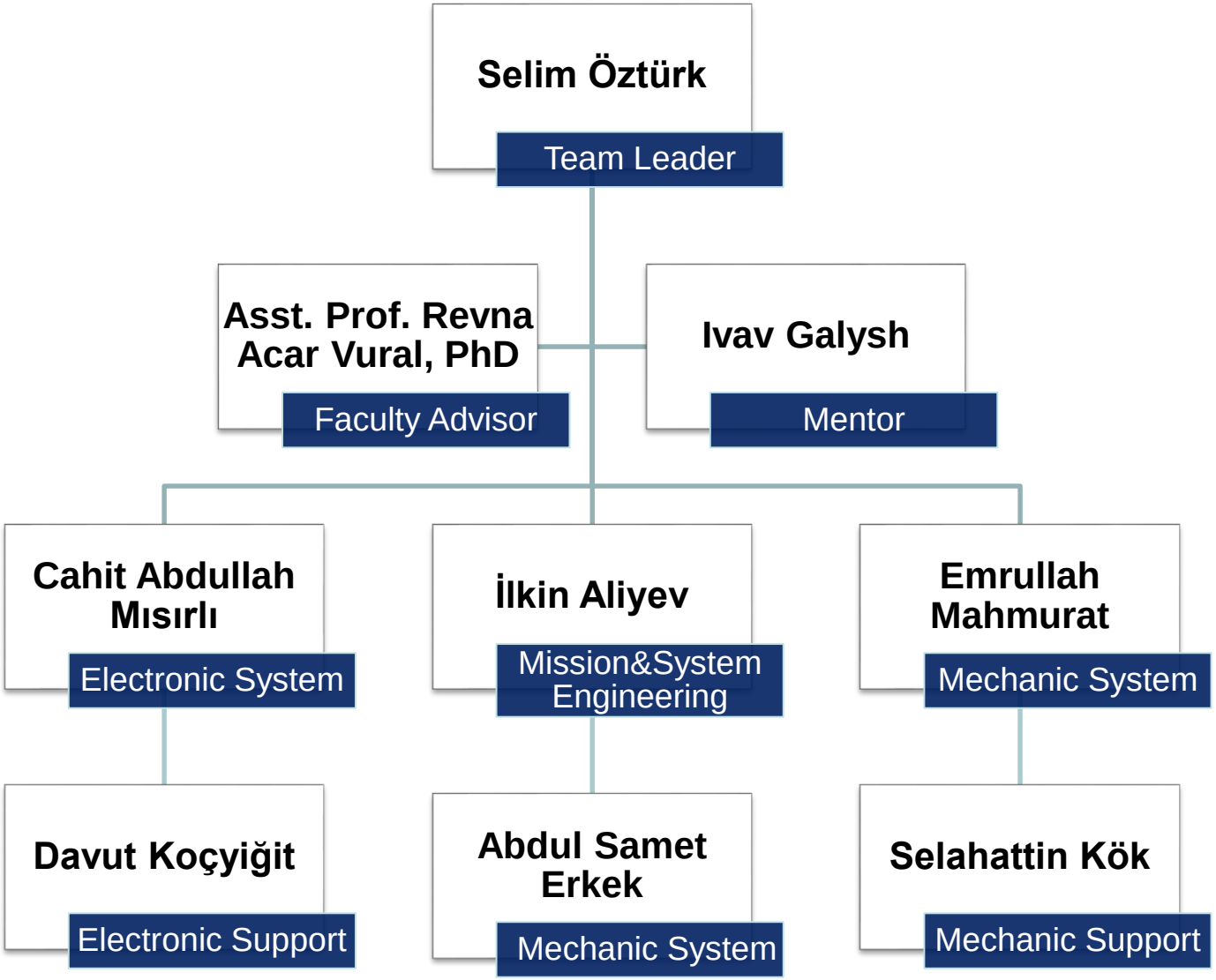
CanSat 2017
Post Flight Review (PFR)

Team 5851
IQRASAT
Yildiz Technical University

Presentation Outline

Section	Presenter(s)
Introduction	İlkin Aliyev
System Overview	İlkin Aliyev
Concept of Operations and Sequence of Events	İlkin Aliyev
Flight Data Analysis	Abdul Samet Erkek & Selahattin Kök
Failure Analysis	Abdul Samet Erkek
Lessons Learned	İlkin Aliyev

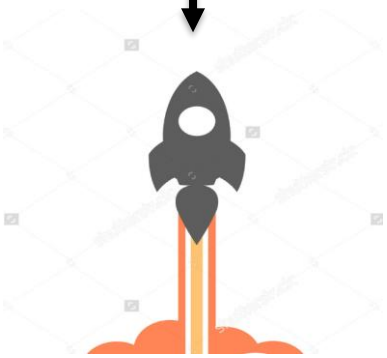
Team Organization



System Overview

İlkin Aliyev

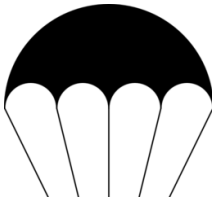
Mission Summary (1 of 2)

