Pacific Academy Rocketry Club

2024 RFS Review Report
Pacific Academy Rocketry Club (PARC Team)
05/27/2024

Basic Information

The PRAC Team is the representative team of the Pacific Academy Rocketry Club at the Irvine Campus, mentored by Mr. Neal Hunstein from the Rocketry Association of California. For the Rockets For Schools 2024 competition, the team constructed a Class II high-power rocket equipped with an electronics bay. The costs associated with setting up the team will be covered by the team members and the Pacific Academy PTO Club Fund.

Brief Description

First of all, we need to admit that unfortunately we failed in this competition. Our team failed to achieve the expected ranking. Based on this situation, as the captain of the representative team, I take full responsibility.

During the preparation process for this competition, I mistakenly ignored the team presentation and related parts of the poster and failed to pay due attention to it. This is the main reason for this failure.

Secondly, I did not fulfill my due responsibilities in organizing and arranging the competition. I did not pay enough attention to our very important member Tony. Tony retired from the competition midway due to personal reasons, causing our team to lose the support of a key member. I did not effectively predict and set up emergency plans for emergencies such as team members withdrawing midway, which indirectly caused the failure of this competition.

In addition, there were many temporary decisions during the trip, which fully demonstrated that I did not have a clear understanding of the entire game process, which resulted in us lacking time on many things, such as the rocket reception inspection.

To sum up, I take full responsibility for this failure. Next, I will summarize our program for this competition.

Payload Description

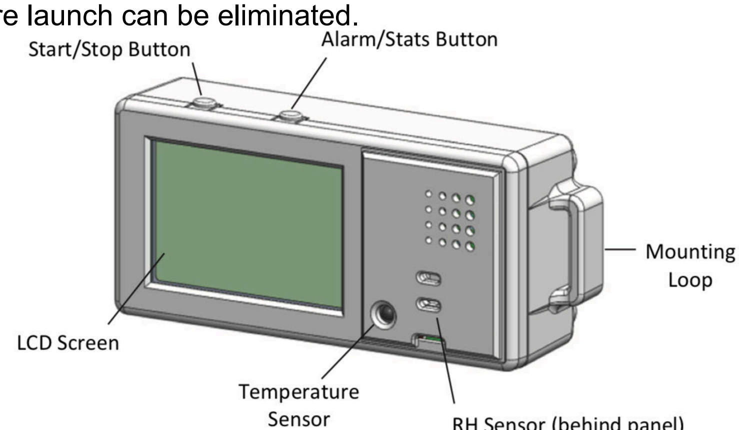
The system was constructed by a temperature sensor and a data logger. There is a power unit providing the electricity for the system. (Show in Graph I)

The power unit provides power to the data logger and temperature sensor. It is using two #7 batteries to provide the power. The battery bay is changeable. The power unit is able to ensure that it can provide power supply for a sufficient period of time to support data recording and transmission during the entire rocket flight.

The temperature sensor is a resistance thermometer. The sensors typically have high accuracy and stability and are able to work reliably in a variety of environmental conditions. Install the temperature sensor at the electronic bay on the rocket. Using the air grille to perform gas exchange inside and outside the rocket and electronic bay in order to measure and record the data that is required to analyze.

The air grille is made by densely opening holes on the rocket to exchange gasses inside and outside the rocket, so that the measuring device can complete the measurement of the outside air temperature even if it is inside. In order to prevent the rocket motor from affecting the temperature measurement during operation, holes will also be made in the lower part for heat dissipation. At the same time, an insulating plastic film is used at the bottom of the electronic bay to block part of the heat transfer.

The data logger will be built into the sensor and use the same power supply as the sensor. The data logger will be set to record data every two seconds, and the system's built-in battery can guarantee its operation for at least 3 hours. After the rocket returns to the ground, the data logger can use the bluetooth or WiFi connected to a computer or smartphone to download and analyze the recorded temperature data. The way to accept the data from the system is to use the APP that the kit provides. When it is within the signal range, it will automatically synchronize data to the connected device. When it is out of range, it will switch to receiving mode and use its own 128KB memory to record. The record will be set to automatically overwrite the existing record from front to back when the memory is full, so that useless data before launch can be eliminated.



