Post-Flight Performance Report

Team Phlight

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Launch	✓
Parachute deployment	✓
Recovered	
	✓
Determined to be in flyable condition	
	✓

The launch and recovery of the Team Phlight rocket "Phil" was successful. The rocket launched, deployed both parachutes at the correct altitudes and was in flyable condition upon its recovery. We encountered an anomaly at the apogee when the drogue-chute deployed. As shown in Figure 1 below, there is an anomaly at apogee in which the altitude negatively spikes to several hundred feet below actual apogee. Rapid pressurization of the payload bay by the drogue chute deployment charge damaged the aft bulkhead seal of the payload bay, increasing the pressure inside the payload section. This rapid increase in pressurization was falsely recorded by the altimeter sensor as a sudden decrease in altitude. This incident did not affect the flight or performance of the rocket. Additionally, an error within the code on the secondary altimeter prevented the sensor data from being saved as it was taken during flight. Consequently, no data from the measurement system was available for comparison.

The propulsion system met expectations and fired accordingly without any anomalies before, during, or after the flight. The flight path was unperturbed and flew as expected with the amount of wind. The recovery system deployed both the drogue-chute at apogee and the main chute at 800ft perfectly and allowed for a safe recovery of the rocket. The location of the rocket was estimated and was off by roughly 1 mile. This is likely due to not taking enough measurements of the latitude to determine the latitudinal length of ten feet.

The predicted and actual altitude data curves differed in several areas, but overall, followed the same trend. Figure 1 below compares the data collected during the flight with the predicted data. The first difference in the curves was mentioned previously; a seal failure during the deployment of the drogue chute at apogee caused a temporary increase in the payload bay pressure, characterized by a sharp trough in Figure 1. This occurrence could have prematurely deployed the main chute if the payload bay was pressurized to 800 ft. A second difference between the predicted and actual data were their descent rates while under the drogue chute. The actual flight had a lower descent rate, possibly due to OpenRocket's underestimate of the drag coefficient on the rocket. This would also explain the actual flight's lower ascent rate and apogee altitude. The difference in drogue descent rates

caused the actual main chute to deploy after the time predicted, but at 800 ft as predicted. The descent rates under the main chute concur.

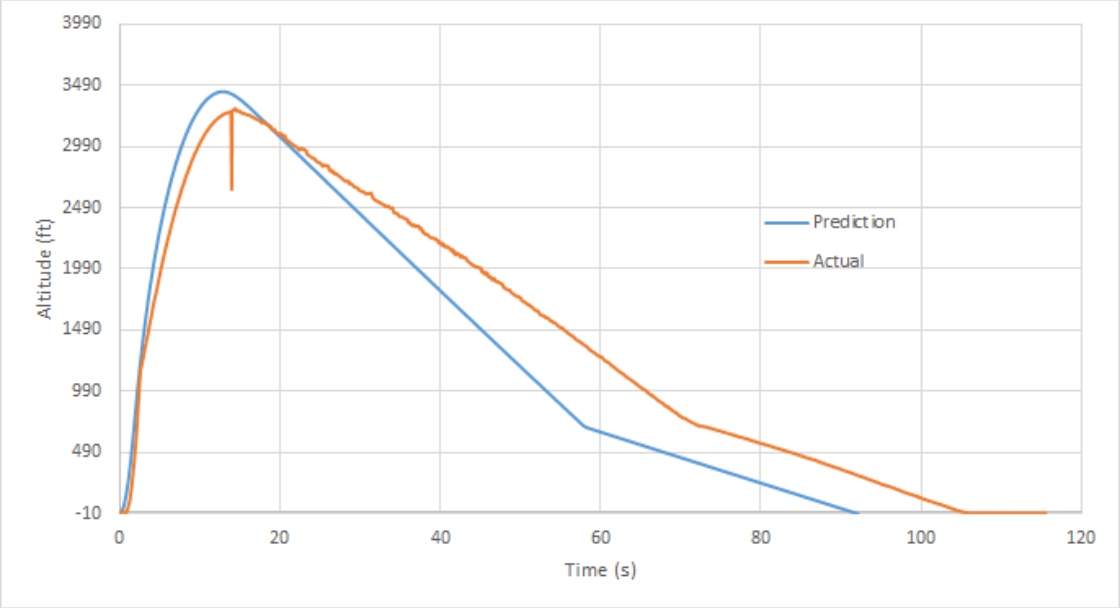

Figure 1. Altitude comparison of predicted and actual flight data.

