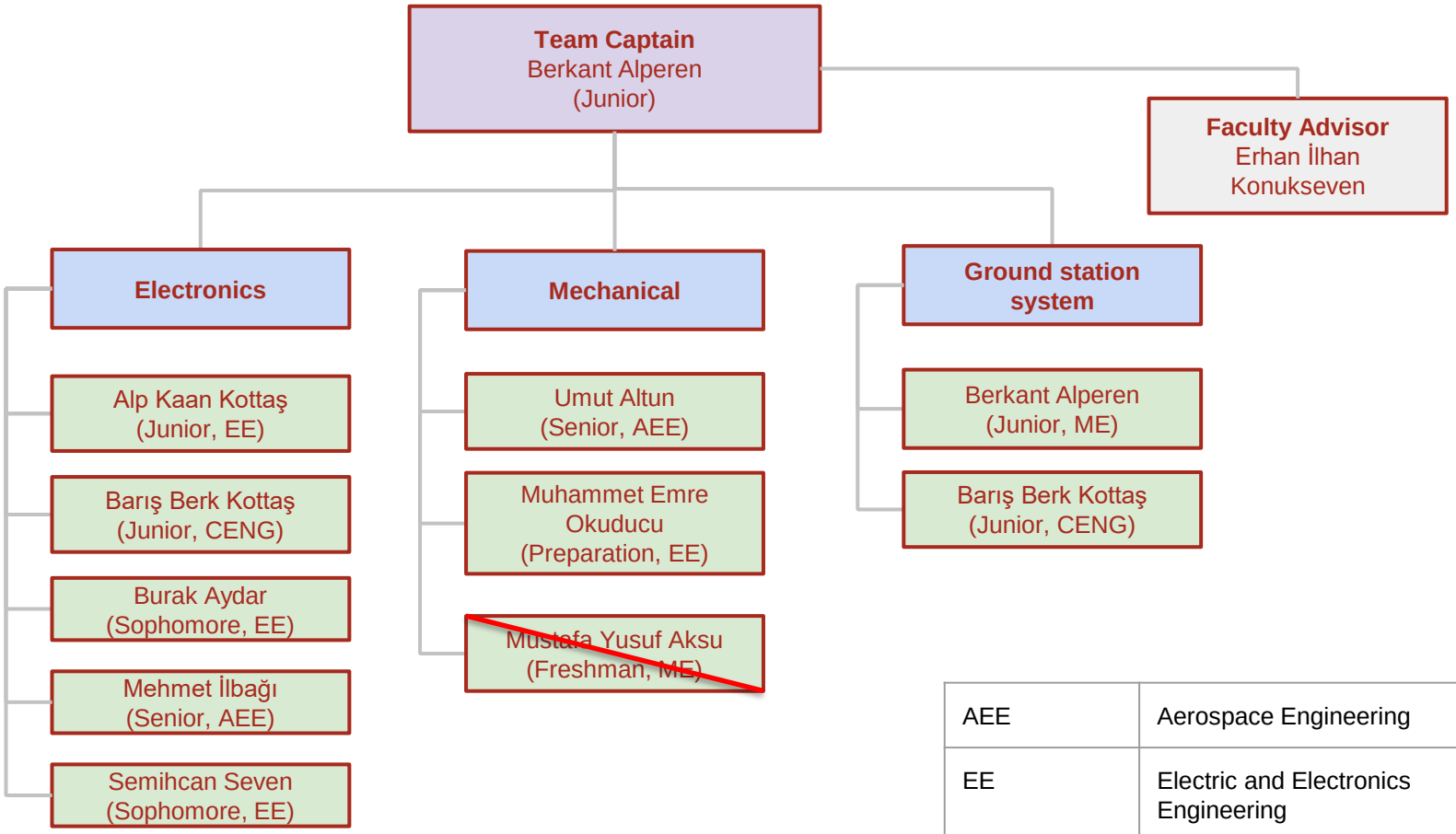
CanSat 2023
Post Flight Review Presentation
Version 1.1

#1068

METUOR SPACE

Presentation Outline

Team Organization



AEE	Aerospace Engineering
EE	Electric and Electronics Engineering
ME	Mechanical Engineering
CENG	Computer Engineering

Team Roles at Launch Site

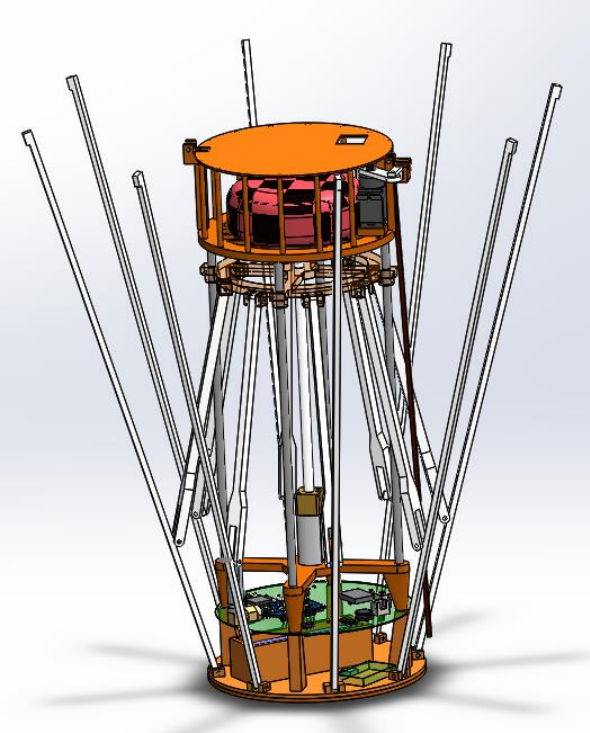
Role	Responsibility	Team Member(s)
Mission Control Officer (MCO)	• Manage the entire operation • Communicate with the launch crew	Berkant Alperen
Ground Station Crew (GSC)	• Ground Station Setup • Transmission of Telemetry • Initialization and calibration of CanSat at the launchpad	Alp Kaan Kottaş, Barış Berk Kottaş
Recovery Crew (RC)	• Recovering the CanSat	Muhammed Burak Aydar, Emre Okuducu
CanSat Crew (CC)	• CanSat final preparations and integration to the rocket. • Tracking the descent trajectory and notifying the recovery crew.	Alp Kaan Kottaş, Barış Berk Kottaş, M. Burak Aydar, Emre Okuducu, Umut Altun, Semihcan Seven, Mehmet İlbağı

