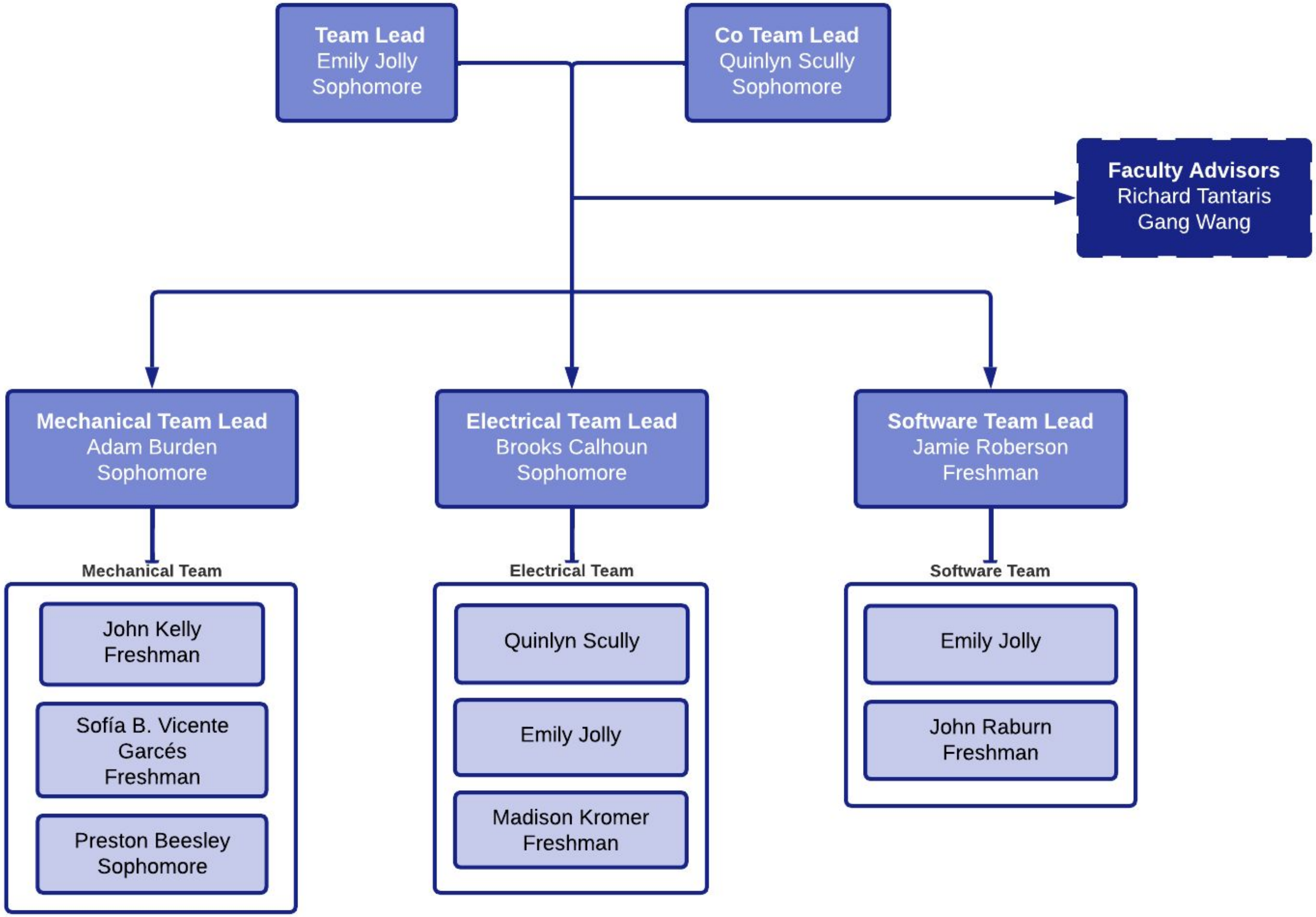
CanSat 2023
Post Flight Review (PFR)
Version 1.0