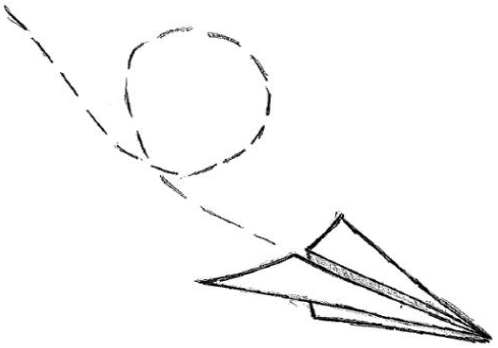


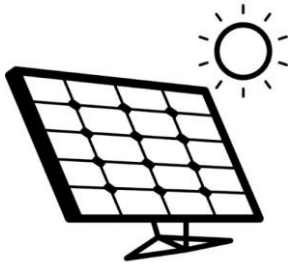
Design

Build

Launch







Mission Summary (2 of 2)

Mission

The 2017 mission simulates a solar powered sensor payload traveling through Venus atmosphere while sampling the atmospheric composition of the planet during flight.

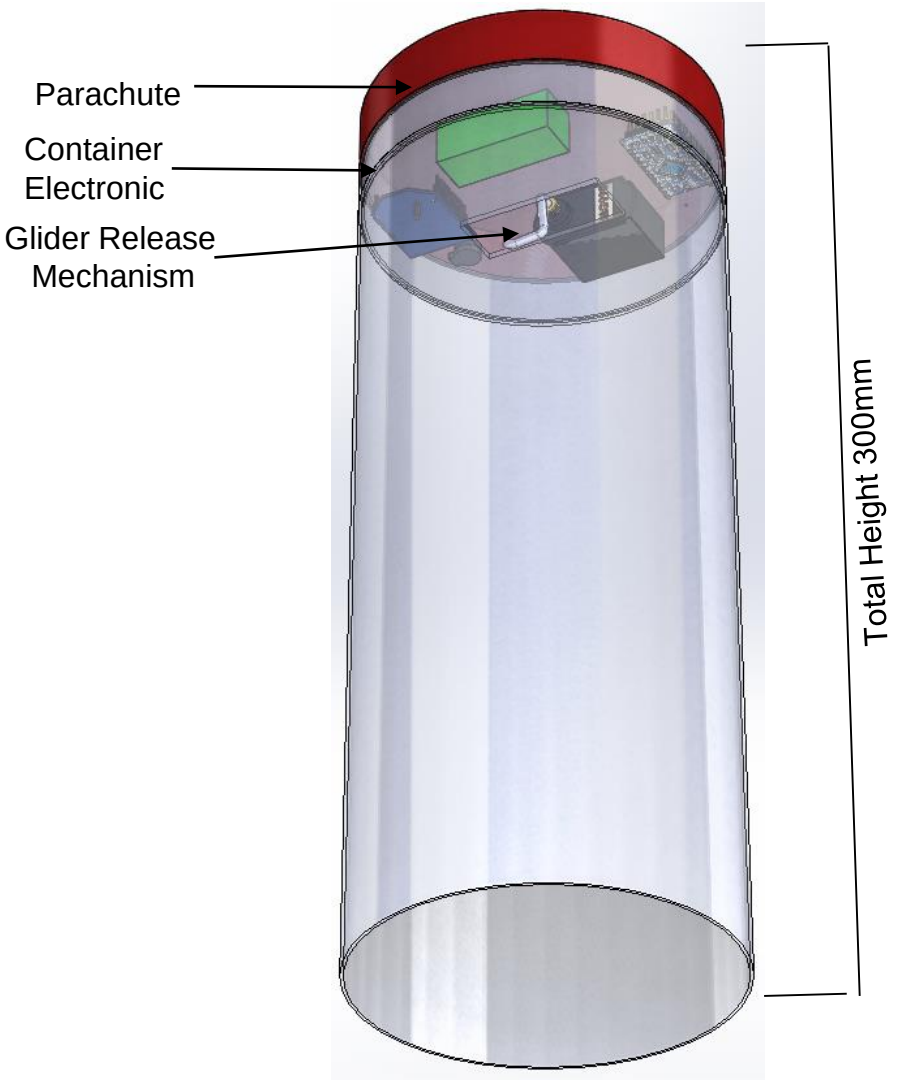
Mission Objectives

- Design special elegant CanSat system and ensure system robustness.
- Payload will be protected in container during initial deployment from rocket.
- Container will use parachute for descent.
- Container will use mechanism for ejection of SV.
- Payload will glide in circular pattern.
- Payload will be fully powered by solar cells.
- Both container and glider will collect data from environment using sensors. (pressure, temperature, altitude etc.).
- Telemetry data will be transmitted to and monitored at a ground station in real time.

