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# *Post Launch Assessment Review*

## Mark Twain Atmospheric Sounding Rocket Project
## Krueger School of Applied Technologies

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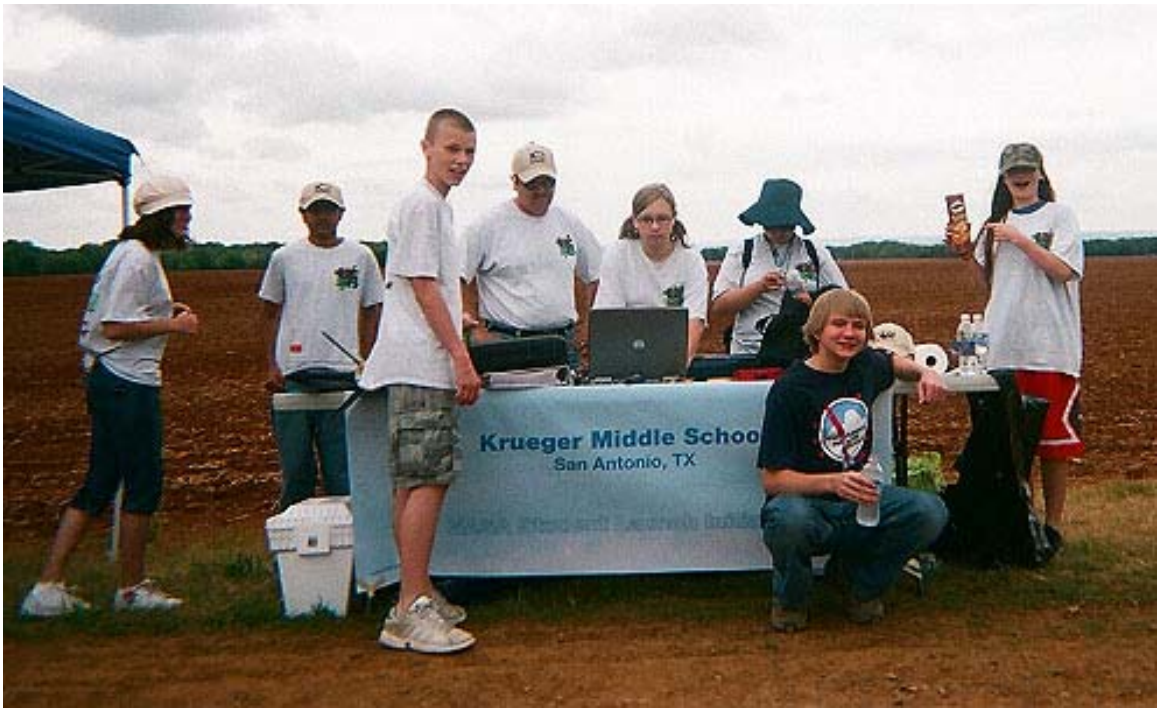