1070

Obsidian

Presentation Outline

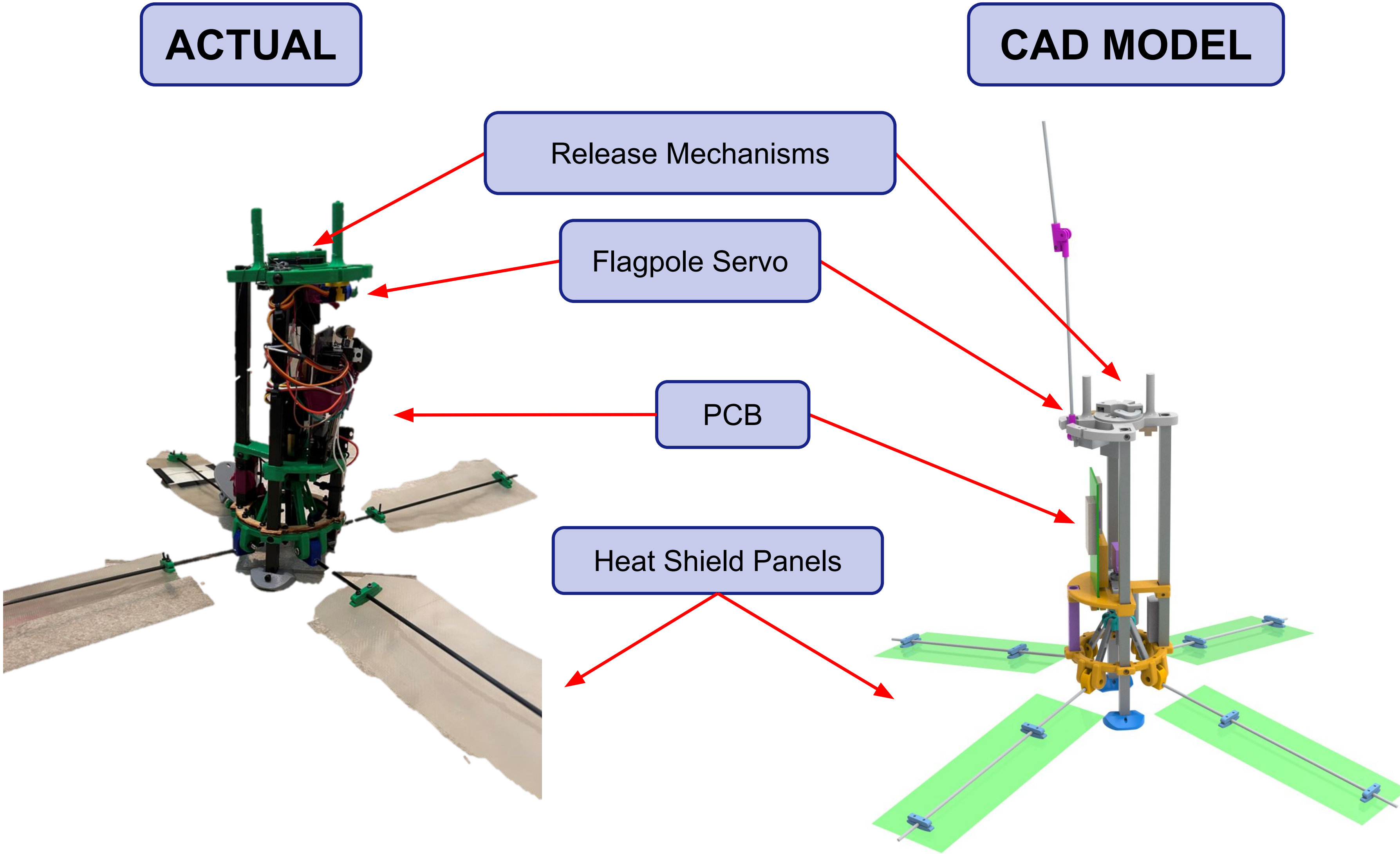
Team Organization



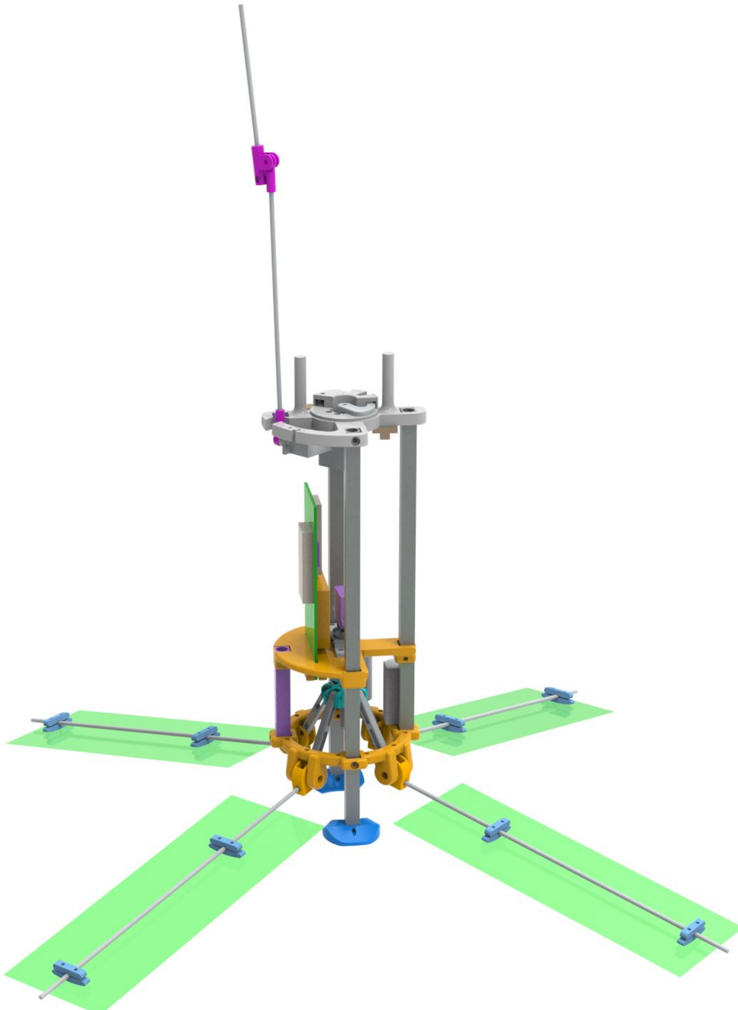
System Overview

Adam Burden

Payload Design Description (1/6)

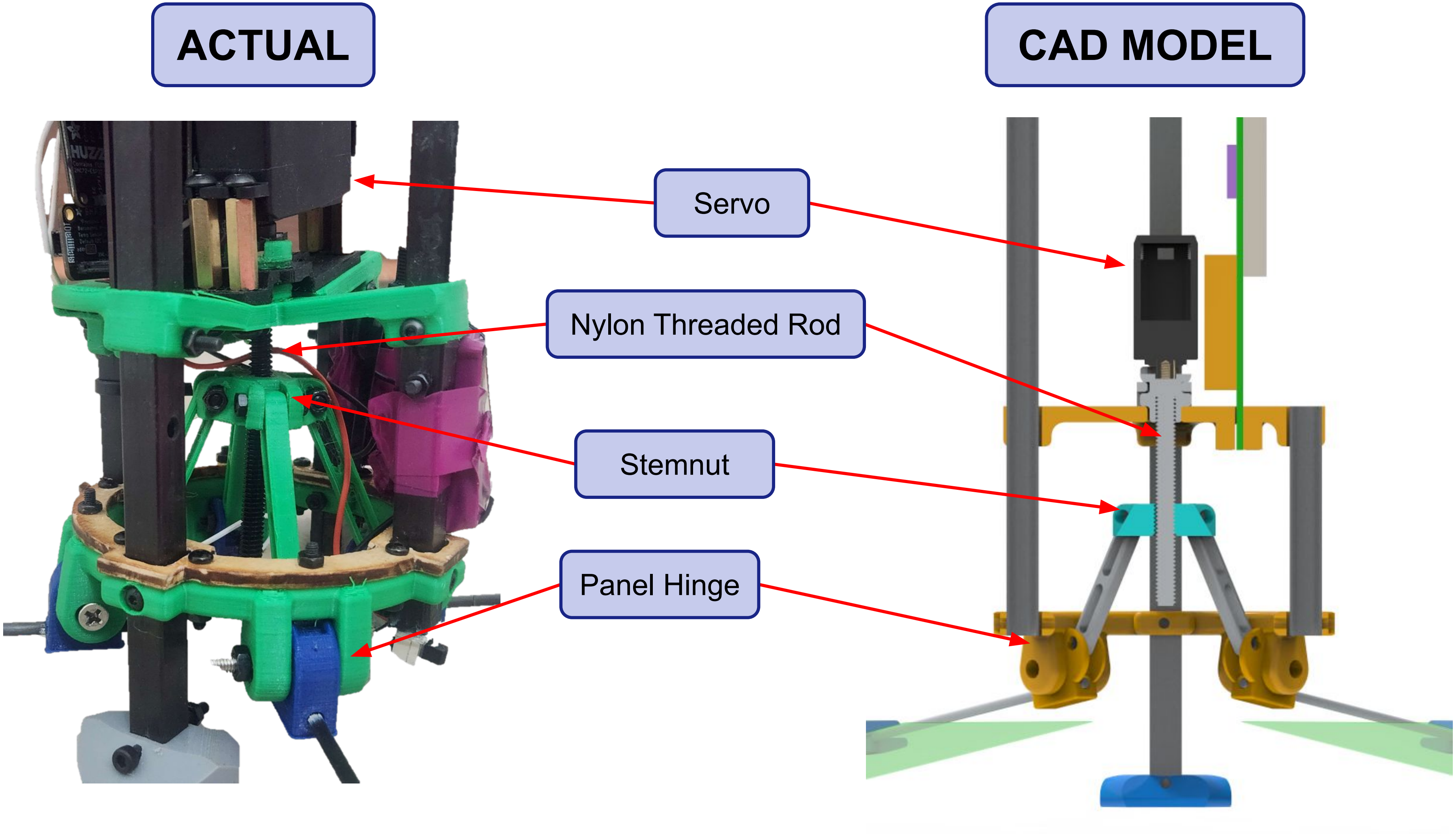


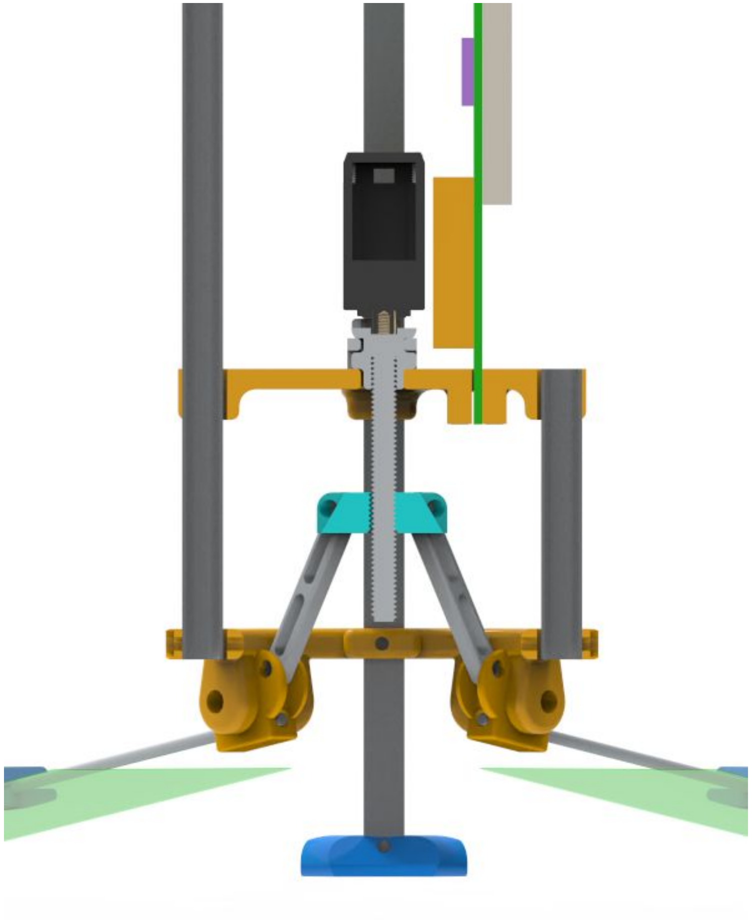
Payload Design Description (2/6)



Our payload has a four-panel heat shield and uprighting system and a two-segment flagpole.