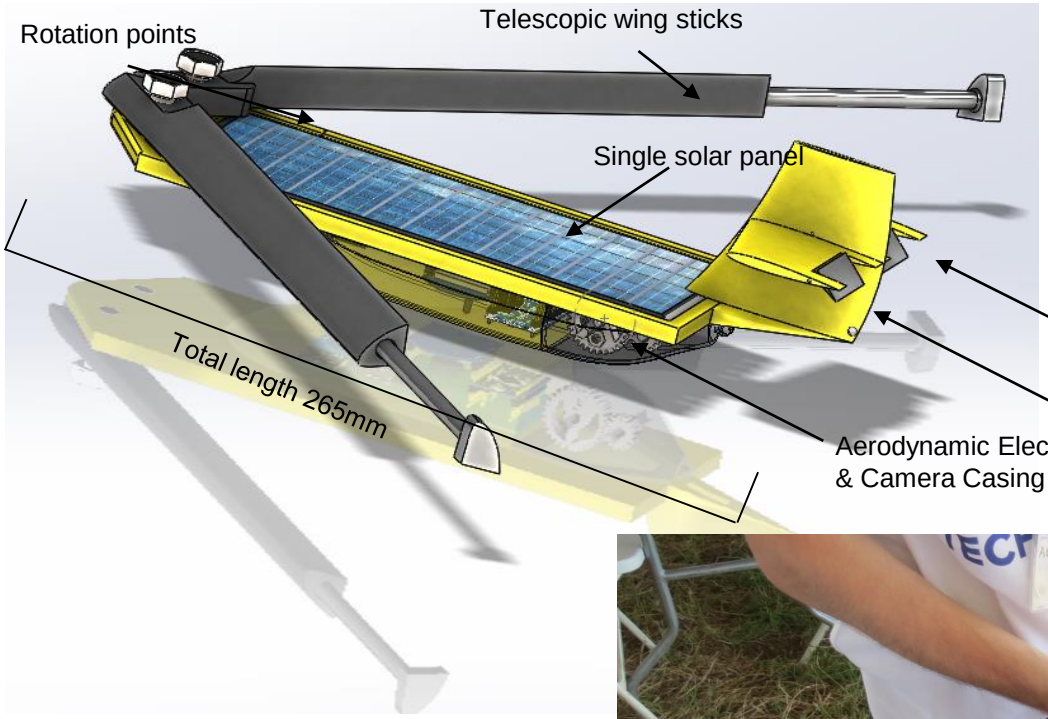
Bonus Objective

A color Camera located at the bottom of glider will be snapping HD pictures as fast as possible.

Cansat Overview - Container



Cansat Overview - Glider



Cansat Overall Cost

Electrical Costs			
Descriptiona	**Quantity**	**Price[$]**	**Status**
Arduino Pro Mini (C&P)	2	5.15	Actual
XBee s2c (P)	2	38	Actual
XBee Pro s2c (C)	1	25	Actual
BMP280 – pressure sensor for pitot tube (P)	2	6	Actual
BMP280 – (pressure+ compass) (C&P)	1	32.07	Actual
Servo Motor (C)	1	3.28	Actual
RTC DS1338 (C&P)	1	2.85	Actual
LS-Y201 Camera mod. (P)	1	45	Actual
5.5V Solar panel(P)	1	7.95	Actual
Buzzer (C&P)	2	1.18	Actual
9V Battery (C)	1	4	Actual
SD card socket (C&P)	1	2.25	Actual
SD card (C&P)	1	6.50	Actual
Supercapacitor (P)	-	20	Estimated
Subtotal		**277.25**	Estimated

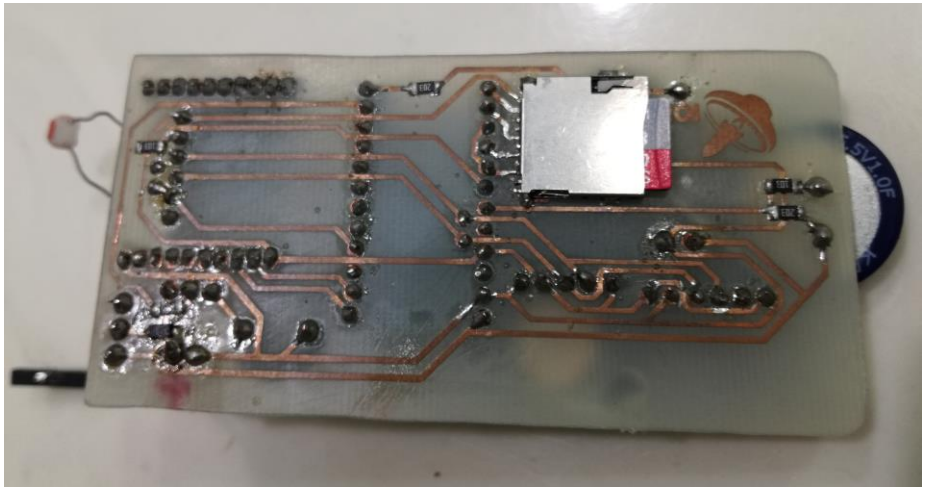
Mechanical Costs			
Description	**Quantity**	**Price[$]**	**Status**
Ripstop nylon (C&P)	4 merer	62.45	Actual
Rubber band (P)	N/A	8.16	Actual
Swivel (C)	1	12.05	Actual
ABS filament (P)	0.5 Kg	17.33	Actual
Screw, nuts etc. (C&P)	N/A	20	Estimated
PVC	1	25	Estimated
Spring (P)	1	4.15	Estimated
Neodymium magnets(P)	1	2.14	Actual
Other parts (C&P)	1	50	Estimated
Subtotal		**202.68**	Estimated