[Graph I]

The above system is produced using relatively mature commercial DIY kits purchased on Amazon to ensure the stability of the system. In addition, in selected DIY kits, an additional RH sensor was included.

Payload Theory and Supporting Calculations

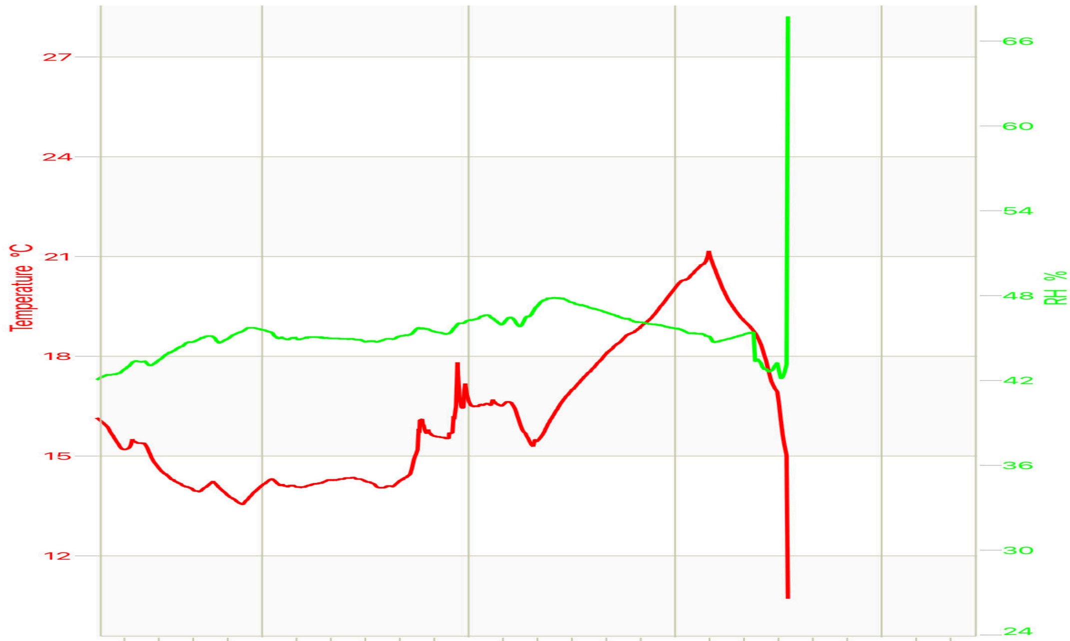
The temperature changes during the rocket flight are influenced by various factors such as altitude, atmospheric conditions, and the rocket's speed. Due to the limitations and design of our equipment, we chose to measure the temperature individually to provide data on how the temperature changes over time during the rocket's flight. The unit time of data recording is two seconds.

Generally speaking, the temperature in the atmosphere generally decreases with increasing altitude, which is called the temperature gradient. This approximate relationship can be used to describe how atmospheric temperature changes with altitude at low altitudes, but it does not hold true in all cases because atmospheric temperature is affected by many factors. Typically, this approximate relationship can be expressed as a temperature drop of about 0.65°C for every 100 meters of elevation. It should be noted that this relationship is more accurate in the near-ground height range, but does not apply in all situations.

We use the data recorded by the recorder to analyze the temperature changes during the rocket's flight. For this, we will be able to use the recorded temperature data to compare with time and calculate the height and average speed of the rocket flight. Then compare it with the rocket's designed flight height.