Payload Design Description (3/6)



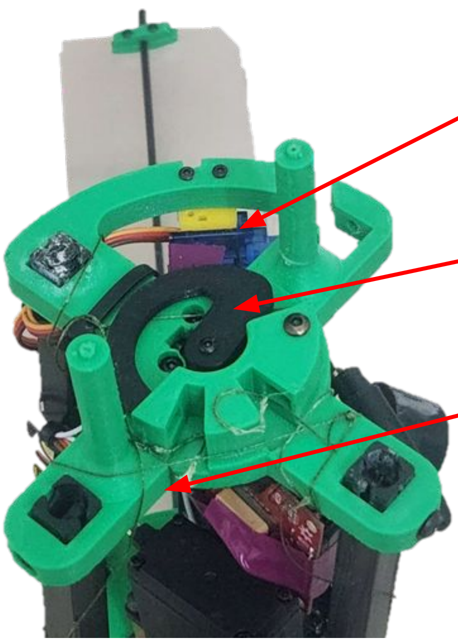


The Stemnut is operated by the servo causing the panels to move up and down.

Payload Design Description (5/6)

ACTUAL

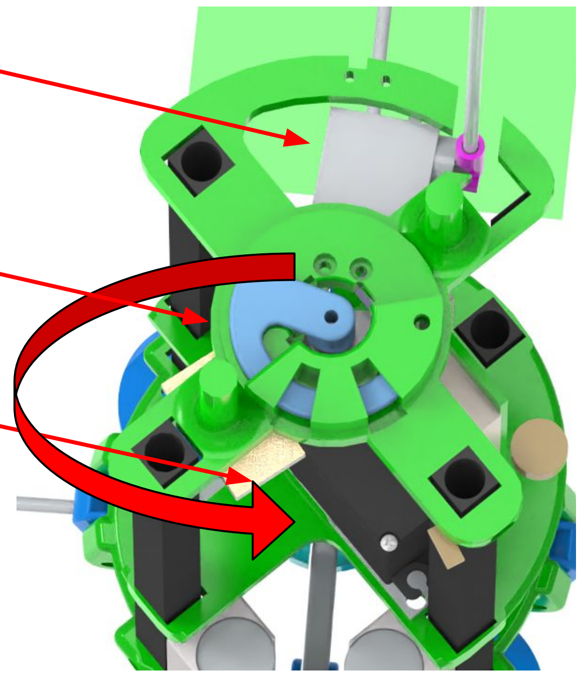
CAD MODEL



Flagpole Servo

Release Latch

Camera Facing Down



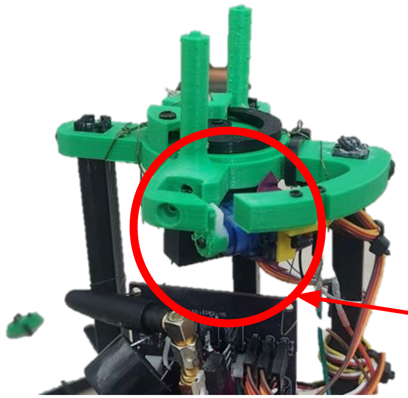
The release mechanism is operated by a servo under the Top Plate.

Payload Design Description (6/6)

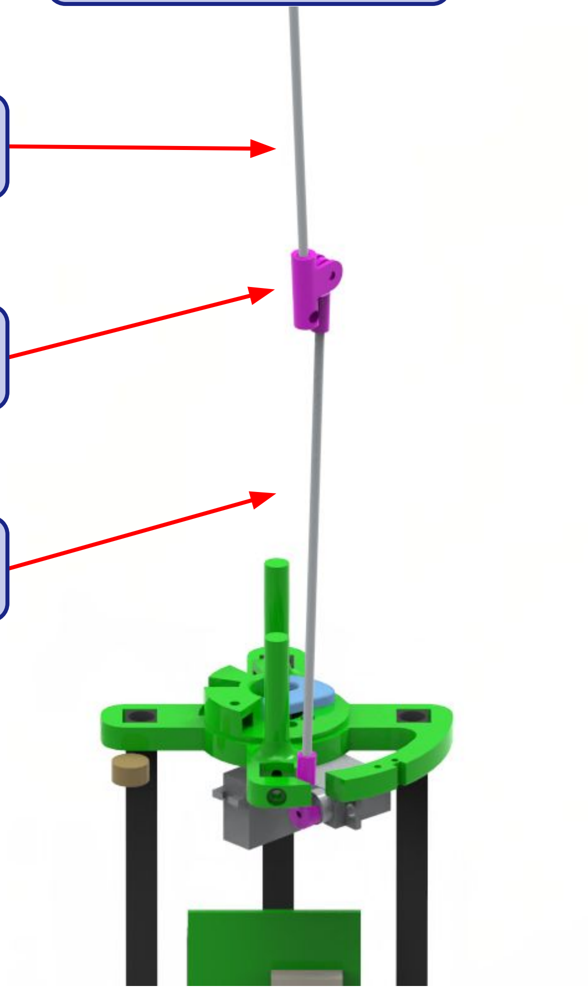
ACTUAL

CAD MODEL

Flag Servo rotates 180 degrees from downward position to upward position while counter weight keeps extension point nadar towards the sky.



Broken Flagpole



Flagpole Section Two

Hinge with Counterweight

Flagpole Section One

Container Design Description (1/2)

ACTUAL

CAD MODEL

TPU Holding Plate

Fiberglass Container Shell

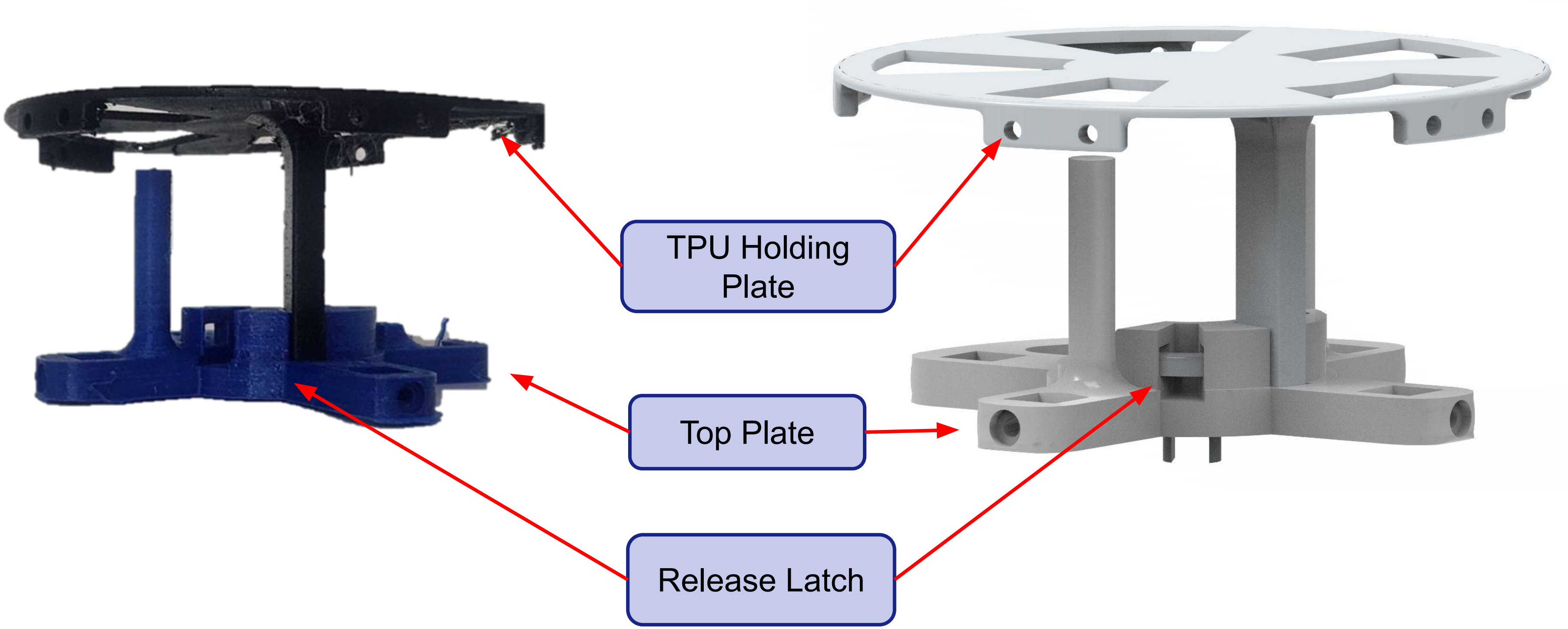
The Holding plate is attached to the container by screws and nuts.