- No component is reused from previous years.
- C - Container
- P - Payload

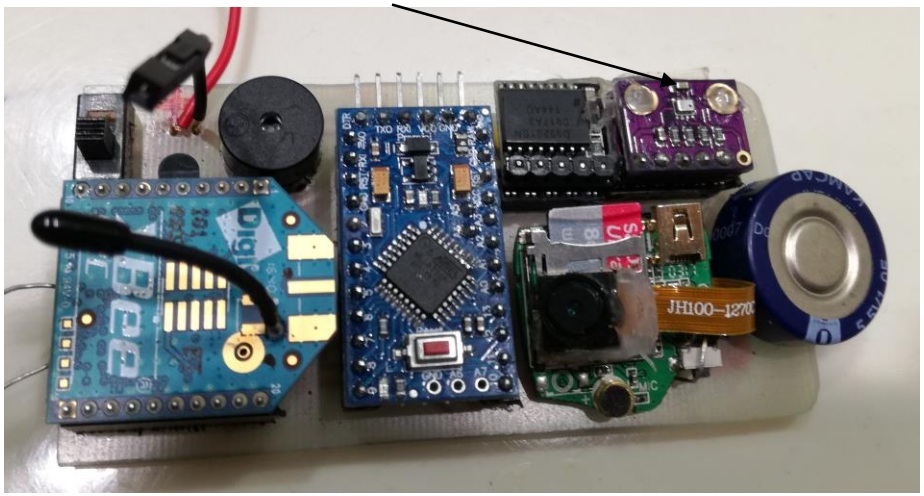
Total CanSat Budget: 481.93

Components summary

- **Container**
  - Rip Stop Parachute
  - Strong paramini chute chords
  - Swivel fpro or preventing parachute chord circuling
  - Arduino Pro Mini (3v3)
  - BMP280 for altitude and temperature measurement
  - XBee S2C wire antenna
  - Pvc container Wall
  - ABS container bulks
  - Nichrone wire for seperation
- **Glider**
  - Telescopic carbon wingstiks
  - 3d printed ABS electronic casing
  - ABS reinforced XPS base
  - Rip stop wing kite
  - Neodmium magnets
  - Single solar panel from seed (80x180mm)
  - XBee S2C wire antenna
  - SD card socket
  - 1F supercapacitor
  - Y2000 Mini Camera
  - 2xBMP 280 pressure sensor
  - DS3231 RTC modüle
  - Buzzer and Switch

