

# The Cheyenne Mountain Charter Academy SLI Team's PLAR

Our final flight on 4-14-09 was quite successful. The rocket flew straight up, as planned, and excellent footage was taken. One thing that went wrong was that it spun 4.5 times, which was very unexpected as this had never happened before. A bigger problem we had was that the engine we initially received was missing an O-ring. Thankfully, we were able to remedy this later since Ernie Puckett, one of the mentors of our team, insisted that we be able to check that it was built correctly. These actions, however, proved vain since we received a Green Gorilla instead of the ordered White Wolf, an error that caused the rocket to be 1000 ft short of the mile mark.

Our original hypothesis was as follows: that if we place a digital camera and GPS in the rocket and a known-length object on the ground, then we will be able to determine the exact level of accuracy of the altimeter through comparison of GPS data, pixel analysis, and altimeter data. We have realized that this was not a hypothesis, but an experiment. This statement was based on absolute fact, and did not reflect any opinion of how the results would turn out.

The Pico altimeter read that the rocket reach apogee at 4017 ft, the Perfectflite read 3976 ft, and the GPS read 4207 ft; however, the video analysis showed the apogee occurred at 3859.77 ft. The edited down form of the video (at lower resolution) may be seen on our website. We also analyzed five other frames to get a clearer picture for a graph of all the data received. The first frame featured the targets that were 6 ft apart from each other and was taken 0.47 seconds into the flight. The HD video showed that the number of pixels between these was 448. The altitude at this point is 22 ft, 11 in. The second frame showed targets that were 66

yards apart and 607 pixels across from each other on the video. This was taken at 2.27 seconds into the flight and revealed that the rocket had attained an altitude of 557.28 ft. The third frame, taken 3.5 seconds into the flight, depicts targets that were 166 yards apart and 689 pixels on the video. The height here is 1234.00 ft. The fourth, taken 4.13 seconds into the flight, showed targets 266 yards apart and 894 pixels on video. The attained altitude here is 1523.96 ft. The fifth, taken 7.23 seconds into the flight, was a depiction of the targets 266 yards apart and 502 pixels on the HD video. The height reached here is 2713 ft. The final frame showed the targets that were 584.45 feet apart and was taken 12.63 seconds in. This was determined as apogee, and using Sara Volz' equation " $Y=cl/x$ " and the value of pixels of 258.52, we found that this was frame was taken at 3859.77 ft.

The targets were found in later analysis of the data to be not exactly square, but rather 3 degrees off from a perfect right angle. Therefore, we had to multiply final results by 0.96843, a number found through mathematical processes.

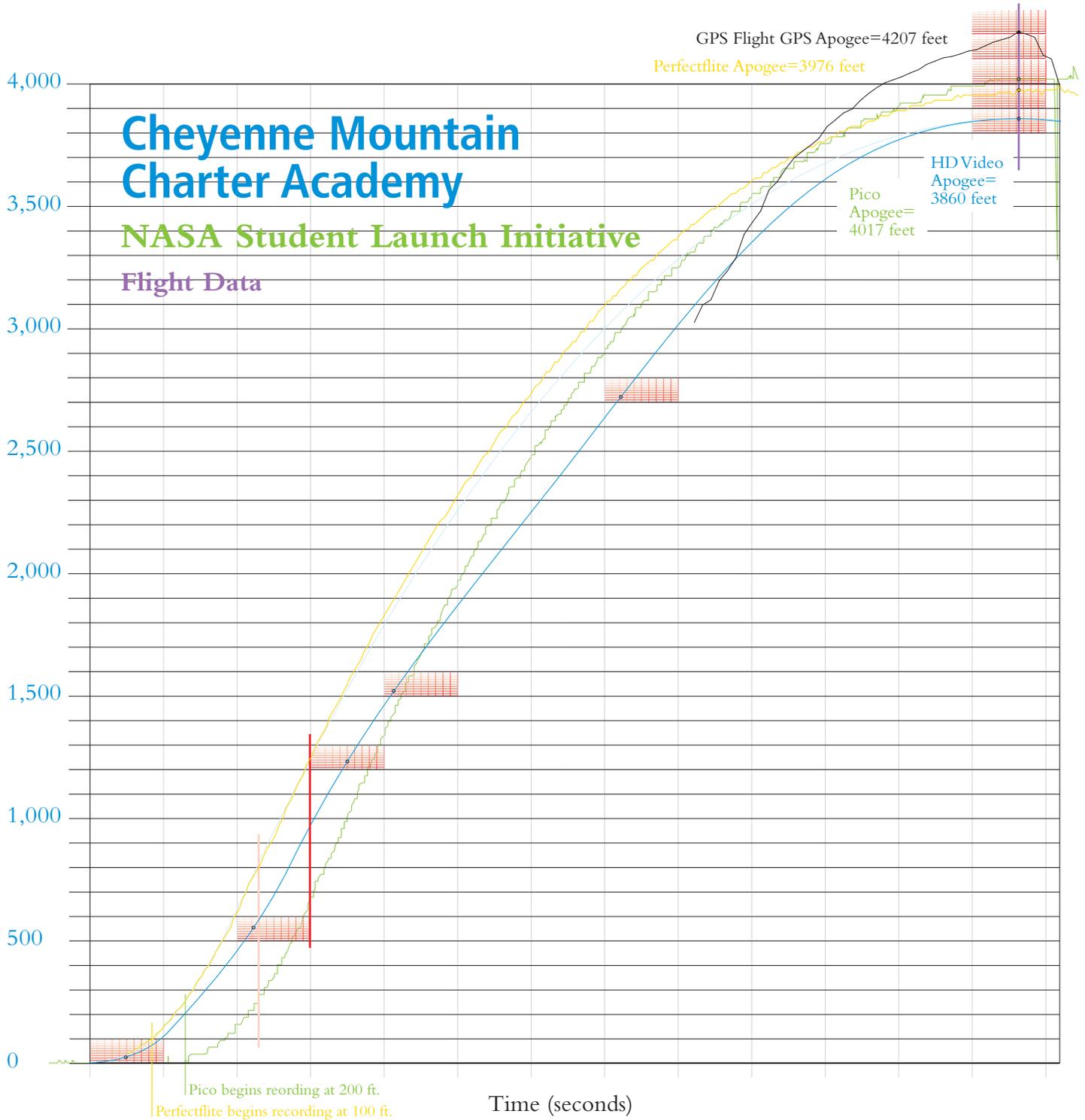
We had two GPS units in our rocket, and one provided us with much data. However, the information from the other GPS was lost once we arrived back in Colorado Springs. We realized that it had been left on for the entire trip home, so when the battery was replaced, all data was deleted from it.

The results of our data show that, in the end, the Perfectflite altimeter was closest to actual altitude, the Pico altimeter second, and the GPS in final place.

# Cheyenne Mountain Charter Academy

## NASA Student Launch Initiative

### Flight Data



- Rocksim Curve (Feet)
- Actual Burnout (too small nozzle?)
- Perfectlite MAWD Altimeter
- Time to Apogee (12.63 sec)
- Observed Video Altitude
- GPS Flight Transmitting GPS
- Predicted Burnout
- Pico AA-2 Altimeter



Frame 47645 shows Northeast—Southwest targets in perfect horizontal orientation, while a 90 degree line shows the Southeast—Northwest targets off square. Approximate deviation is 3 degrees as shown. This results in the placement of the two Northern targets at a greater distance than the 566 feet they would have been given a square target arrangement.

Ideal position of Northwest target shown. The distance in pixels between the Northwest and Southwest targets in the apogee frame must therefore be multiplied by a factor of .96843 in order to get the correct number of pixels.