Systems Overview

Umut Altun

Systems Overview-Payload

Payload



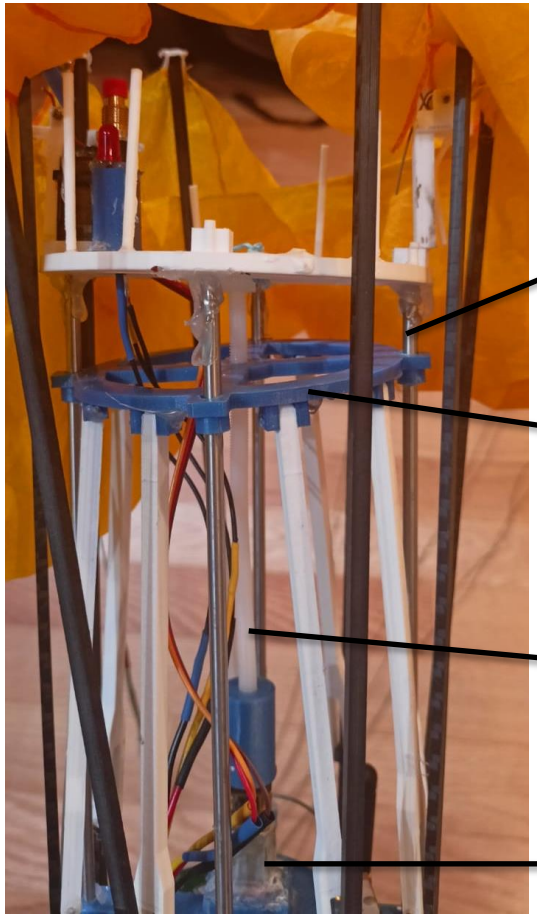
3D model

- The rotating arms were supposed to conduct 3 operations. First, they would retract and cause separation. Then, they would extend and form the heat shield. Finally, they would fully extend and upright the payload.
- Unfortunately, we were not able to see the operation of our payload as we had a separation failure due to the rocket.
- The servo mechanism worked as intended. First the payload parachute was deployed, and then the flag mast was released.
- Almost the entirety of the payload remained intact apart from the connection points of the heat shield arms.