**Preparing the Rocket for Launch**

## Mission Performance

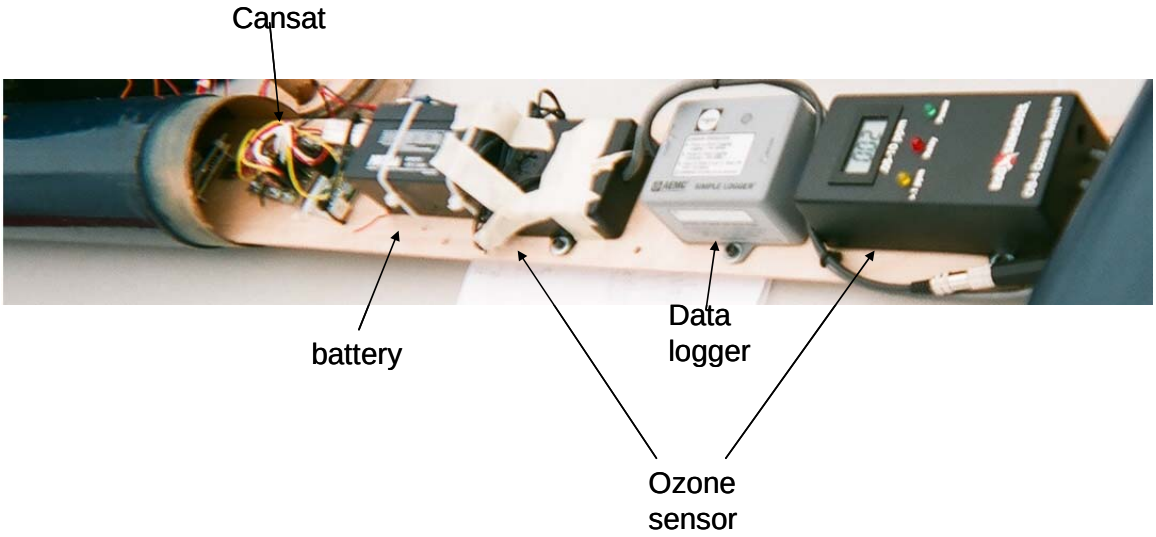
Our rocket was required to take a scientific payload to 5,280 feet, or one mile. At the Huntsville launch our rocket reached 4,278 feet in altitude. The Ozone sensor which made up the main portion of our payload experiment maintained a reading of 0.05ppm through out the flight.

## Experimental Concept

Our experiment was to measure the difference of ozone from ground level to one mile up. To accomplish this we set up the rocket with an ozone sensor in the payload. A few minutes before the rocket was placed on the launch stand we turned on the data logger (the device that would record the sensors readings). During setup one team member was responsible for recording the time for different events toke place during before, during, and after the flight. We recorded when the data logger was turned on and when the rocket launched. That way we could match up the data from the CanSat (which measured temperature and air pressure) and the ozone sensor.

The rocket itself used a K550 motor. When at apogee, the altimeters inside were to signal the rocket to deploy the drogue chute, stabilizing the decent until the rocket reached 750 feet, when the altimeters would deploy the main chute.

## Payload Tray Set-up




The ozone sensor developed by Ecosensors pictured above shows a reading of 0.02ppm during pre launch warm up. It will then send sensor readings to the Data Logger which will store them until retrieval. The CANSAT shown to the far left was installed to either broadcasts GPS readings to enable us to locate the rocket or air pressure and temperature changes during the flight. Not shown are the two dual deployment altimeters which are part of the recovery system.

Above team member Ali Klemm is waiting to monitor CanSat Telemetry on her laptop. Travis Lamb is standing behind her holding the Yagi antenna designed to receive CanSat telemetry.

**Rocket Flight Results**

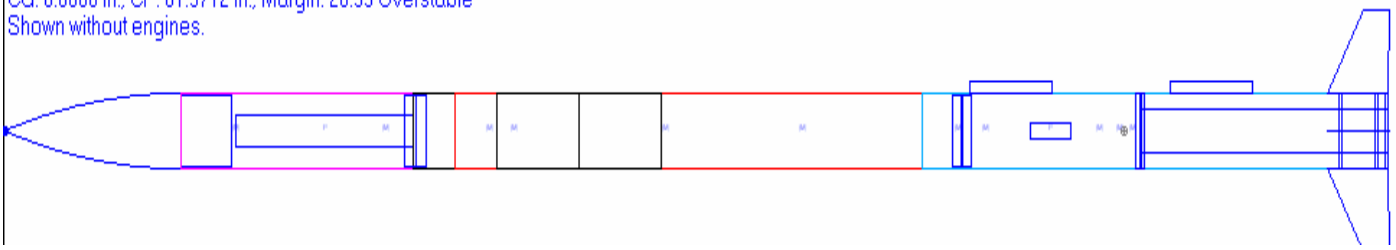
After the launch the team reconfigured the simulated Mark Twain rocket in Rocksim by changing its Coefficient of Drag in an effort to match the altitude achieved the day of the flight. The team also changed the weight of the rocket to match the actual weight of the rocket the day of the launch. The difference in weight was almost 75 ounces. It was obvious the team incorrectly measured the rocket and payload during the construction of the rocket.

