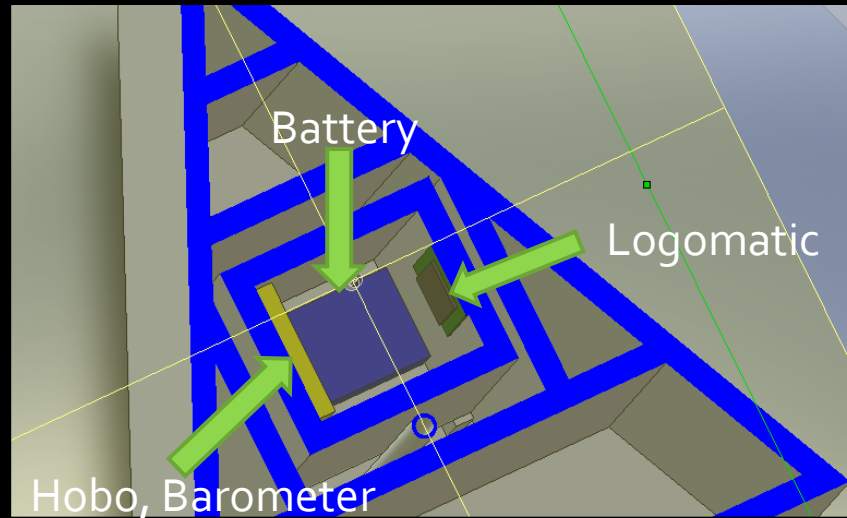


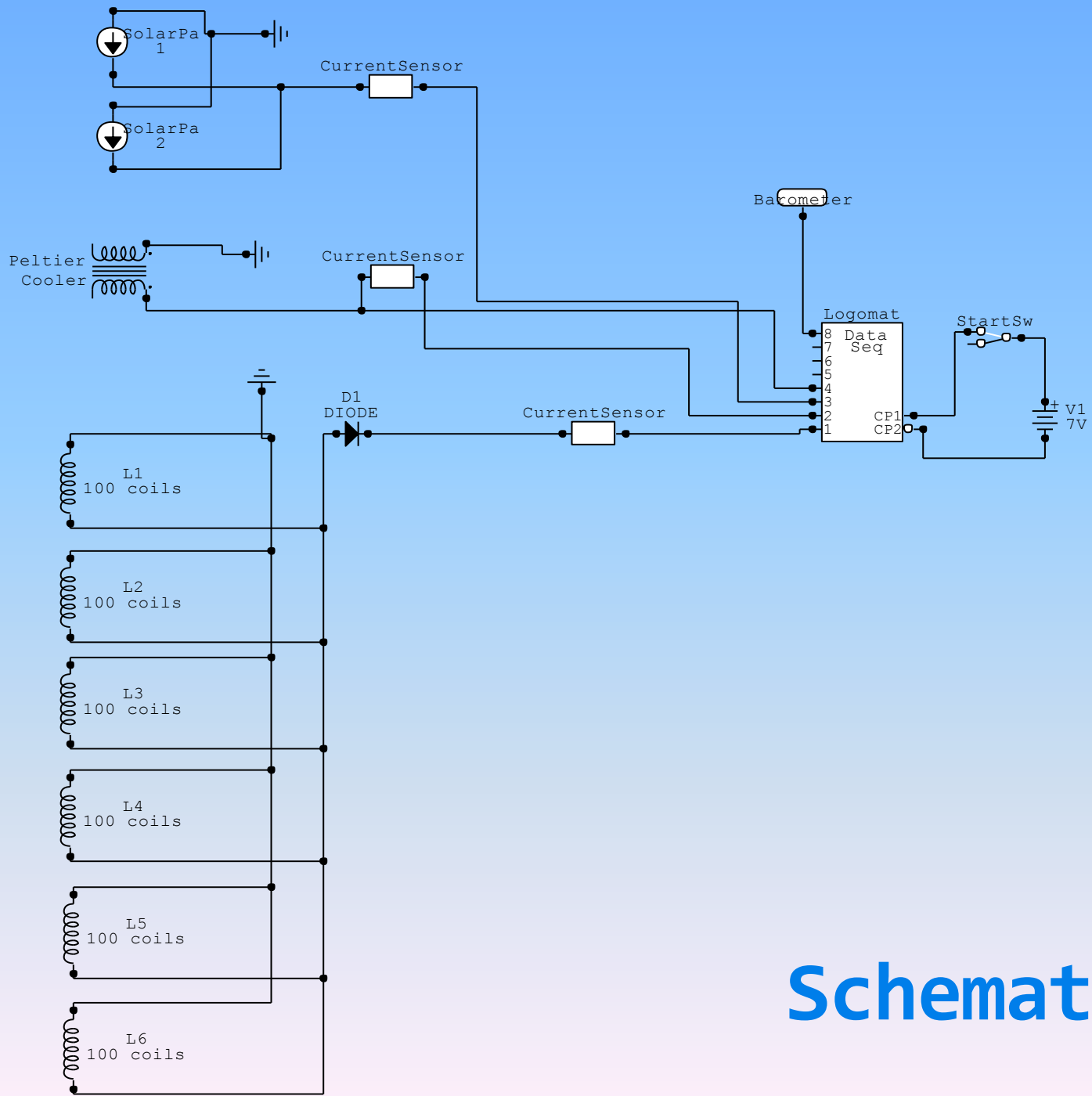
Pendulum



Side View of Box, Solar Panels on Top

# Structural Drawings





Schematic



# Parts List

Parts	Company	Model
Solar Panels	Flex Solar Cells, OEM Components	RC 7.2-75
Peltier Cooler	Frozen CPU	437W
Magnet	K&J Magnetics, Inc.	DX0X0-N52
Low Current Sensor	Sparkfun Electronics	ACS712
SD Card		
Logomatic	Sparkfun Electronics	V1.0
Ball Bearings	McMaster-Carr	57155K356
Copper Sheet	Whimsie	21-gauge
Foam Core Board	Hobby Lobby	1/2"

# Subsystem Overview

- Power for the payload will come from a 7V battery.
- Data from the flight will be stored in a SD card.
- The payload will have two states, non-active and active. A switch will be installed on the outside of the box to activate the payload.
- Peltier Cooler-there must be a temperature difference between the two plates.
- The inner components (Hobo, battery, logomatic, and SD card) should not get below negative 20°C.
- Pendulum-Must swing in only one dimension.

# Management

- Program Manager-Jessica
- Project Members-Max, Brent, Ryan, Zach
- Faculty- Dr. Bob Walch
- Meetings, Tue. 6:00 p.m. and Thus. 7:00 p.m. and scheduled as needed
- Budget-\$800-\$900

# Test Plans

- Cold Test- Dry Ice/Liquid Nitrogen, Styrofoam cooler, four thermo probes, four multimeters, timer
- Impact Test- high place to drop box from
- Shake Test- Line/string
- Time Test- Timer

# Conclusion

- Issues/Concerns:

- The magnet used in the pendulum system will interfere with other components in the box.
- The current produced by the pendulum system will be too little to measure at times.
- The temperature difference between the two plates of the peltier cooler will “flip-flop” during the descent, which will pull energy instead of produce it. This problem could be solved with a diode.
- The box will continue to swing in one direction for extended amounts of time, causing the pendulum not to move much.

This data from this payload should allow the efficiency of each system to be analyzed during the different sections of the flight.