Data Analysis and Results

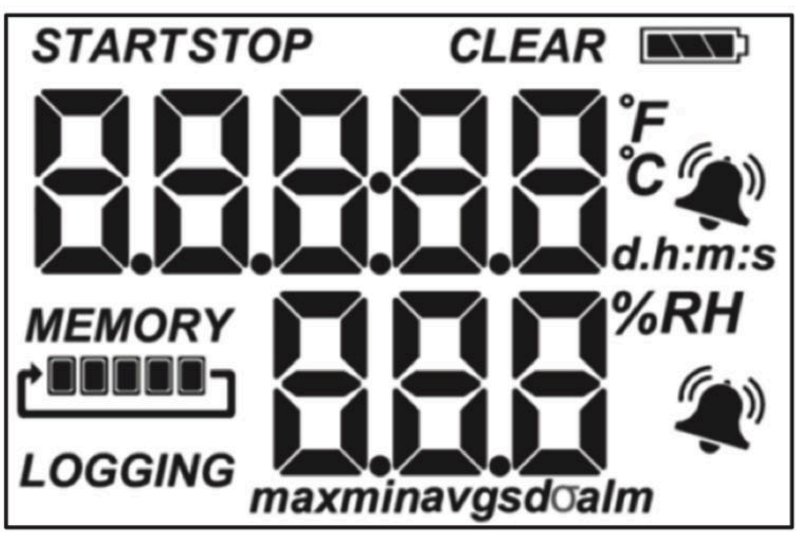
According to the data that the logger got, the team had produced the graph of how the temperature and RH data change. (Show in graph II)



[Graph II]

As the graph shows, clearly, the temperature had decreased about 8°C as the rocket flew up, which is about 5 min time period maximum.

There is also another way that the team can see the data real time, which is using the screen on the system to see it directly. The LCD screen will have battery status, memory status, temperature and RH percentage in real time to show. (Show in graph III)



[Graph III]

According to the data, the rocket flies up to about 4060 feets high, which is about 8°C effective change in the temperature.

Pre-flight Weight of Payload

According to the data that the judge recorded, the pre-flight weight of the payload is about 90g, which is 0.2 pounds, including the batteries.

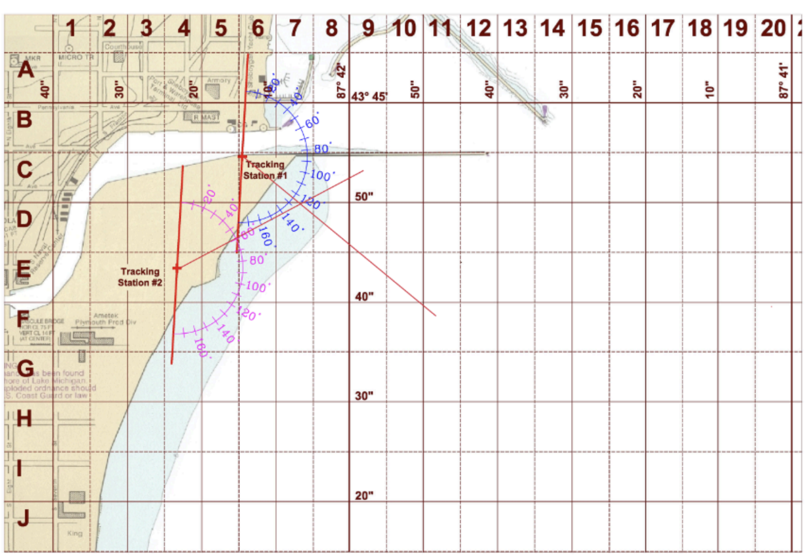
Raw Data Summary

According to the xlsx file data that downloaded from the data logger, here is the data table that the team produced. The way to produce it using the data from the 10s range of the time point to calculate the average value of the temperature. Using the average temperature to be the data at this data point. Every point had a 30s interval. However, graph II was using the original data to produce, so it will be a little bit different.

T=00’	21.65°C
T=30’	20.96°C
T=60’	20.47°C
T=90’	19.06°C
T=120’	18.66°C
T=150’	18.35°C
T=180’	17.96°C
T=210’	17.11°C
T=240’	15.92°C
T=270’	14.51°C
T=300’	13.03°C

Physical Measurements

Listed below are the rocket landing point data provided by the competition organizing committee, which can be used to further analyze the rocket’s three-dimensional flight trajectory.



[Graph IV]

Judgment based Problems on scoring criteria

Nose Cone: did not attach screws.

Payload Section: bulkhead epoxy filet & recovery sys componente, focus on the water proof.

Fins: epoxy filet did not go all the way to root, edges are not tapered.