After examining the rocket, it was determined that there was too much black powder in the drogue chute charges. When the charges were set off, the force deployed the drogue chute, but the force also pushed off the nose cone, which pulled out the main chute, causing our rocket to drift. Also, the extra black powder caused the shock cord to tear through the body tube, or “zipper” the rocket.

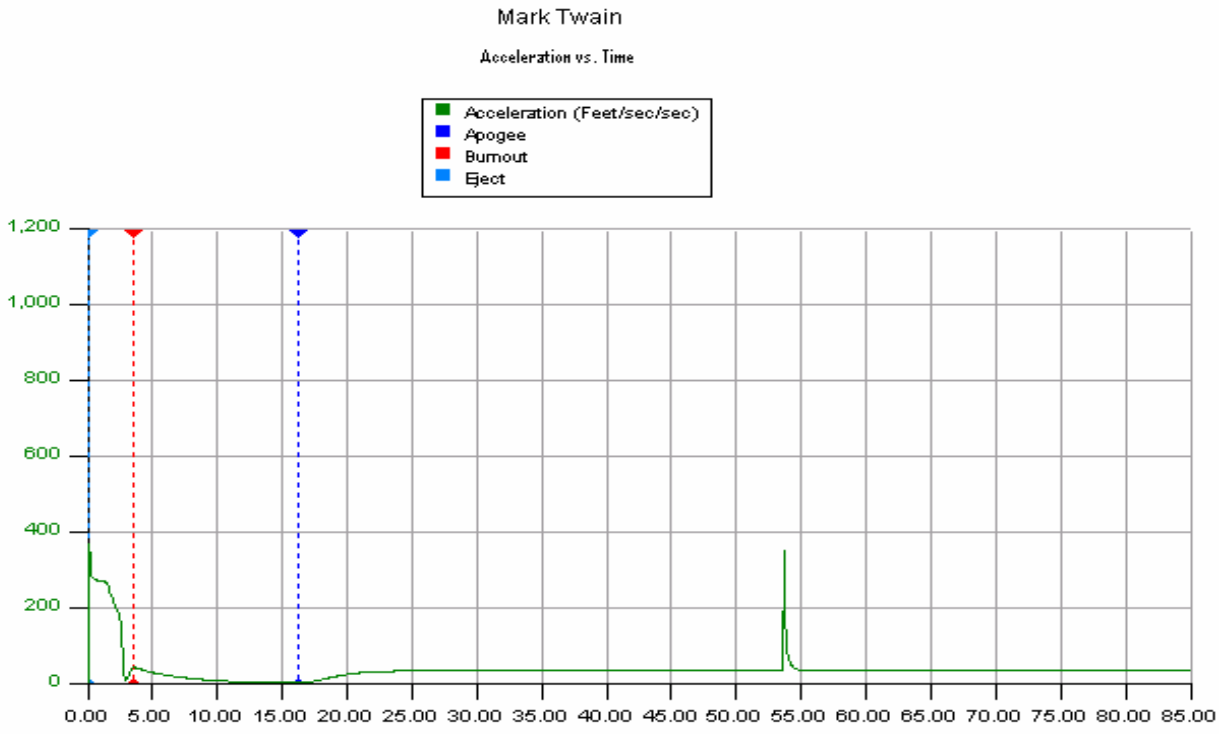
**Rocket Data**

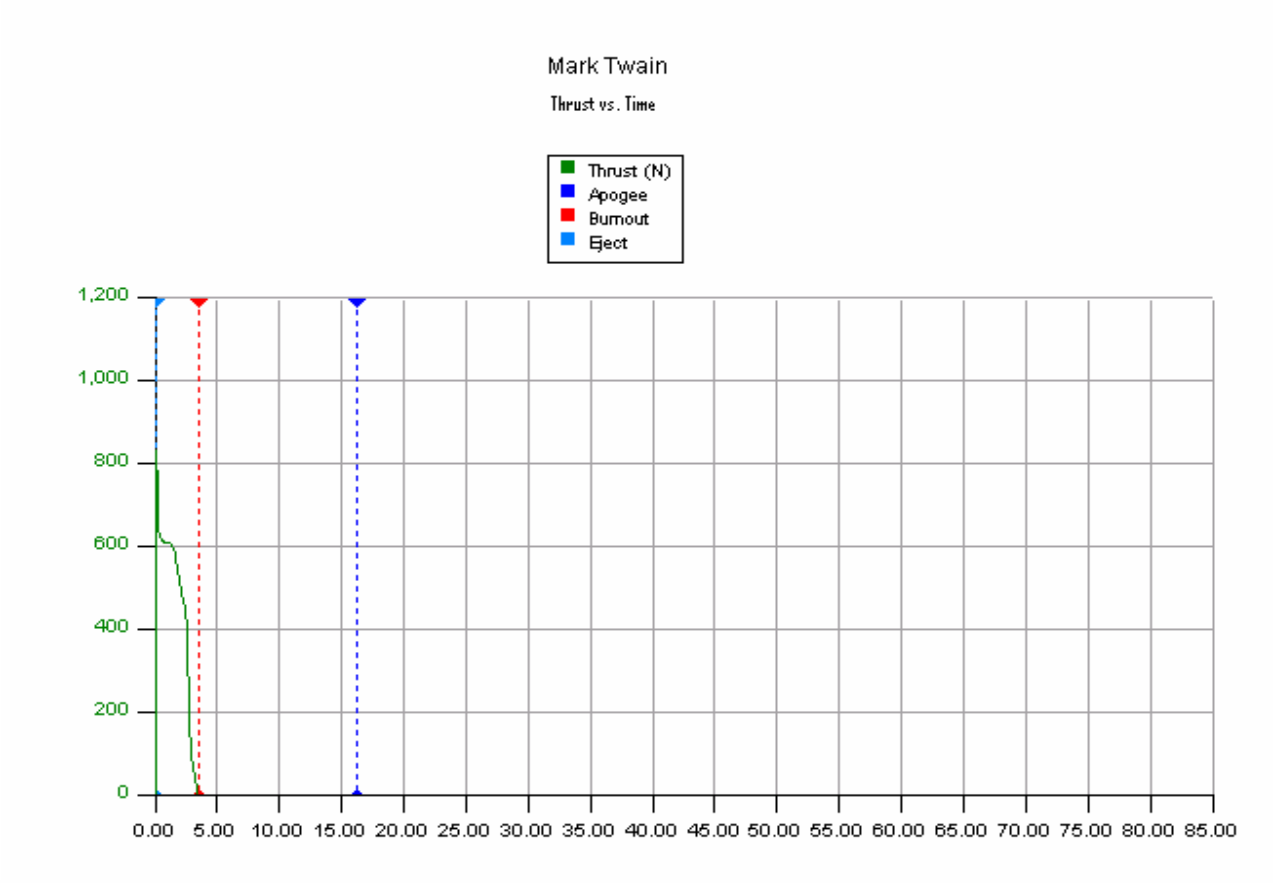
The data below is from the updated Rocksim file of the Mark Twain. The new images were added due to changes in the weight of the rocket prior to launch. The images in the FRR are inaccurate.