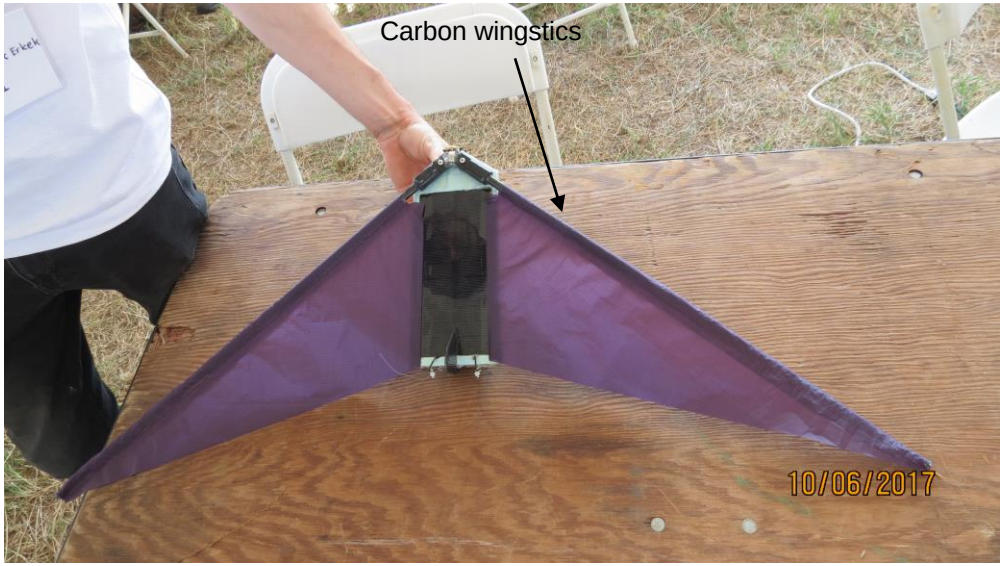


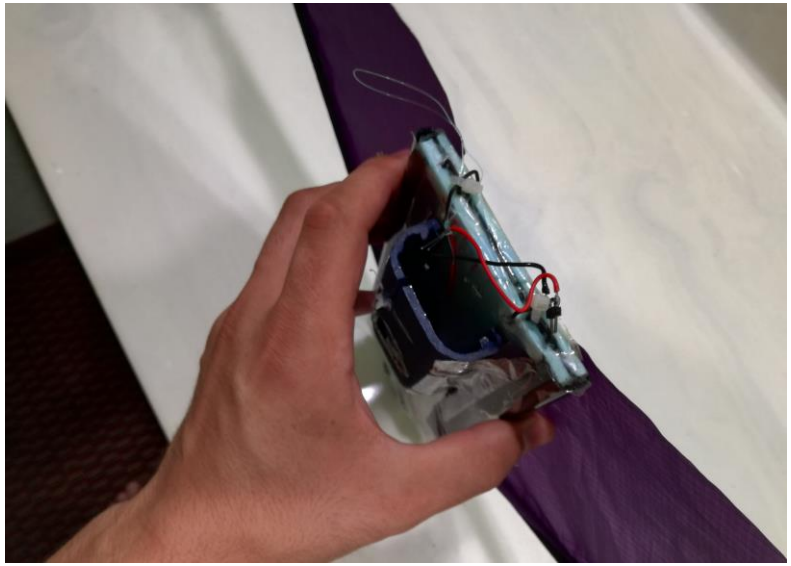
Altitude, pressure, temperature and speed measurements



All componenets runs on 3v3 excepting camera with 3.7v

Physical layout





Rotation points

Rubber band and magnets

CanSat Recovery

Concept of Operations and Sequence of Events

İlkin Aliyev

Comparison of planned and actual Con-Ops

Planned	Actual	Clarification
CanSat placed on the rocket – 14:15	İn time	The cansat was loaded into rocket
CanSat Launch – 14:30	30 minutes later	
CanSat Deplyment from rocket	30 minutes later	
Glider seperation	Before launch	
Glider circular pattern	as planned	Due to great design the glider performed perfect helical descent. The diameter was within
Landing – expected		İt is landed
Recovering and mission data rehtrieval	50 minutes later	Since the glider seperated at the 610 meter it glided

SV release logic

- The release was planned to be happening at 420m.
  - İn order to keep telemetry tranmsiison in control it was programmed to send the telemetry once the glider sees above 400m

- Release carried out by container electronics.