Deployed version

Systems Overview-Payload

Payload



Structural rods

Moving Template

Threaded Rod

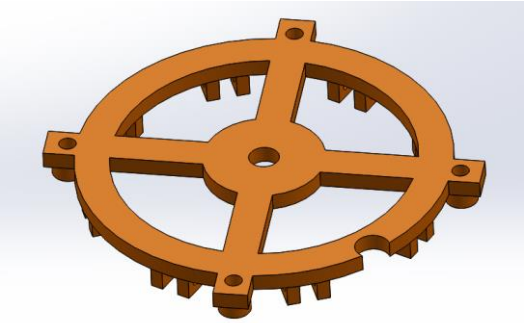
DC Motor

Deployed Version

Servo Motor

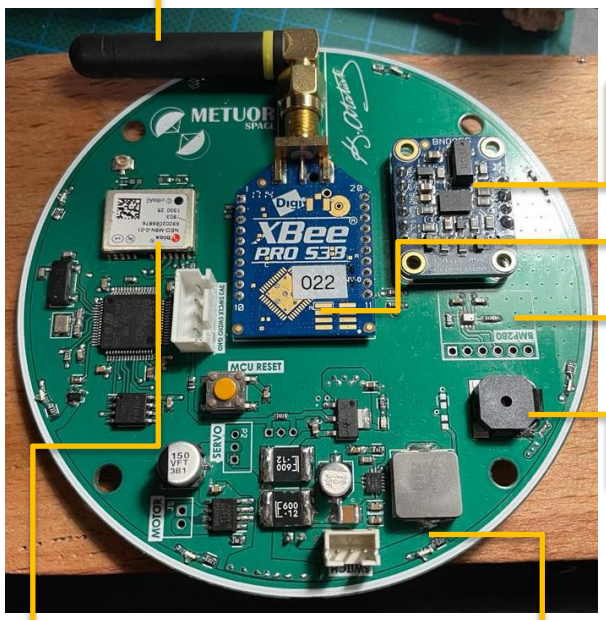
Switch

Parachute Bay



Systems Overview-Payload

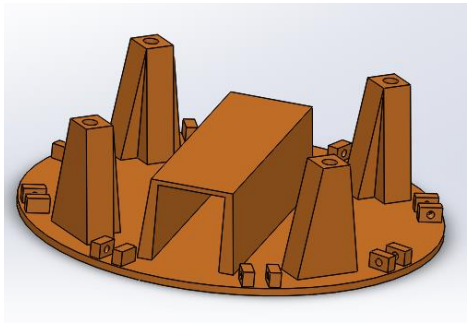
Payload

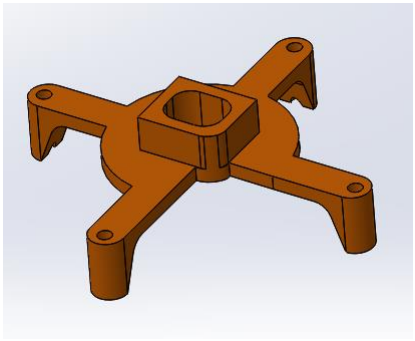


Deployed Version

Systems Overview-Payload

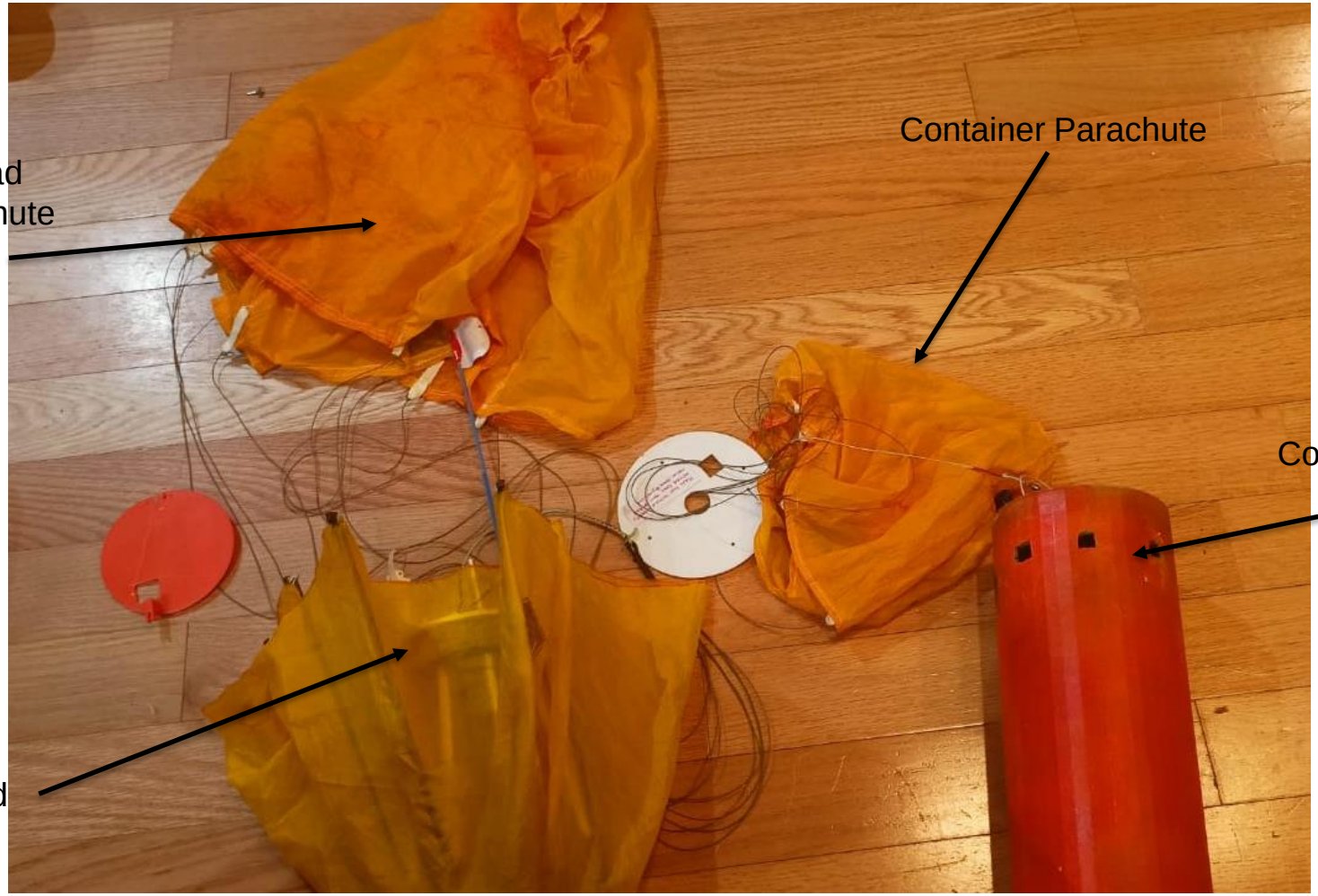
Payload



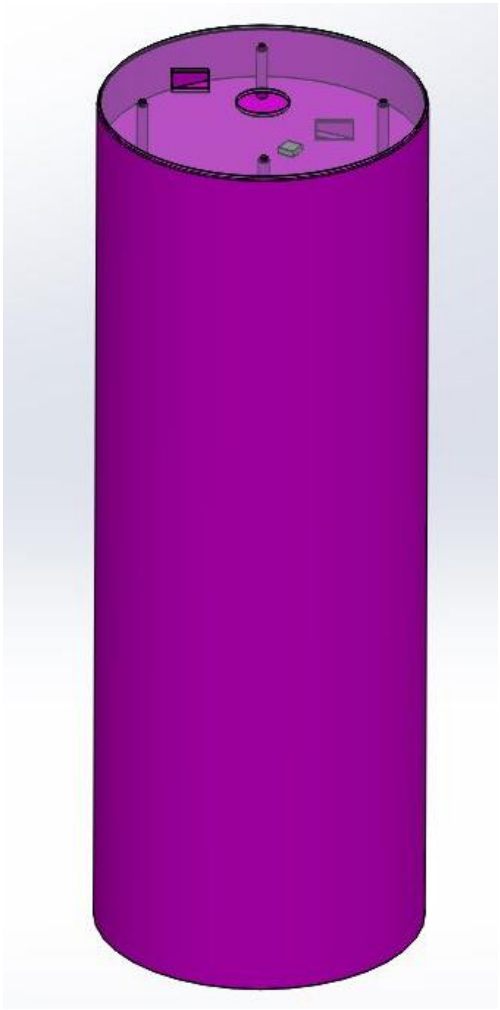


The baseplate was damaged and some of the arm hinges were broken during the crash.

Systems Overview (Container)



Systems Overview (Container)



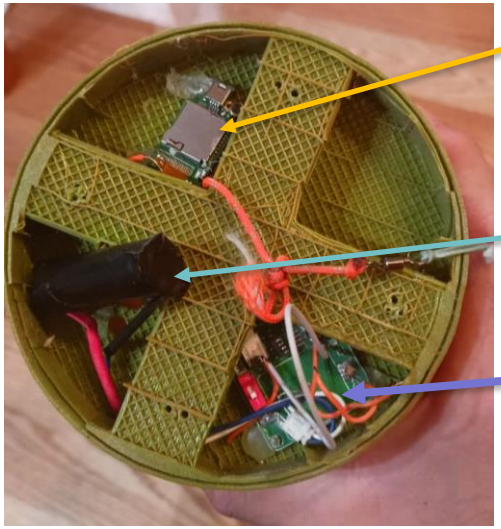
3D model

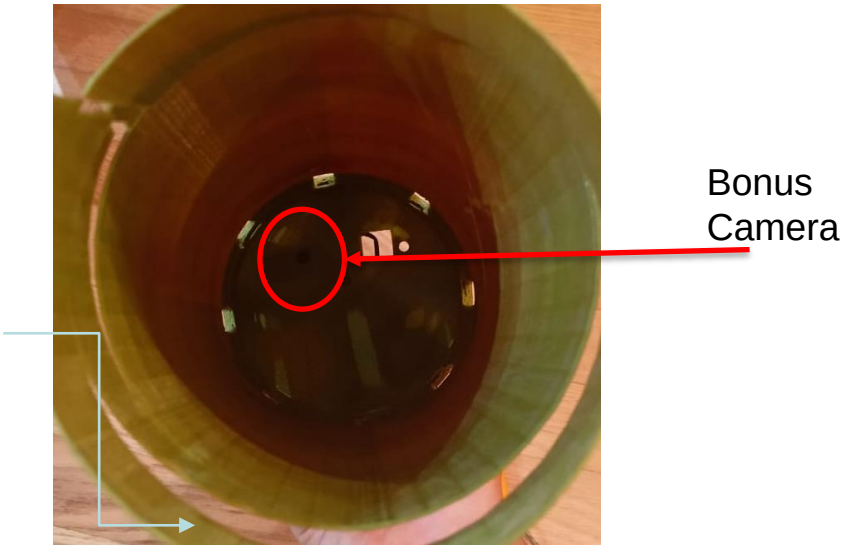
- The design is mostly unchanged from the CDR
- Small holes have been placed to ensure better locking and weight savings has been implemented
- Unfortunately the Container did not survive the freefall however it protected the bonus camera.