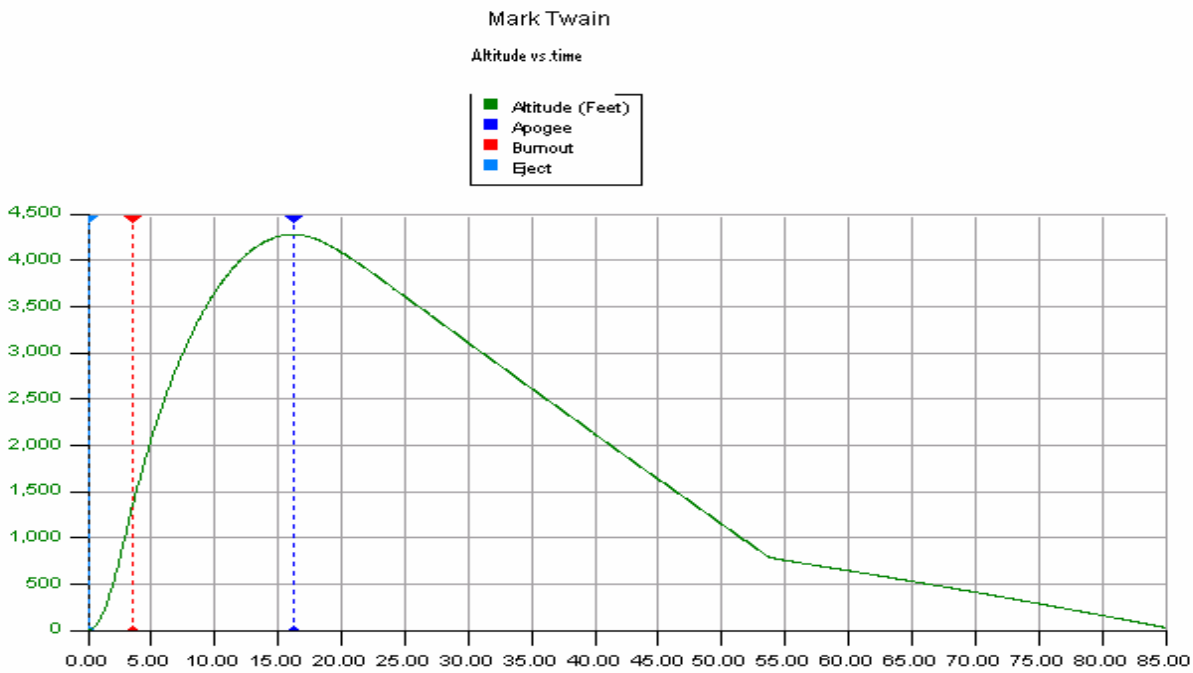
Mark Twain
Length: 100.8200 In. , Diameter: 4.0000 In. , Span diameter: 12.9200 In.
Mass 210.1601 Oz. , Selected stage mass 210.1601 Oz. (User specified)
CG: 0.0000 In., CP: 81.5712 In., Margin: 20.39 Overstable
Shown without engines.