The container is attached to the payload by holding plate is inserted into the top baseplate and held by a servo head.

ACTUAL

TPU holding plate slots into releasing mechanism in manner shown.

CAD MODEL

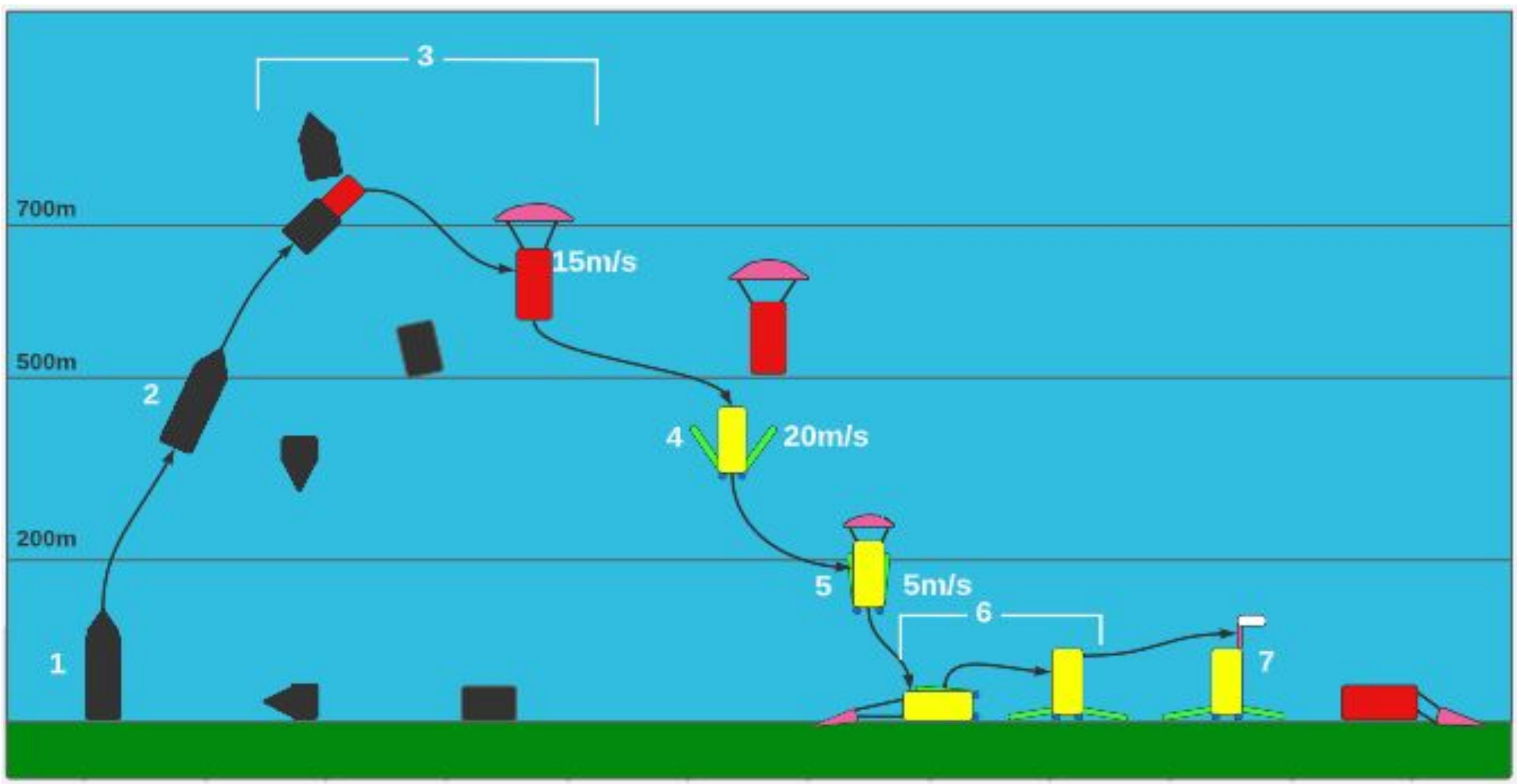


Concept of Operations & Sequence of Events

Preston Beesley

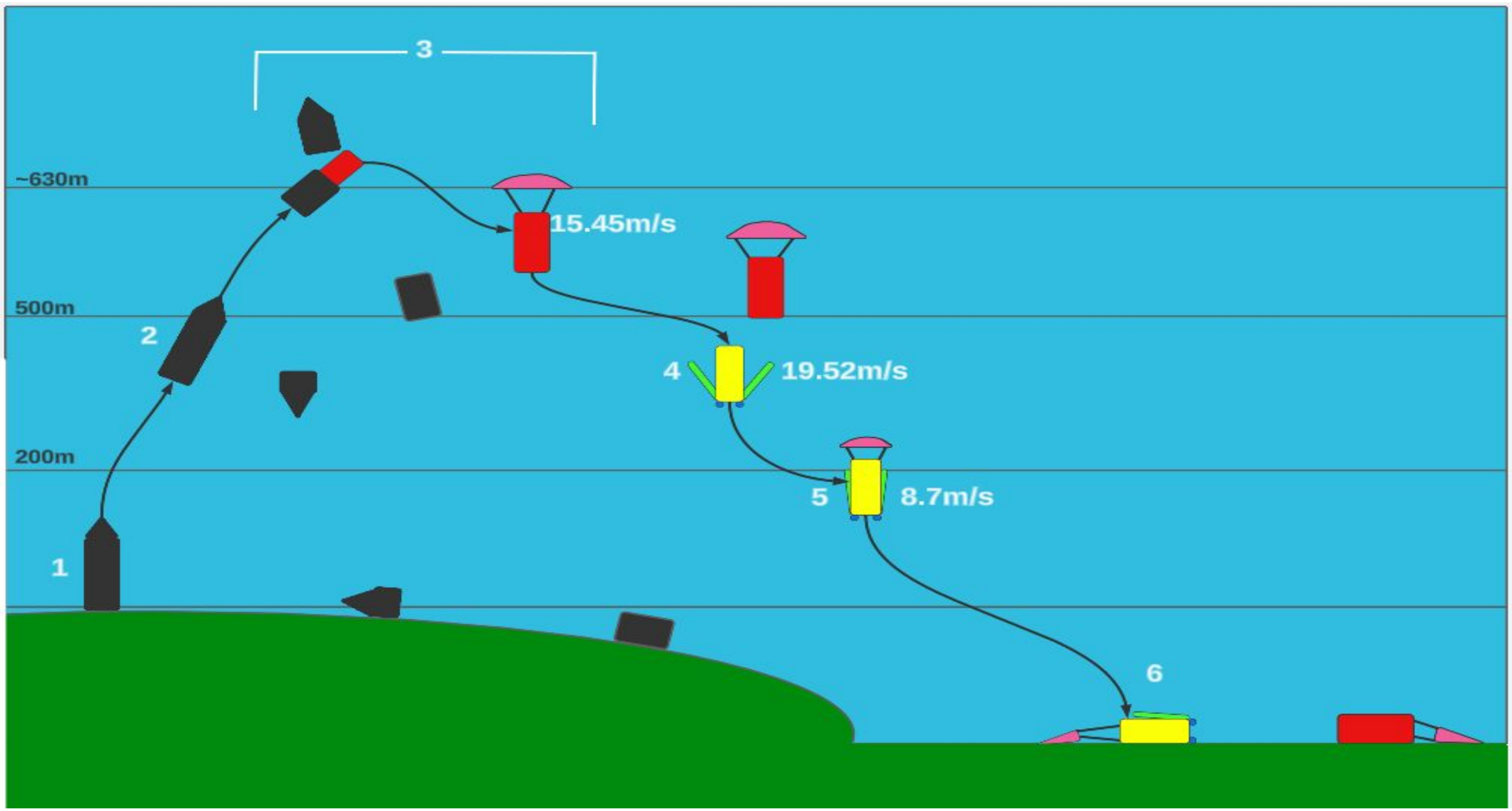
Planned & Actual CONOPS (1/3)