Deployed version

Systems Overview (Container)

Container Electronics



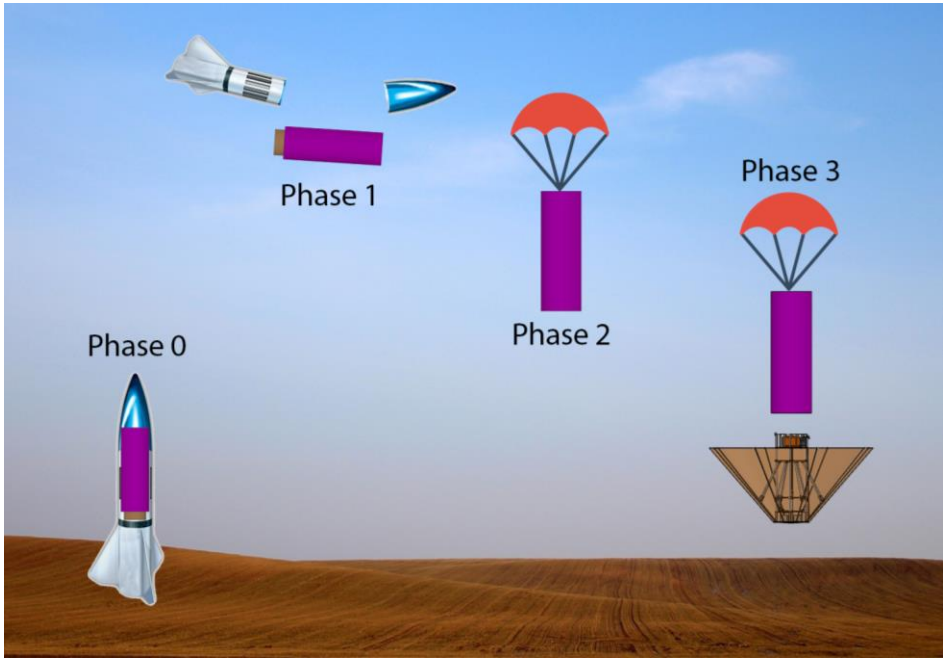


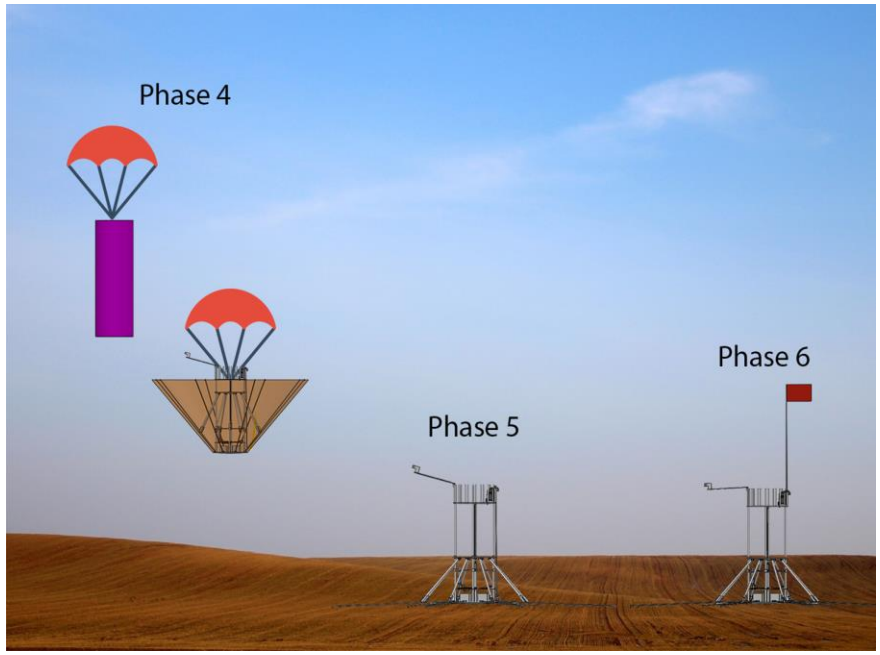
Container electronics were intact and operated as intended. We are overall very satisfied with our design.

Concept of Operations and Sequence of Events

Berkant Alperen

Concept of Operations and Sequence of Events (1/3)





Concept of Operations and Sequence of Events (2/3)

Planned CONOPS	Situation	Comment
CanSat is turned on and GCS connection is established	✓	
CanSat is placed in the rocket at launchpad	✓	
Sensors are calibrated and data transmission begins	✓	
CanSat is separated from the rocket and container parachute is deployed	✗	Nosecone failed to separate
Descent	?	N/A (Occurred inside the rocket)
Separation and Aerobraking	?	N/A (Occurred inside the rocket)
Probe Parachute Deployment	?	N/A (Occurred inside the rocket)
Landing and Upright Operation	?	N/A (Occurred inside the rocket)
Flag Mast Operation	?	N/A (Occurred inside the rocket)
Recovery and Data Collection	✓	

Concept of Operations and Sequence of Events (3/3)

Planned Sequence of Events	Comment
CanSat Check in	On time
Weight Test	Passed
Going Over Checklist	Done
Communications Check	Communication established nominally
Mechanical Check	All parts visually inspected and found to have no defects
Container and Payload assembly	Payload attached to the container properly
CanSat to Rocket integration	CanSat placed inside the rocket without any issues
Prepare the Rocket for Launch	Rocket Prepared for Launch Properly
Rocket Launch	Rocket Launched Properly
Separation	Container failed to separate from the rocket due to nosecone

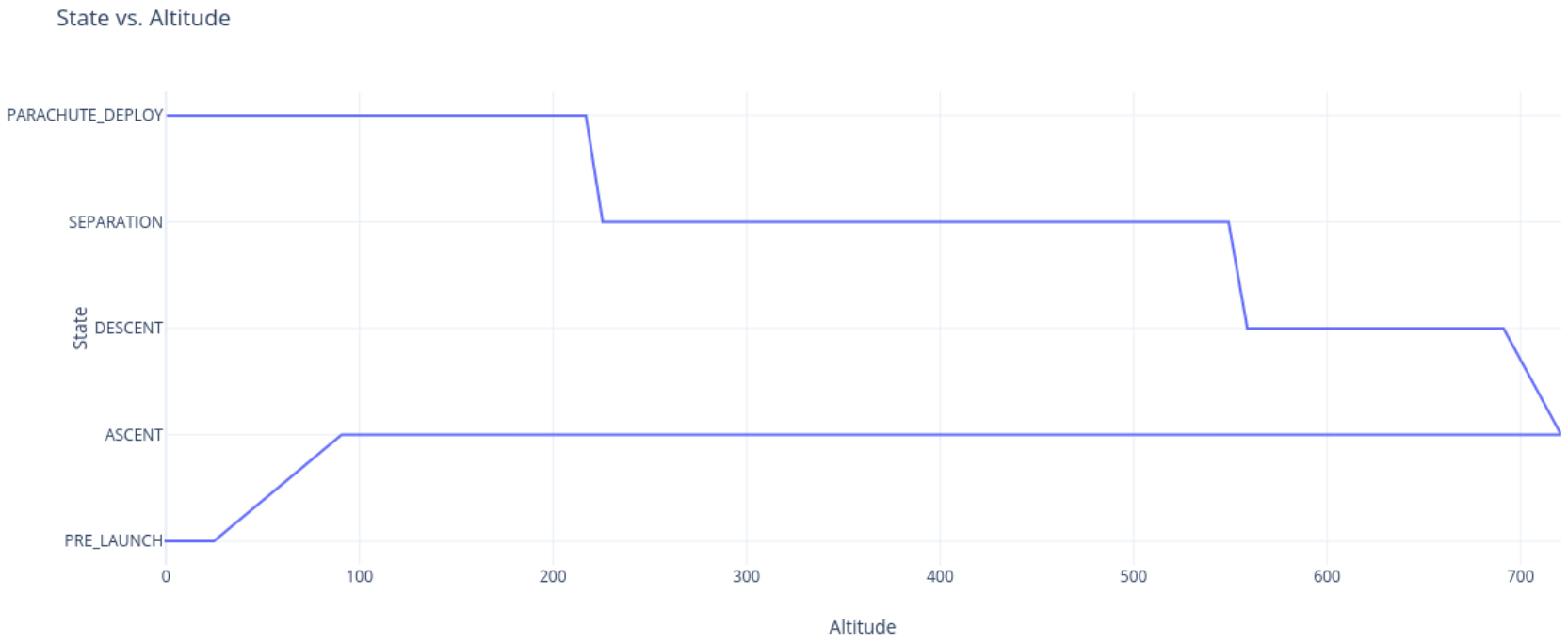
Concept of Operations and Sequence of Events (3/3)