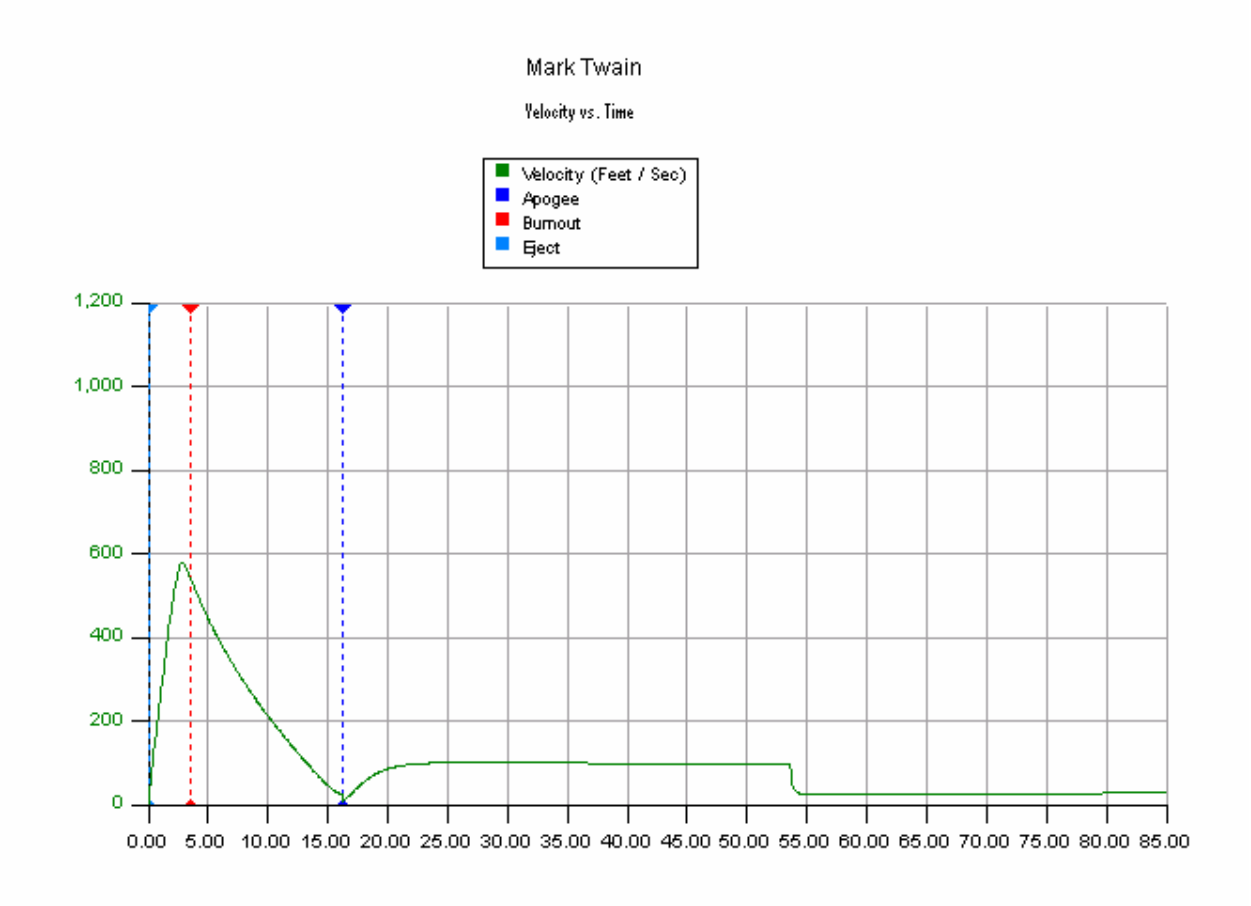


| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | [K550W-None] | 4278.25 | 578.28 | 572.81 | 16.16 | 25.80 | 4278.26 |




Mark Twain
Thrust vs. Time
Thrust (N)
Apogee
Burnout
Eject
1,200
1,000
800
600
400
200
0
0.00 5.00 10.00 15.00 20.00 25.00 30.00 35.00 40.00 45.00 50.00 55.00 60.00 65.00 70.00 75.00 80.00 85.00


Mark Twain
Altitude vs.time
Altitude (Feet)
Apogee
Burnout
Eject
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0.00 5.00 10.00 15.00 20.00 25.00 30.00 35.00 40.00 45.00 50.00 55.00 60.00 65.00 70.00 75.00 80.00 85.00