Planned CONOPS



Planned & Actual CONOPS (2/3)

Actual CONOPS



Planned & Actual CONOPS (3/3)

Operation	Planned	Actual	Reasoning
Ascending	CanSat is launched inside rocket	YES	Visual launch
	Ground Station continues receiving telemetry	YES	Received throughout
Descending	CanSat is released from rocket at apogee	YES	Released at apogee of 632 m
	CanSat descends at 15 m/s	YES	Descended at 15.45 m/s
	Container is released at 500 m	YES	Visual deployment
	CanSat descends from 500 to 200 m at 20 m/s	YES	Descended at 19.52 m/s
	Payload Parachute is deployed at 200 m	YES	Visual deployment
	CanSat descends from 200 to 0 m at 5 m/s	NO	Descended at 8.7 m/s
Landed	CanSat uprights	NO	Lost Power
	Flag is raised	NO	
	Audio beacon triggers	NO	

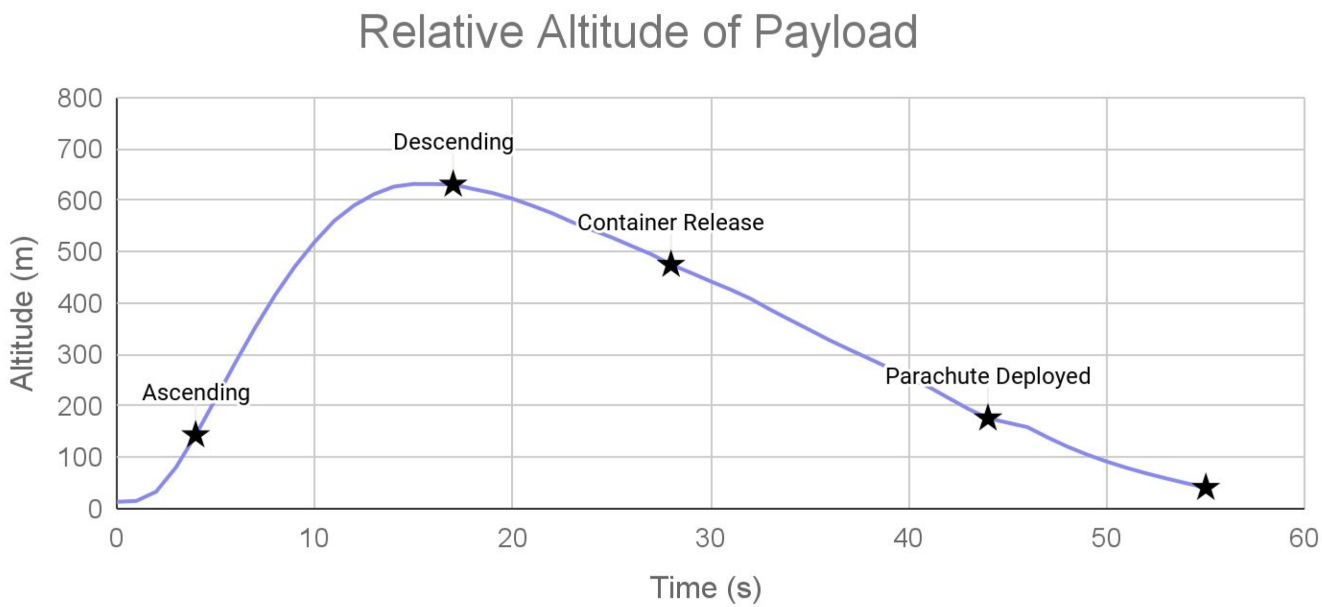
Planned & Actual SoE

Mission Timeline	Planned	Actual
Pre-Launch	Ground Station Setup	**YES**
	Prepare CanSat for launch	**YES**
	CanSat Check-In	**YES**
Launch	Turn CanSat on	**YES**
	Integrate CanSat with Rocket	**YES**
	Monitor Ground Station	**YES**
	Move to Launch Control Table & Execute Launch	**YES**
Descent	Monitor Ground Station	**YES**
Recovery	Recover the CanSat	**YES**
Data Analysis	Analyse Data	**YES**
	Turn in Thumb Drive	**YES**

Flight Data Analysis

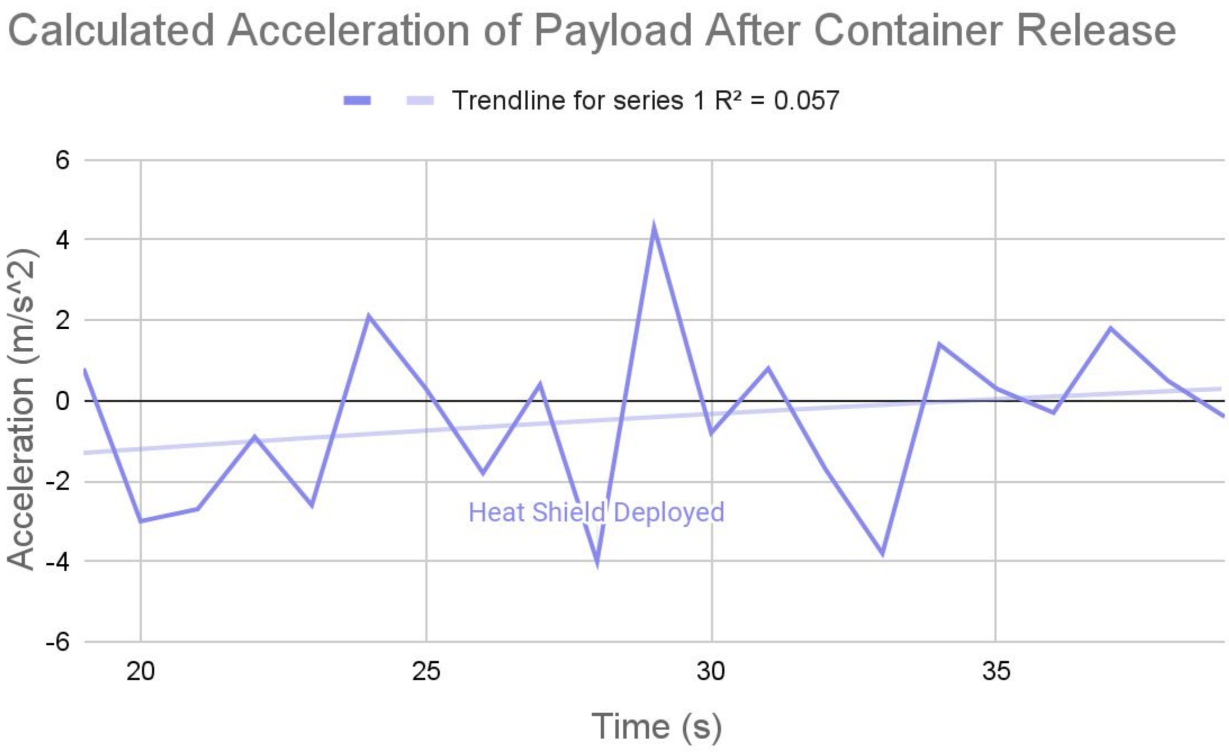
John Raburn

Payload Altitude Plot (1/4)