Booster: rail button alignment is bad, Aft Centering Ring Filet is not strong enough.

Preparation: organized well.

Explanation of mission patch: not bad, need to be more specific.

Explanation of payload: not bad.

Well prepared: not enough.

General knowledge of ideas: Not everyone is familiar with it.

Project Concept: Not unique, Creative and artistic design is not outstanding.

Scientific Thought: Usage of the data is not clear enough.

Payload Engineering: can adequate for stated goal or not need to be examined.

	Ready on time:	3
	Introduction of Teams:	3
	Stayed within 5 - 10 minutes:	3
	Entire team involved:	3
Preparation		
	Organized:	4
Presentation		
	Explanation of mission patch:	3
	Explanation of payload:	3
	Well prepared:	3
General		
	Ideas presented clearly:	3
	General knowledge of ideas:	3
Project Concept		
	Original / unique:	3
	Creative / artistic / inventive:	3
Scientific Thought		
	Clear purpose / hypothesis forme]:	3
	Concept clearly demonstrated:	3
Payload Engineering		
	Adequate for stated goal	3
	Construction and workmanship:	4
	Representative of skill and grade	4

Rocket Construction Judging Results			
Judge ID Number:	101		
Team Number:	307		
Nose Cone			
Smooth Fit to Payload Airframe:	4	**Artistic Design**	
Shock Cord Attachment:	1	Complexity of Design:	2
Attachment Screws:	0	Execution of Design:	2
Payload Section		**Preparation**	
Smooth Fit to Booster:	5	Spiral Grooves Filled:	1
Bulkhead Epoxy Fillet:	2	Nosecone Seam Filled:	1
Recovery Sys Components:	2		
Fins		**Texture**	
Straightness:	4	Smoothness:	2
Epoxy Fillet at Root:	1	Consistent Paint Coverage:	3
Tapered Edges:	2	**Total Score**	43 /100
Booster		**Comments:**	
Shock Cord Attachment:	4	Buttons not functional. Ubolt loose. Coupler glued in too far.	
Engine Mount Installation:	3		
Rail Button Alignment:	1		
Aft Centering Ring Fillet:	1		
Motor Retention T-Nut:	2		

Visual Observations

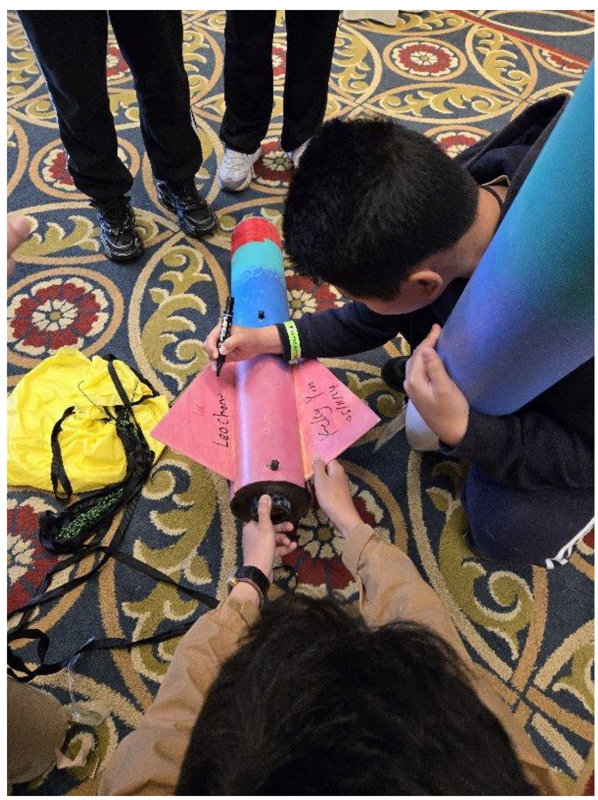
The figure below shows the rocket's ascending flight path marked by the motor's wake.