**Experimental Results**

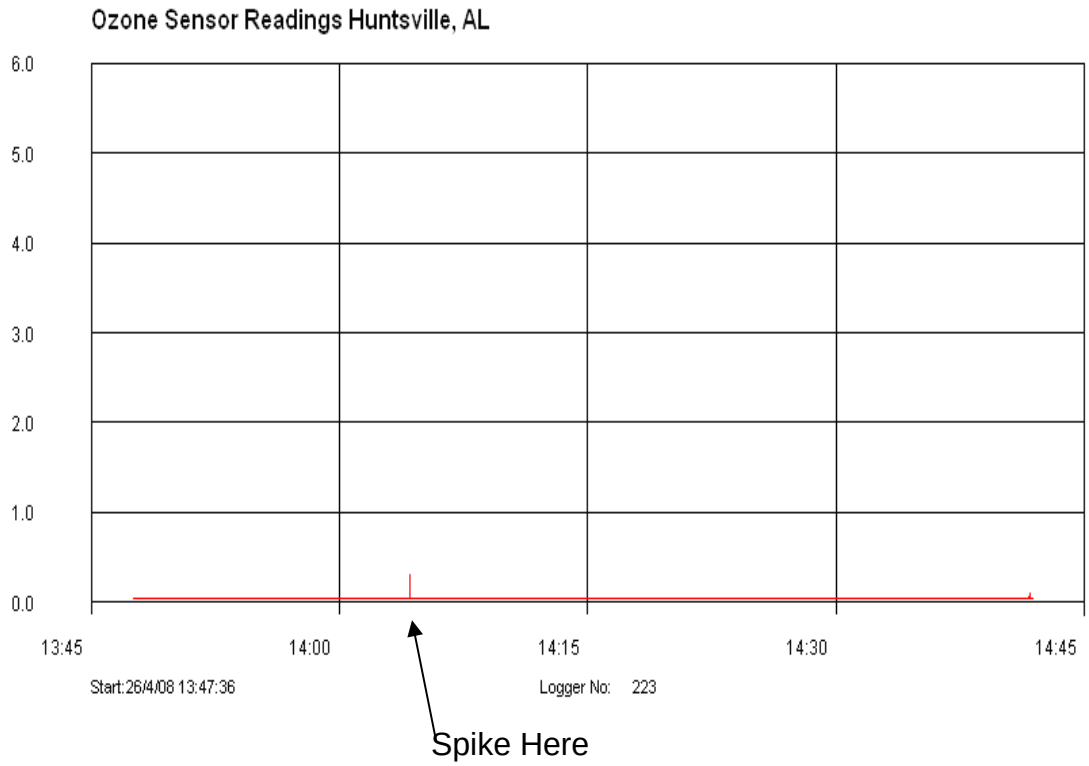
The difference in ozone levels may have not been enough for our sensor to detect during decent. The readings retrieved showed no difference from the readings taken during flight from those taken at ground level before lift off. The experimental results maybe due to the construction of the ozone sensor and its intended use which was to measure ozone readings in climate controlled storage facilities. The readings could also be attributed to the lack of air flow through the payload bay. Before, during and after the flight the CanSat temperature readings stay fairly constant. The temperature in side the payload bay remained a constant 94 to 96°F. This indicates that there was not enough air flow during the descent.

There was a spike in ozone shown in the data table and on the graph below. Based on the time at which the spike happened, we concluded that it was caused by the rocket landing in the corn field and moving the sensor leads to the controller.

***Ozone Sensor Readings Huntsville, AL:***

| | |
|---|---|
| 0.05ppm | |
| 0.05ppm | |
| 0.05ppm | |
| 0.05ppm | |
| 0.10ppm | |
| 0.05ppm | During Launch of the |
| 0.15ppm | Rocket Next To it |
| 0.30ppm | |
| 0.05ppm | |
| 0.05ppm | |
| 0.05ppm | |
| 0.05ppm | |
| 0.05ppm | |

Because the sensor takes two readings every second, if this entire table was shown, it would be 2752 rows long. Therefore, we pulled out the only section of the table that showed an ozone level reading other than 0.05ppm.




**Safety**

During the rocket launch, all precautions were followed. Our NAR certified mentor was watching over the prepping of our rocket. He was also in charge of prepping the black powder for our recovery system. Because of these safety precautions, no accidents occurred.

**Proposed Project Improvements**

As stated above, the ejection charge had too much black powder. If we were to redo this experiment, we would use less. The rocket didn't reach a mile high, so we either need to use a bigger motor, or make the rocket lighter. We also need to find a different sensor. The sensor we used was meant for indoor measurements, and may be the reason we didn't get any change in the readings. The payload bay needs to be well ventilated to insure that the ozone sensor receives enough air to sense changes in ozone. Finally, the team should also continue researching different ozone sensors that may be designed to measure outside ozone levels

Finally!!