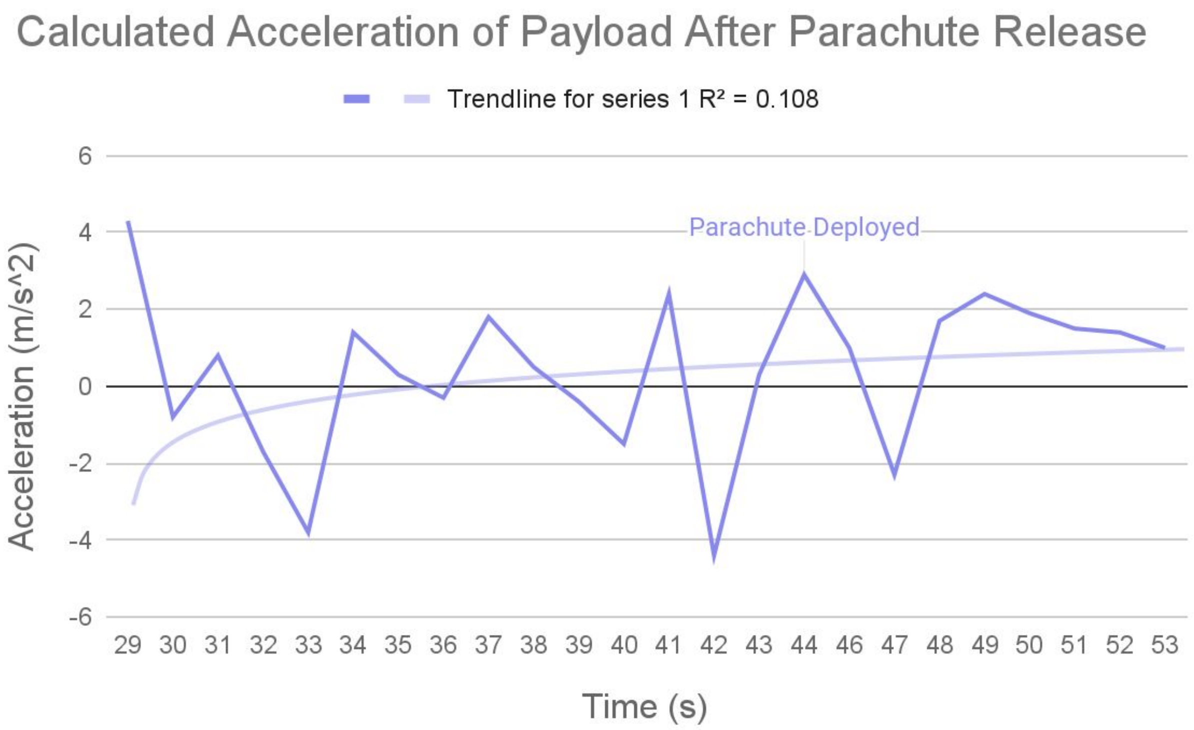
Point of Interest	Value (m)
Ascending	79.6
Descending	631.8
Container Release	495.1
Parachute Deployed	194.0
Power Loss	40.4

The rocket did not reach the expected height of 670 - 725m. The apogee achieved was 632m.



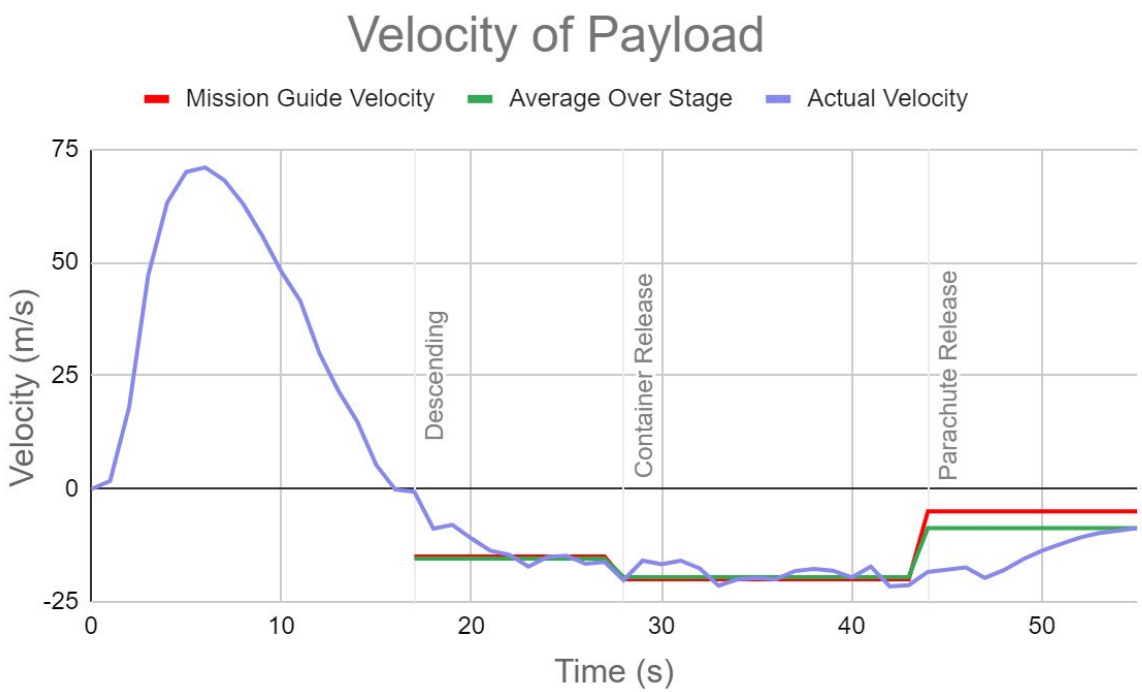
The combination of the payload releasing from the container and the heat shield deploying helped decelerate the CanSat from its downward fall.

Payload Altitude Plot (3/4)



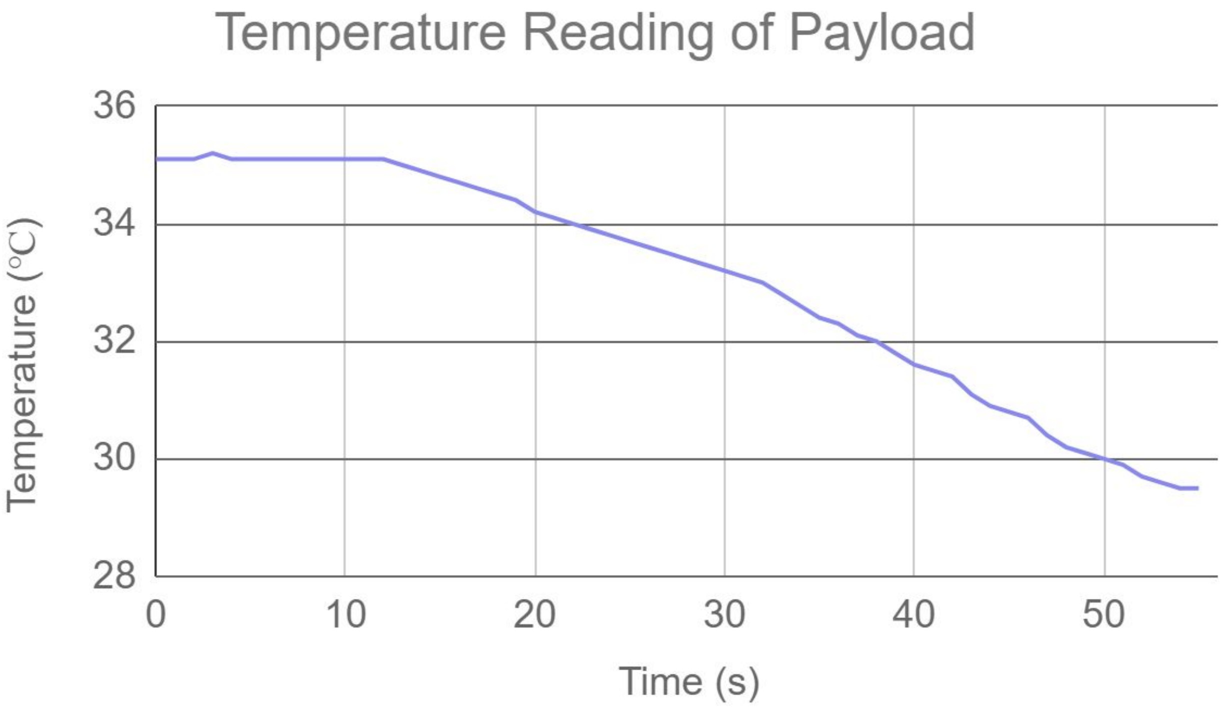
The parachute releasing did cause the payload to decelerate, but not as much as expected which should have been 5 m/s.