Probe Separation	Failed due to rocket separation failure
Heat Shield Deployment	Failed due to rocket separation failure
Probe Parachute Deployment	Failed due to rocket separation failure
Landing	Failed due to rocket separation failure
Uprighting	Failed due to rocket separation failure
Flag Mast Deployment	Failed due to rocket separation failure
Recovery	We had the location of the CanSat from the telemetry, but the judges found before us

Flight Data Analysis

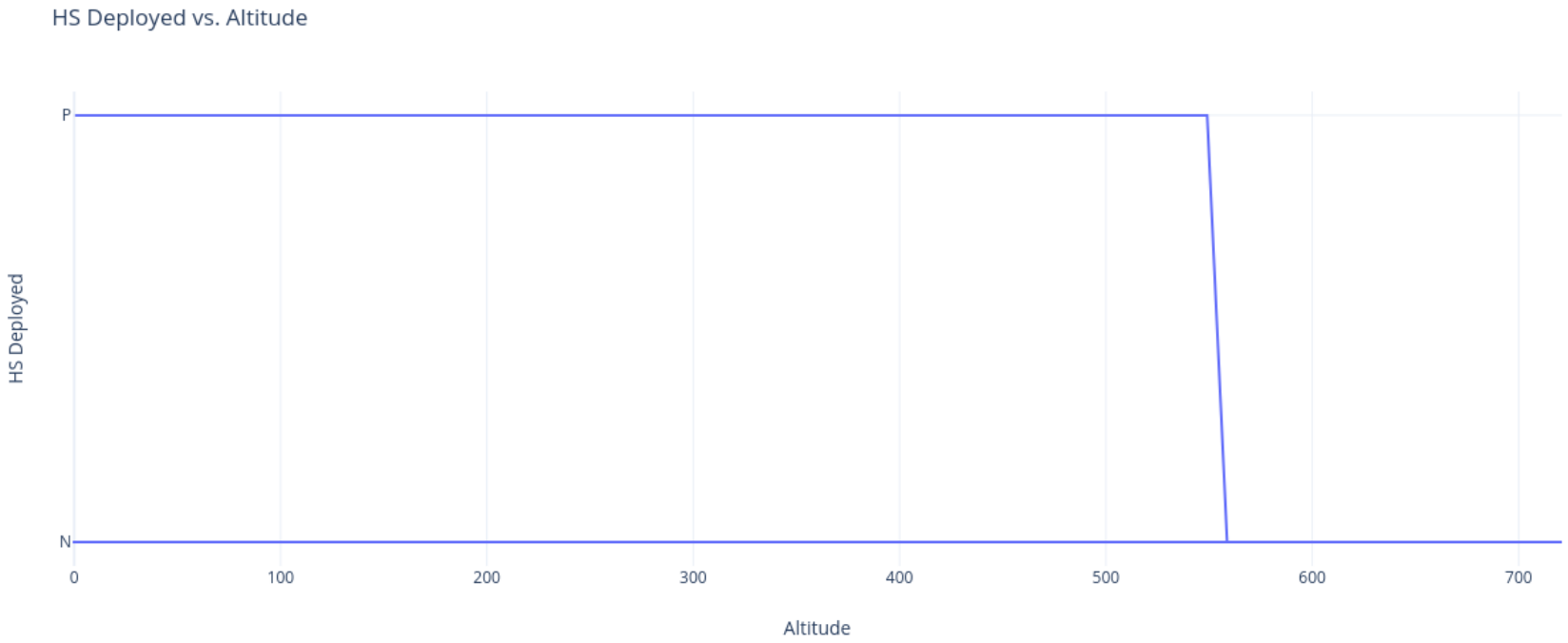
Barış Berk Kottaş

Flight Data Analysis



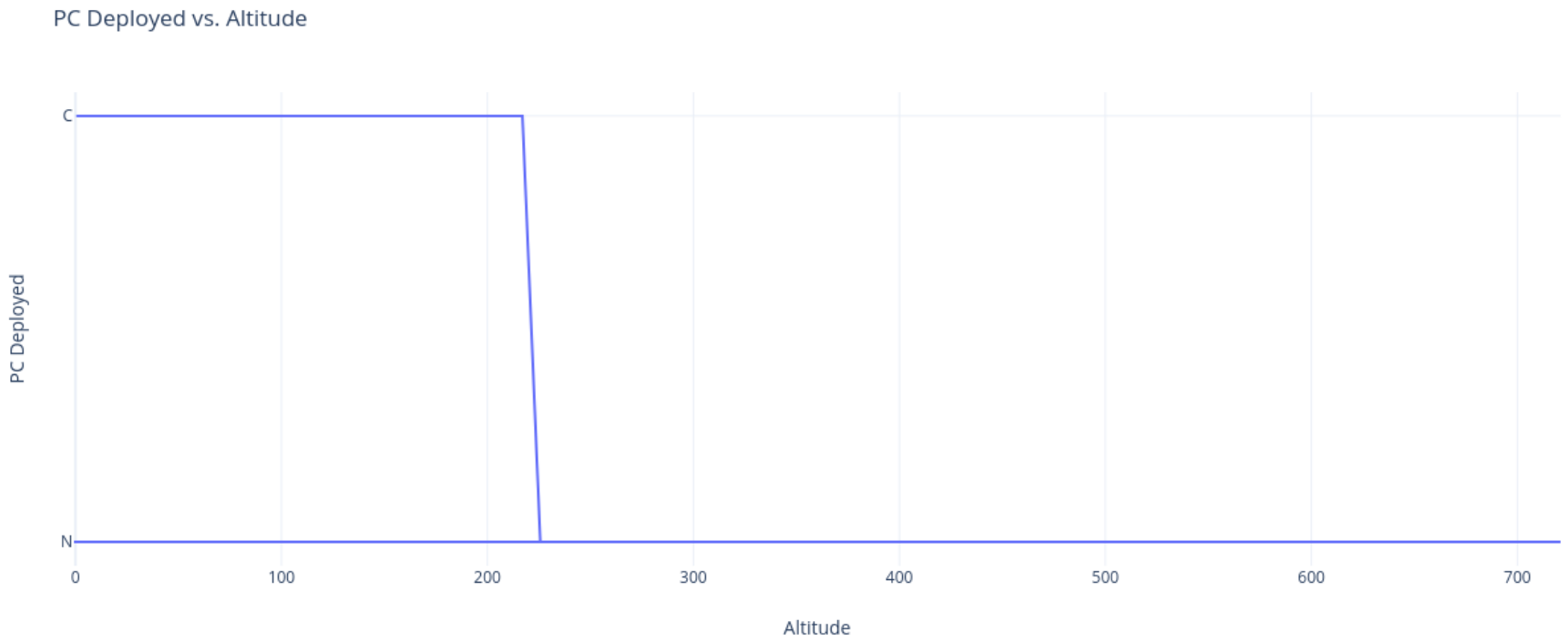
State Transitions w.r. to Altitude

Flight Data Analysis



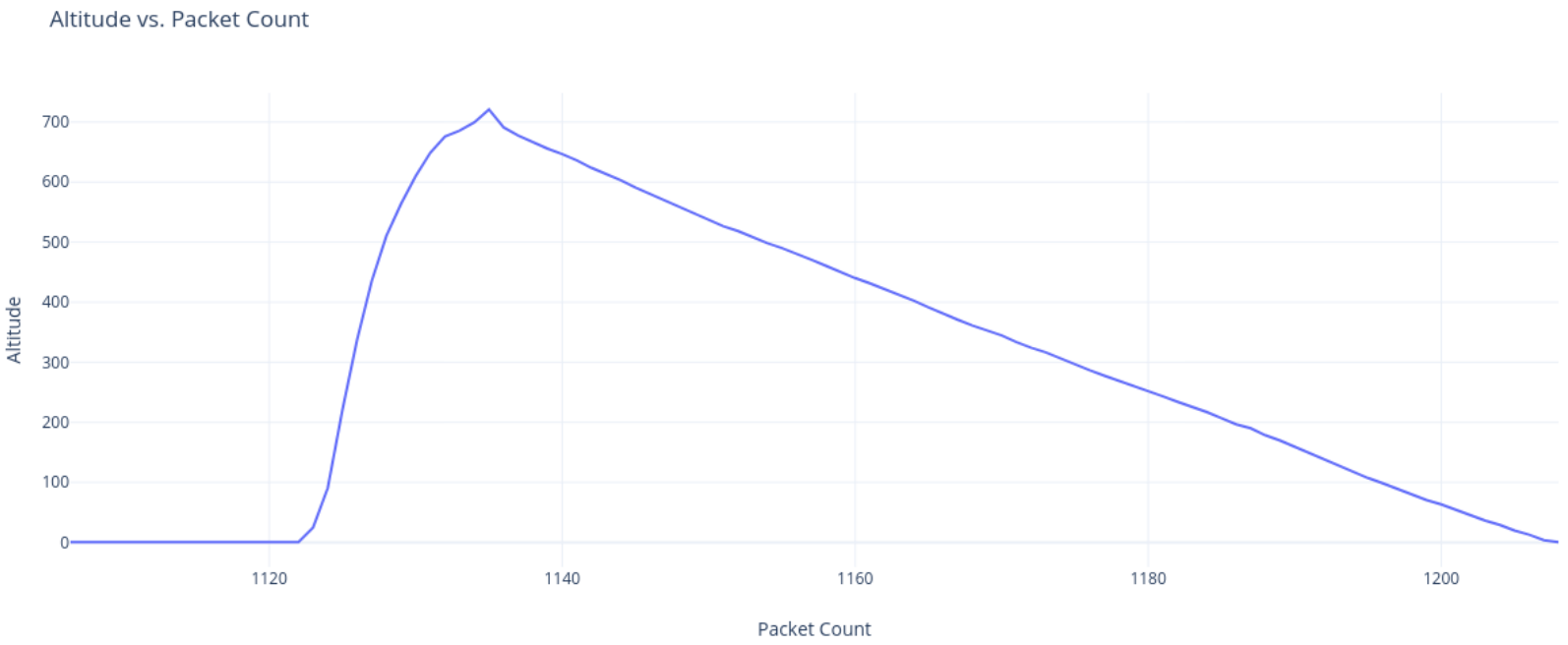
Heat Shield Deployed vs. Altitude

Flight Data Analysis



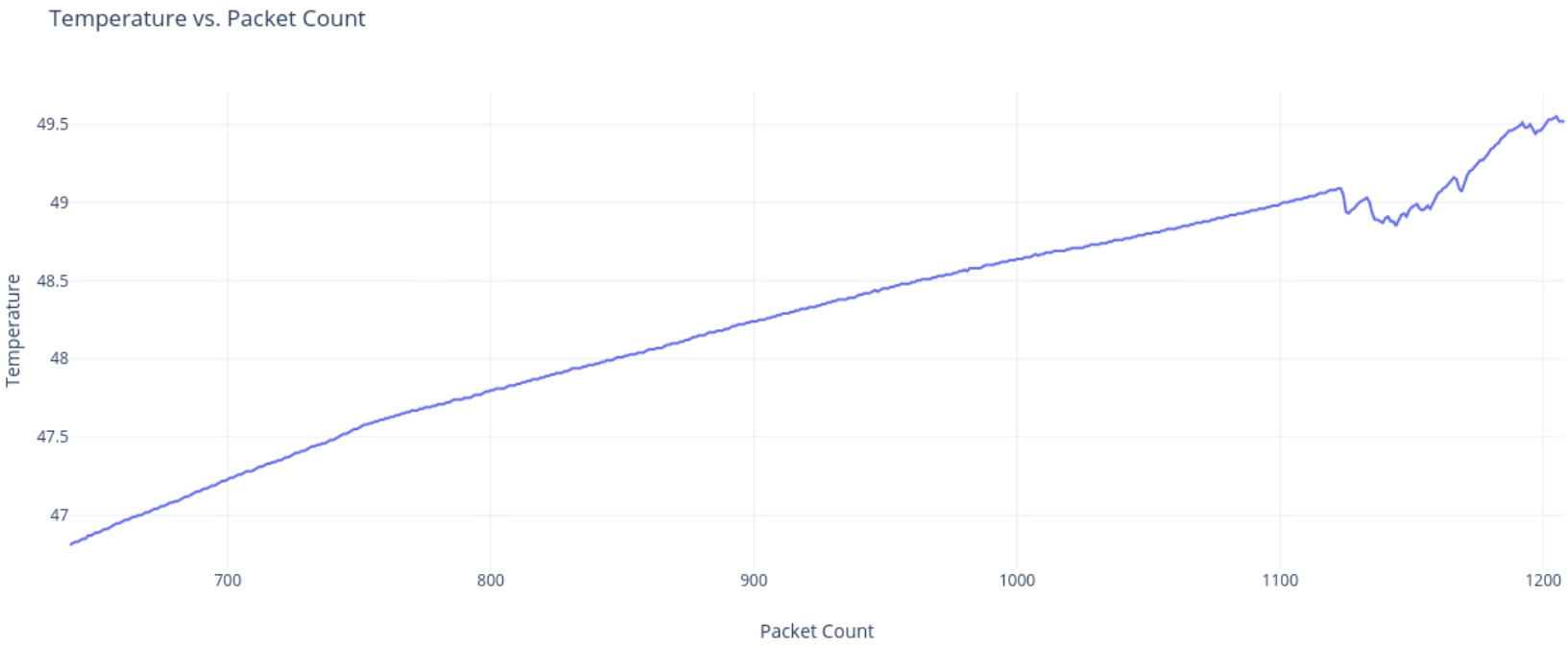