  - Based on melting fishing line which connects glider to conctainer.

125mm

Comparison of planned and actual SOE

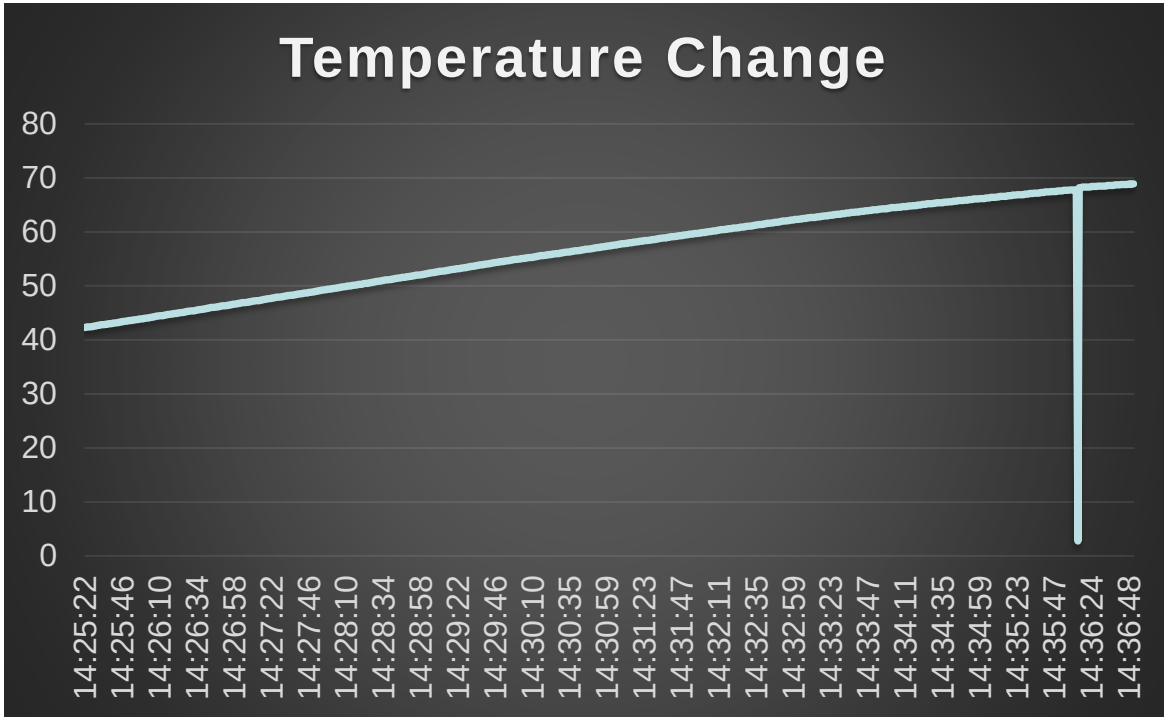
Planned	Actual	Clarification
ARRIVAL – 09:00	İn time	
Preparing CanSat To Communication Test. Check subsystems – 14:30	İn time	
Setup Ground Station	İn time	
Power on CanSat and integrate into Rocket Payload Section	İn time	
Ensure communication between CanSat and GS	İn time	
Execute launch procedures	30 minutes later	Some rockets faşled to launch
Perform Mission. Monitor telemetry data inside rocket. Send Override command when needed	-	Since the glider seperated at the 610 meter it glided
Payload start harvesting. Subsystems initialize and telemetry starts	-	Failed since unkonw problem
Track Container and Payload with their visible color	-	Didnt tracked since seperated above 600 and glided in a huge pattern diameter of 1.03km
Locate CanSat. Track Container and Payload	50 mintes later	We had problems with dinfing, metal detector, walki may be used
Retrieve Mission Data	-	Didnt rehrieved any mission data from glider