Payload Altitude Plot (4/4)



Point of Interest	Velocity
Descending	15.45
Container Release	19.52
Parachute Release	8.7

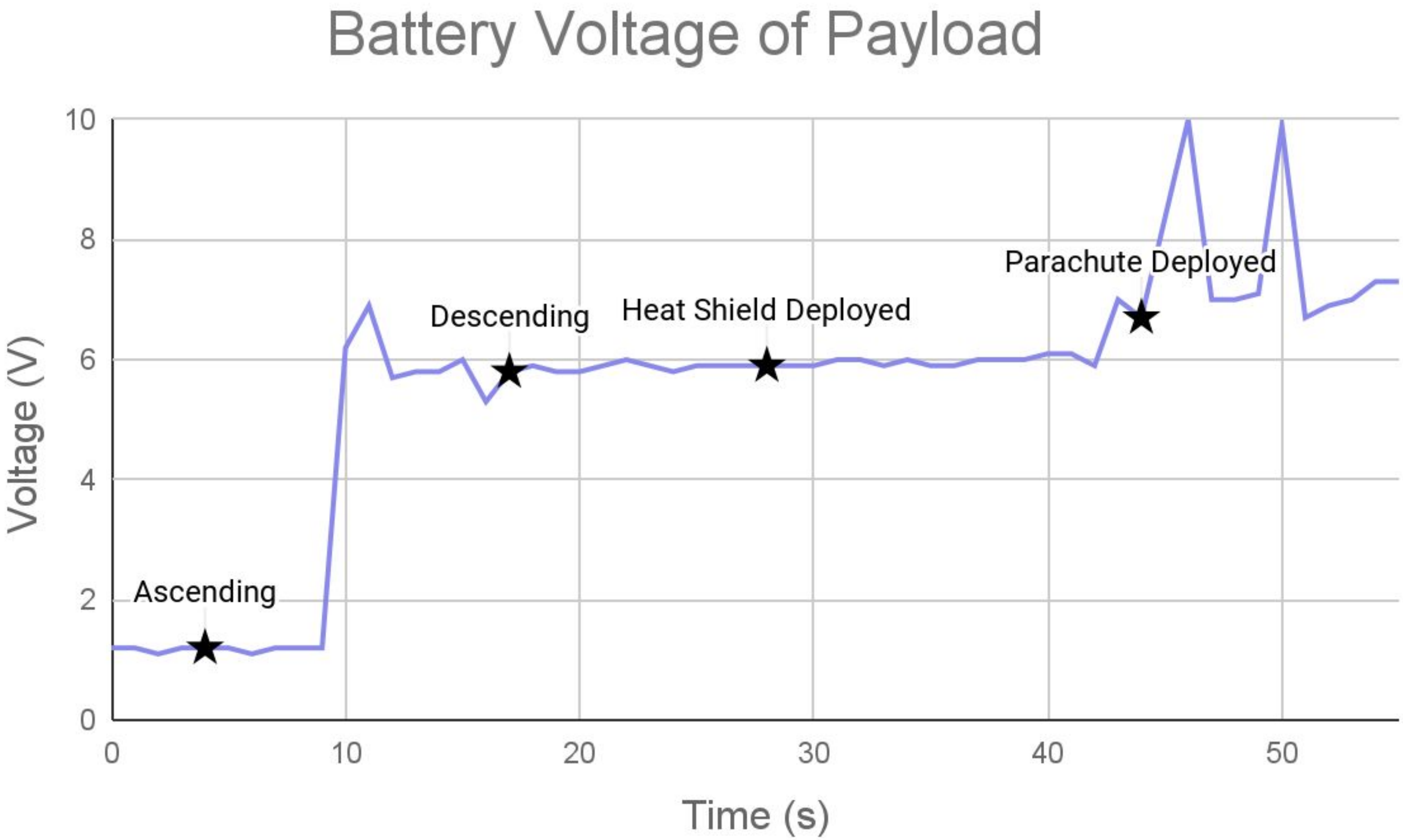
Payload Temperature Plot



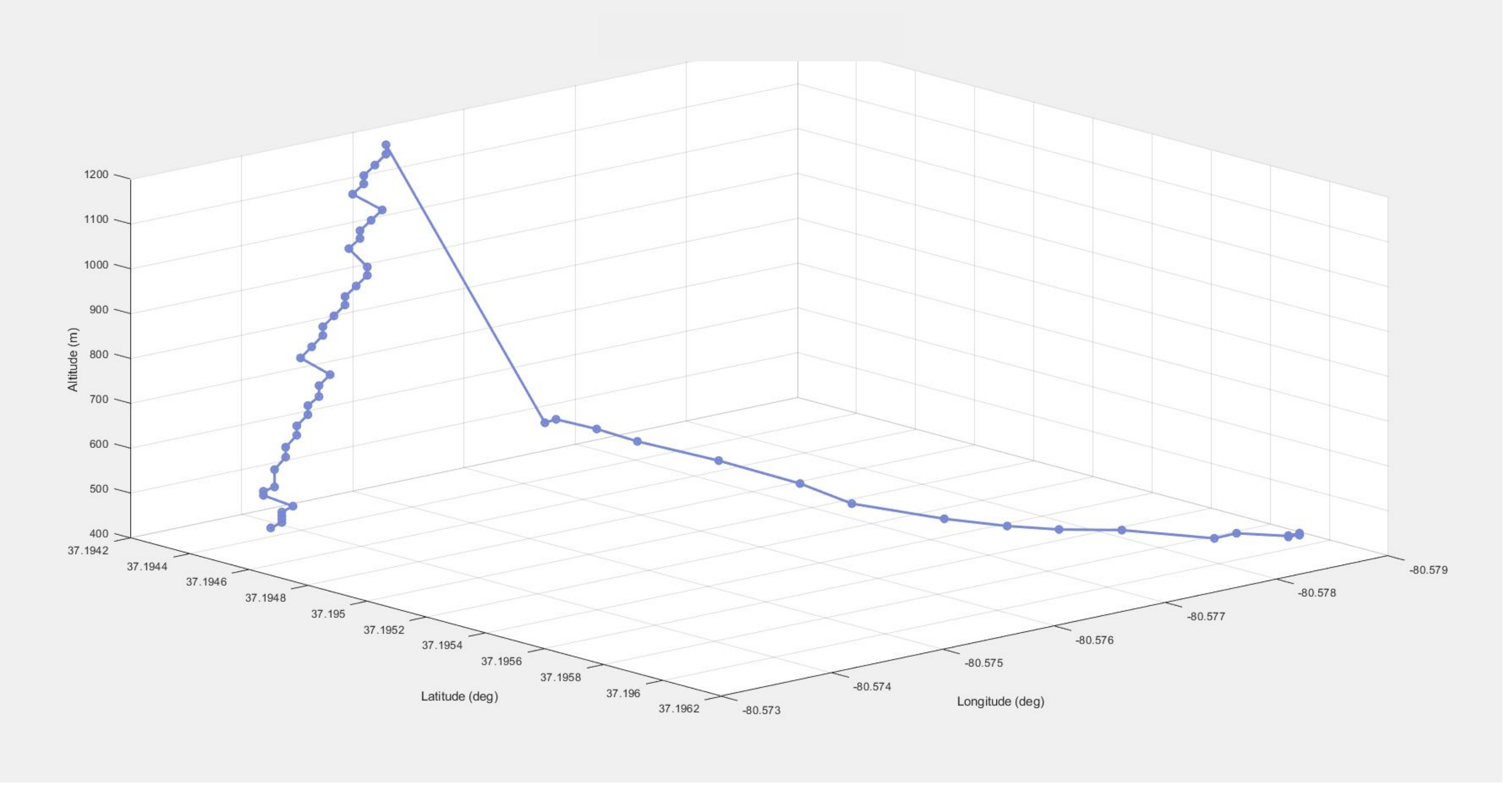
Point of Interest	Value
High	35.2
Low	29.5

The temperature inside the rocket reached up to 35.2 ℃ before releasing from the rocket and decreasing to 29.5 ℃