Payload Parachute Deployed vs. Altitude

Flight Data Analysis



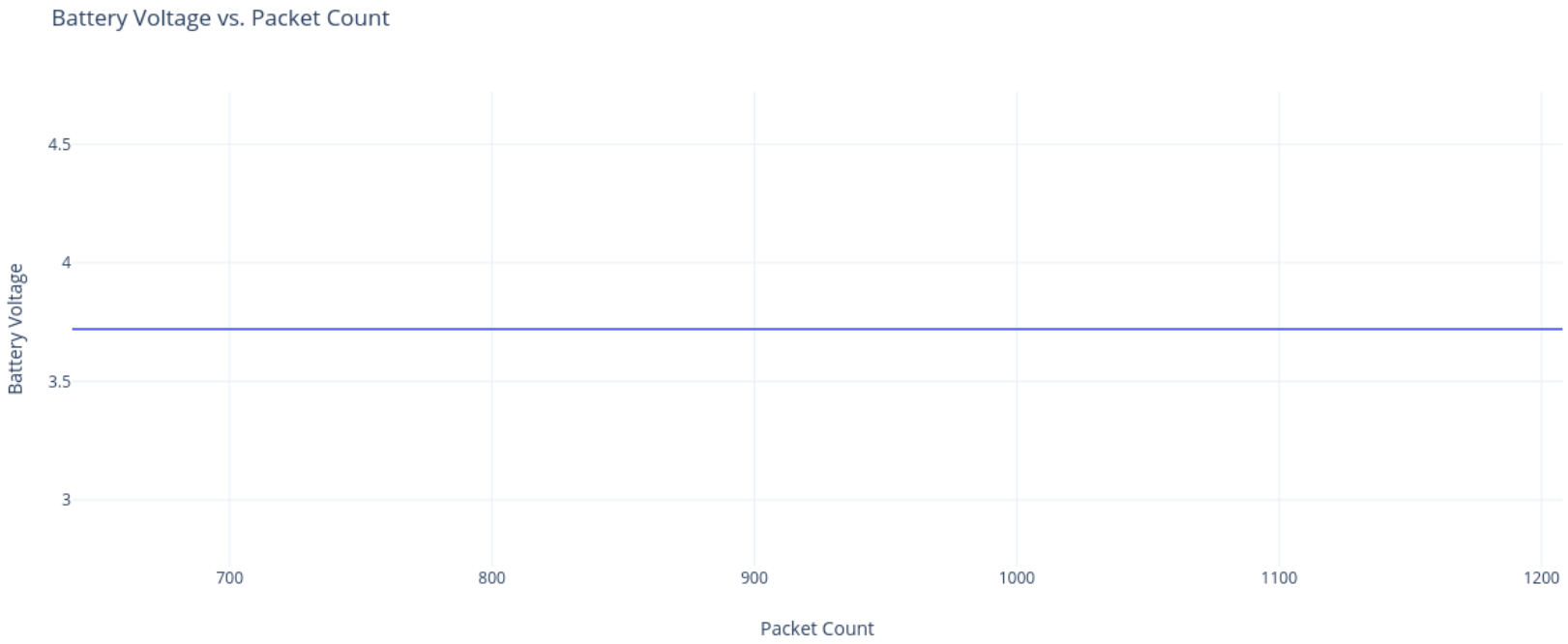
Payload Altitude vs. Packet Count

Flight Data Analysis



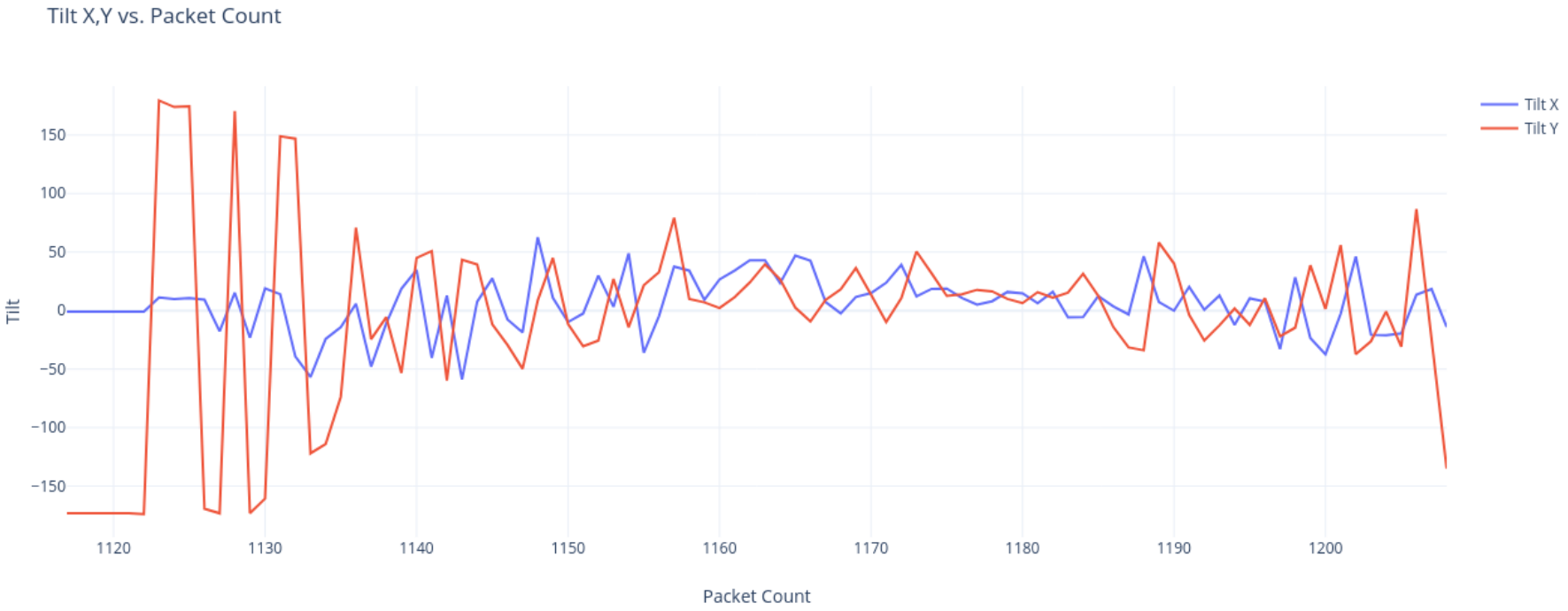
Payload Temperature vs. Packet Count

Flight Data Analysis



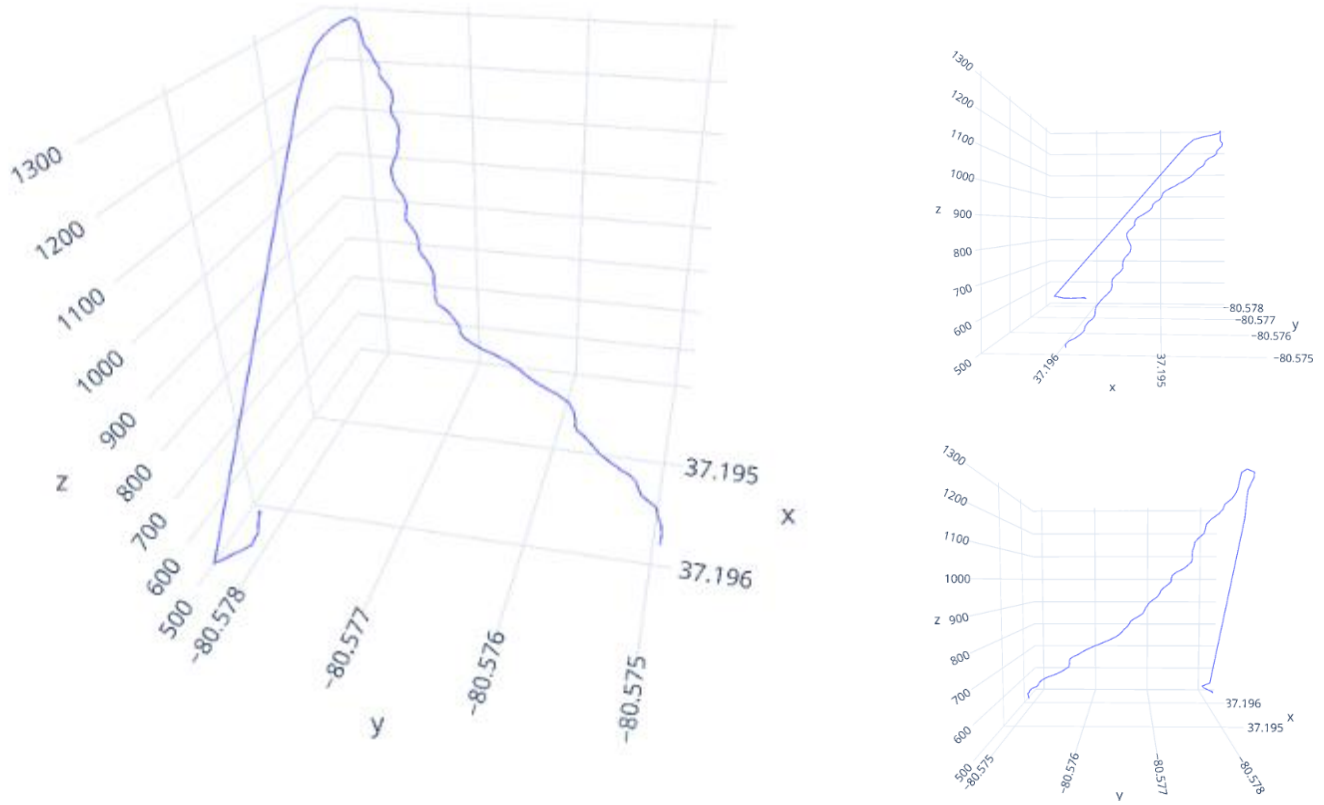
Payload Battery Voltage vs. Packet Count

Flight Data Analysis



Tilt Sensor vs. Packet Count

Flight Data Analysis



Payload GPS Position Plot

Flight Data Analysis

Payload Cam Video: Our camera was recording since when we started it on preflight. The camera was located at the very bottom of the payload, so it had the full impact of the crash. During the crash, we guess that the power cable of the camera was disconnected. Therefore, the video was not saved, and we could not recover it.