Flight Data Analysis

İlkin Aliyev & Cahit A. Misirli

Payload Separation Altitude

- The seperation was planned to be conducted at 420 m however due to very high temperature the container electronics started to work uncorrectly. The graphics below shows that the temperature reaches to peak, 70 degree, inside rocket. It was not supposed or tested to work at that temperature.



Glide Duration

- **The glider descent rate was determıned as 3.7m/s according to tests operated in our country. And other teams saw the smooth gliding of our glider. Therfore the glider glide duration was estimated as 220 seconds after rocket seperation.**

- **Despite the strong wind the glider kept its stable descent**

Glide Duration – landing zone

Landing point of glider

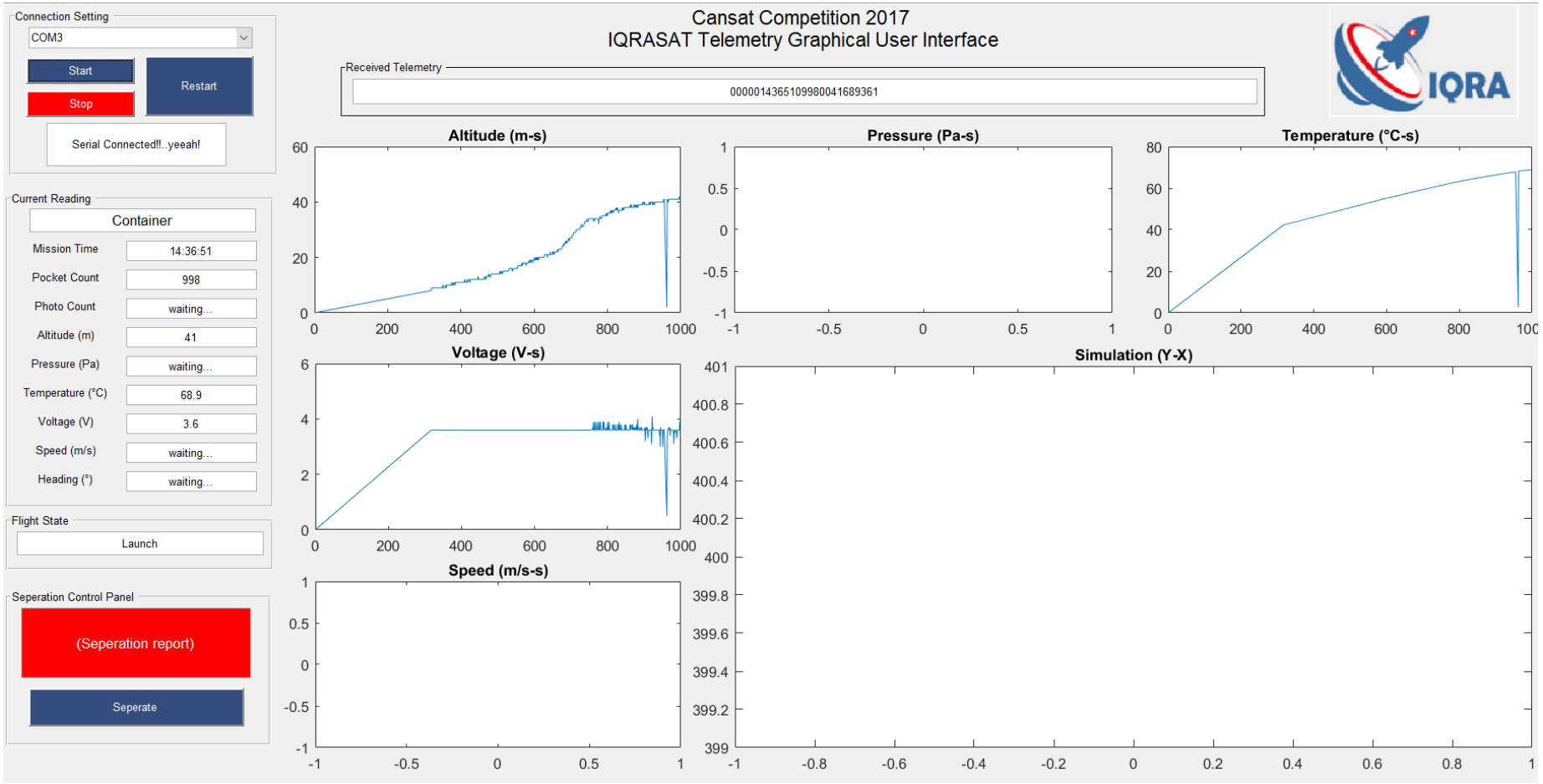
Launch point

Total distance from launch point: 1.03km

This indicates that the gliding diameter of the glider was 1.03km. This is because of it is released aproximately from 610m. İf it released from 400m it would be within 1km

single point of failure caused to multiple consecutive failures.

Container sensor data plot



Payload sensor data plot

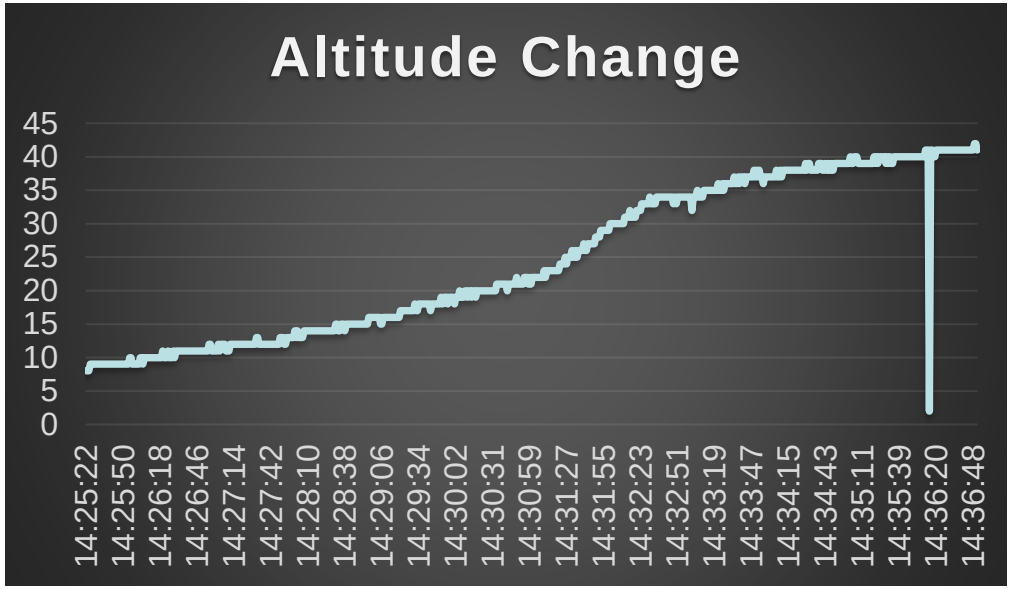
- **Despite the fact that the electrical subsystem of glider was tested even in the launch field before and after mission it wasnt worked during mission due to unkown problem.**
- **İt was tested in our country by a quadcopter by risng the glider up to 200 m. The glider was working perfectly. We have not yet detected the source of the problem.**
- **Glider electrical subsystem was designed to work at 3v3 level and consumes 60mA and with camera 150mA. The single solar panel provides nominal 350mA and 5v5 which corresponds to 2 Watt power.**

Tests carried out at our university

The test was conducted at soccer field of our university. The glider was released from inside of container at 200m. The full system was tested succesfully. Lack of experience caused missing of some minör points