[Graph V]

Team Picture

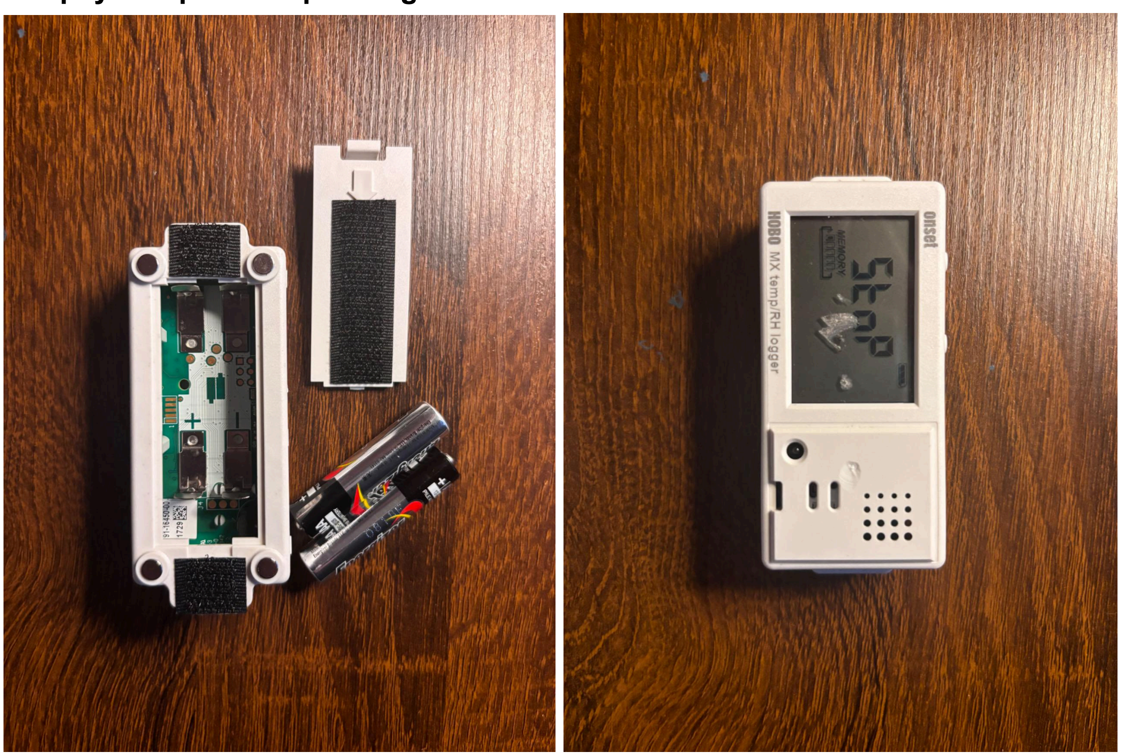
[Graph VI] (Photoed in Chicago O’Hare International Airport)

Photographic Documentation



The rocket pre- and post-flight

The payload pre- and post-flight



Review and Award

First of all, again, we need to admit that unfortunately we failed in this competition. Our team failed to achieve the expected ranking. Based on this situation, as the captain of the representative team, I take full responsibility. Based on this, I will conduct further reflection and strive to avoid the above problems next time.

Secondly, I would like to thank the competition organizers and co-organizers for giving us this opportunity to participate in the competition. It also gave us a perfect communication platform, giving us the opportunity to discuss and communicate with Rockets clubs from all over the country.

Also, I would like to thank Mr. Neal from ROC for his strong support for the team to participate in this competition. Mr. Neal spent much of his personal time helping the team make and improve rockets, and also devoted himself to coaching the team in presentation exercises.

Then, also important, thank you to Pacific Academy and PTO for their strong support of the team's participation in this competition. Without you, the team would not be an army.

Finally, the team would like to express its gratitude to all team members and their parents. It is your hard work and support that enabled the team to achieve its set technology goals.

In the end, the team would like to express its gratitude to all team members and their parents. It is your hard work and support that enables the team to achieve its stated technical goals. To borrow a sentence from German Chancellor Olaf: Believe in yourself and you will be unstoppable. Success is not just about winning; it is about overcoming obstacles and never giving up. I would like to encourage all club members and everyone involved in supporting this competition, I hope you will continue to support us to realize our dreams!