Flight Data Analysis

Container Cam Video: https://www.youtube.com/watch?v=ZtD9vfzpoJE

Failure Analysis

Berkant Alperen

Failure Analysis

Failure	Root Cause	Corrective Action
Rocket Separation Failure	The nose cone failed to separate from the rocket	External Factor – cannot be mitigated by the team
Battery Voltage Misreading	Programming Error	1 more line of code will be added, more stringent checks will be done
Payload Camera Failure	Power disconnection due to rocket failure	External Factor – cannot be mitigated by the team
Missing Telemetry After Landing	Landing behind a hill	An additional omnidirectional antenna at the GCS

Lessons Learned

Umut Altun

Lessons Learned – What worked?

- The team was able to make it to the final stage of the competition (first time for us)
- The team was able to pass all of the FRR tests and launch our first ever model satellite.
- The team was able to follow the requirements and guidelines with great accuracy.
- The GCS was able to recieve accurate telemetry for the duration of the flight
- Flight states were detected by the algorithm and sensors.
- The CanSat was recovered regardless of the damage

Lessons Learned – What didn't work

- The CanSat did not deploy from the rocket
- Our production quality was not up to our own standards
- Product development timelines were not satisfactory

Conclusion

- This was the first launch in the history of our team, and we are very grateful for the opportunity, it was a thrill to be here and experience the launch site.
- Overall, it was a great adventure
- Thank you for having us