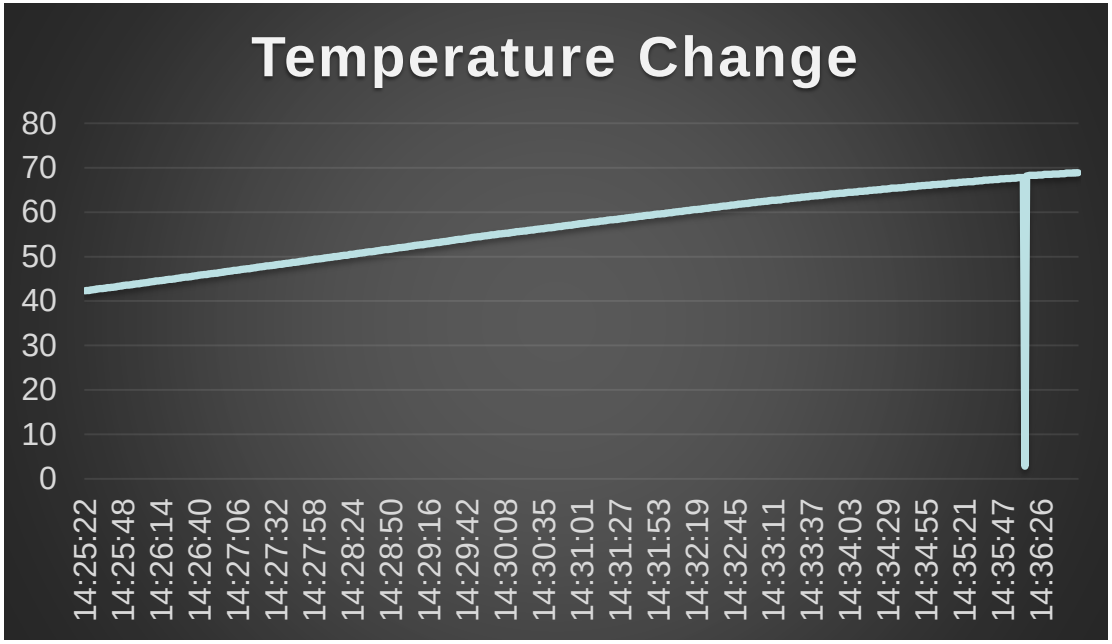
Container altitude plot

- **The electronics stopped working before launch as seen from mission time.**

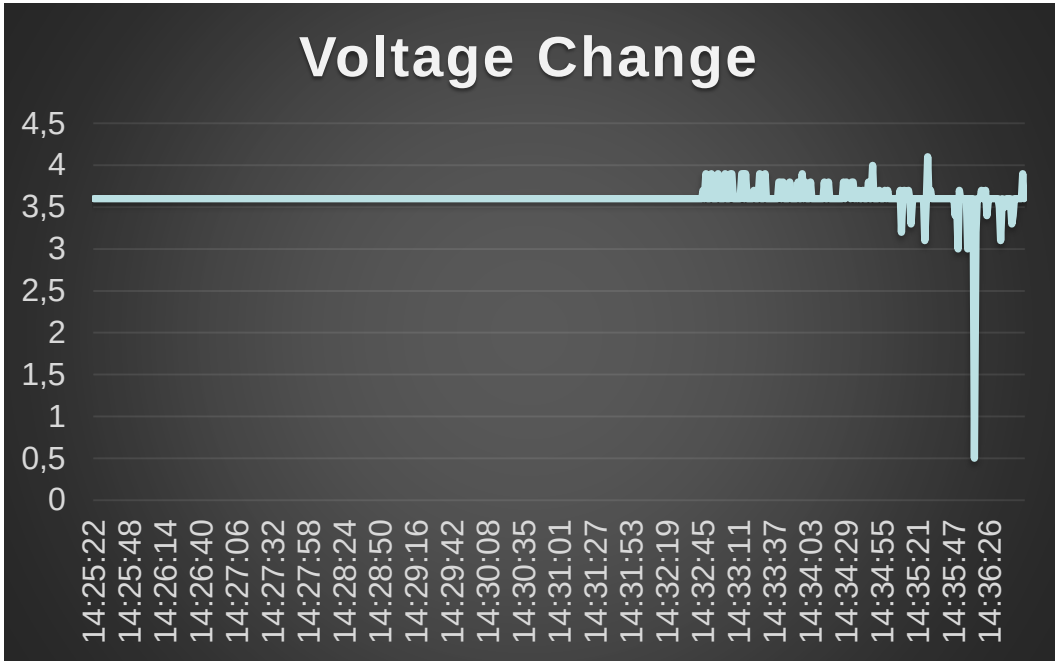


Container temperature plot

- **The temperaure was very high inside rocket.**



Container battery voltage plot



Camera images

- **No image captured**

Failure Analysis

İlkin Aliyev & Abdul Samet Erkek & Selim Öztürk

Identification of failures, root causes, and corrective actions

Failures
Single point of failure caused whole flight spftware bugging. Container stopped telemetry after reaching peak and released the glider which means unporper working of contaşner flight software

Root cause
High temperature ruined the whole electronics and also ecofriend alkaline battery

Corrective actions
We need to prove tour electronics workmanship under high temperatures

Lessons Learned

İlkin Aliyev

Discussion of what worked and what didn't

- **What Worked**
  - ✓ Container telemetry was received
  - ✓ Container parachute was deplyed and descreased the descent
  - ✓ Glider seperated from container
  - ✓ Glider had a very smooth descent after seperation
  - ✓ Glider glided in circular patttern
  - ✓ All mechanical subsystems and mechanisms were worked as expected
  - ✓ Override command was working perfectly as tested at flight readiness review

- **What didn’t work**
  - Container electronics stopped before launch
  - Glider was seperated inside rocket due to unproper working container software
  - Glider electronics didn’t work at all
  - Audio beacon of glider was not beeped due to glider software didn’t start at all
  - Glider didn’t take any Picture beacuse of the same reason above
  - Glider didn’t transmit any telemetry due to same reason

Conclusions

- Great initail design of the glider ensured desired flight.
- We set the simplicity as the highest prority at the beginning.
- Despite unfortunate events it was great experience to compete at such enviroment. Thank you all!