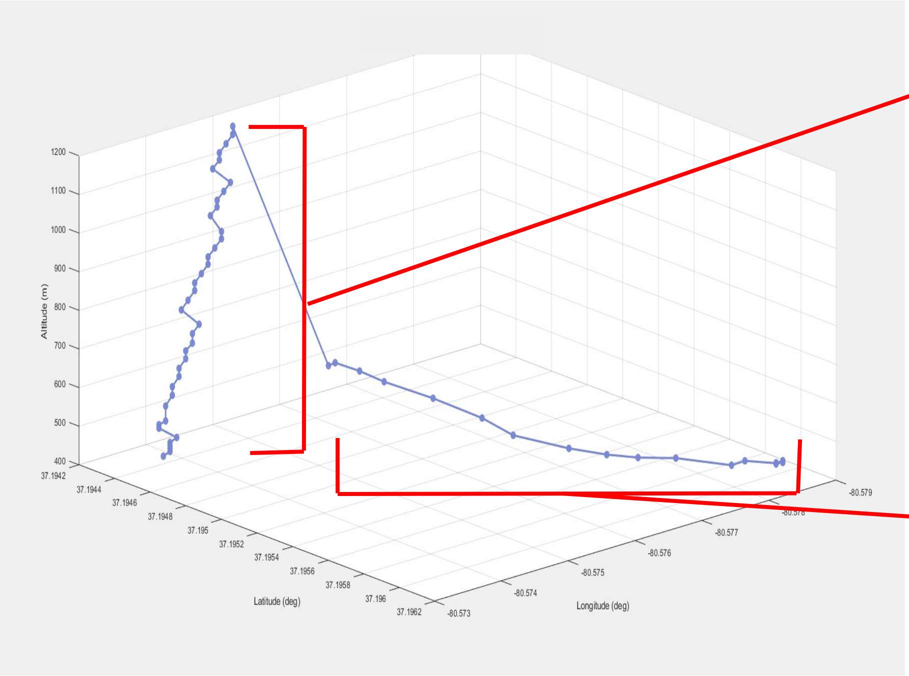
Payload Battery Voltage Plot



Payload GPS Position Plot (1/2)



Payload GPS Position Plot (2/2)

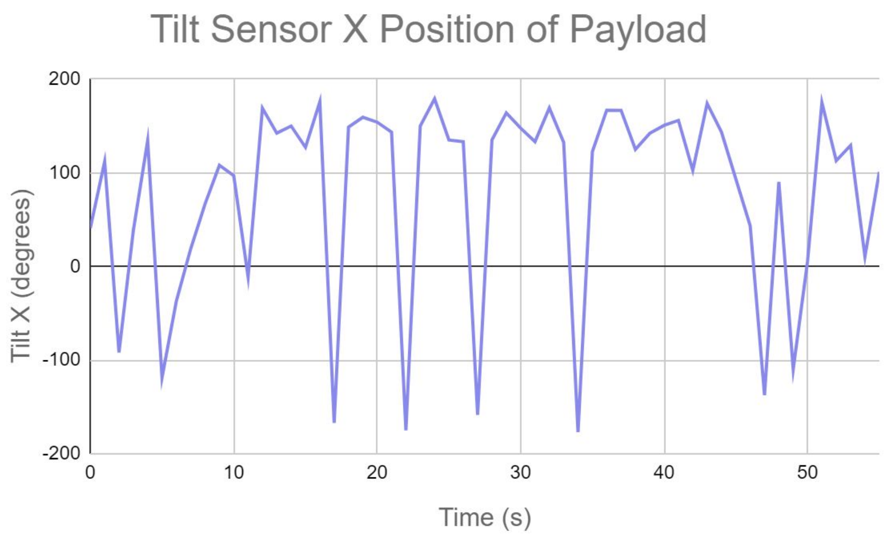


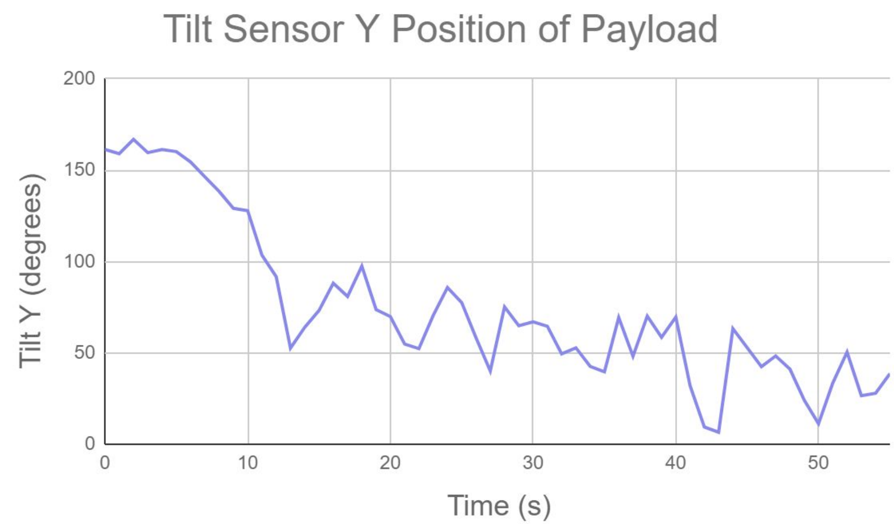
This is the descent of the Payload, which shows it drifting down to the ground

This is the GPS while the rocket was ascending

During the ascent, the SIV count dropped from 15 to 3, meaning that the GPS altitude data could not properly update until it was released from the rocket.

Payload Tilt Sensor Plot





Payload Camera Video

Payload Camera Video

https://www.youtube.com/watch?v=QB1ejdPzqbc&ab_channel=JohnRaburn

Due to inopportune circumstances, our last working camera was missing the blue and green color receptors, resulting in the above video recording in only pink tones

Failure Analysis

Brooks Calhoun

Overview

Description of Failure	Cause of Failure	Corrective Action
Ground station overheating	Lack of fans & shade	Changing GCS computer & heading under a tent for shade
Flag raising mechanism broke	Broke on impact with ground	Strengthen the parts of the flag
Batteries shorted mid flight	Improper insulation from carbon fiber rods	More application of electrical tape or redesign placement of batteries
Heatshield did not operate for uprighting	The batteries shorted	Secure connections and disconnections between power sources
buzEnable did not enable the buzzer	Server required flight or sim mode active in order to receive command	Altered code to allow for change at any point in instruction
Camera start was unreliable	Electrical hardware malfunction	Invest in more reliable hardware that require less maintenance

Failure Analysis

Main Failure

After researching into the graphs and physical data, we discovered that our CanSat failed its landing phase because of power surges. During our ascent and landing phases, arcs were observed crossing through the carbon fiber rods into the PCB, which caused a black-out. The only exception was the camera itself, as it was connected to a carbon fiber rod that was grounded to the power system. This caused the camera to continue working while the rest of the electronics were non-functional.

In the future, we will be more careful and do more research into the materials that we use along with their properties, as this can become a critical failure point later on.

Lessons Learned

Jamie Roberson and Emily Jolly

Accomplishments

Electrical	Mechanical	Software
• PCB held up under stresses and impact allowing for successful data collection • All components remained in mounted position during flight • Successfully created an effective power budget for the mission	• Container parachute slowed payload down to desired 15 m/s. • Heatshield deployed and slowed the payload down to approximately 20 m/s. • Second parachute deployed.. • Structure remained intact and functional.	• The GCS was able to effectively monitor and control the CanSat. • The GCS was optimized so that it could properly receive the telemetry and graph without lagging. • The GCS effectively used a doubly linked list as an enqueueing system for packets. • The embedded systems were efficient and reliable.

Failures

Electrical	Mechanical	Software
• Multiple issues with battery containment theoretically causing a power blink • Mounting components were complicated	• Carbon fiber rods are conductive • The flag raising mechanism broke on impact • Middle plate fractured but did not fail	• Some commands were unnecessary and not optimized correctly. • Some systems had strange timings or were difficult to work with based on their implementation (ie. the buzzer).

Conclusion

CANSAT TEAM 1070	
	Better communication between sub-teams in the early stage of mission development would have allowed for more success in the late stage of the mission.
	Learned invaluable work experience relevant to desired engineering industry.
	Although a perfect launch was ideal, it did not have to be and this was a wonderful learning experience.
	We learned to put more focus on safety and reliability. More time could have been spent ensuring these factors.