The predicted apogee occurred at 3400 ft and actual apogee occurred at 3280 ft. The actual recorded apogee agreed with the competition Raven's apogee to within 12 ft. When using this prediction, the team estimated an overshoot of 10% due to underestimated drag coefficient and atmospheric conditions. An actual prediction overshoot of 7% put the actual apogee slightly above the 3000 ft goal, but within the 3000 +/- 500 ft range.

Figure 2 displays the velocity data from the predicted and actual altitude data. These curves were developed by differentiating and smoothing the altitude data. Although the actual data follows the general trend of the predicted curve, the actual velocity tends to oscillate around the predicted velocity during drogue descent. It is important to note that the altitude data in this flight phase was slightly bumpy, possibly being the cause of the velocity oscillations. The initial spike, due to launch, is larger than predicted, and most likely an error. The rapid ascent, high acceleration, and violent forces during launch most likely caused this spike to be falsely large: around 1100 ft/s, near Mach 1. As before, the lag between predicted and actual main chute deployment is reflected in the lag in the change of velocities at this point.

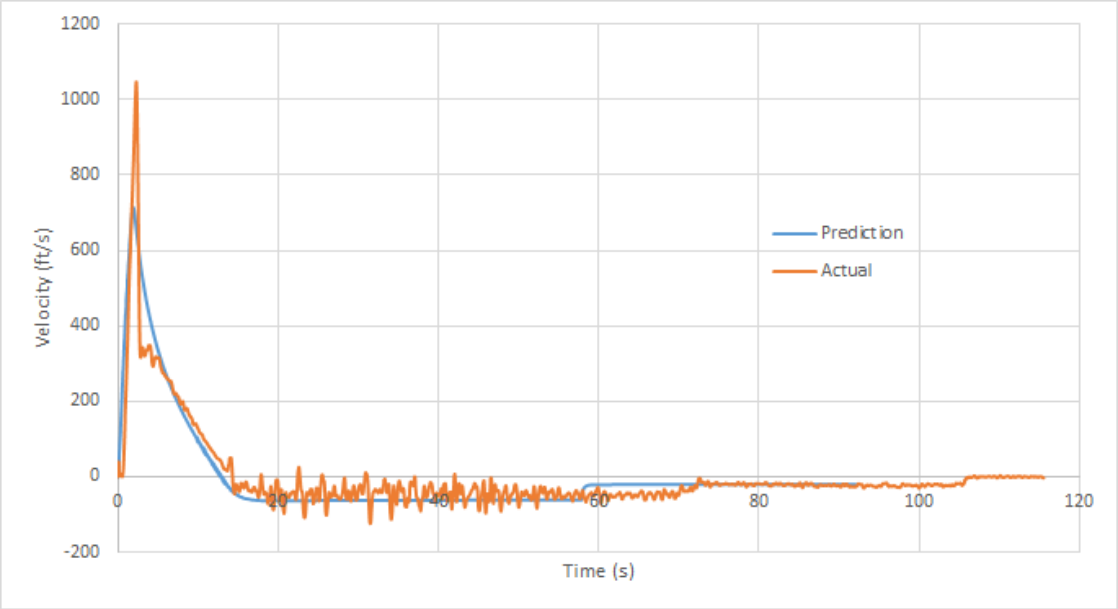

Figure 2. Velocity comparison of predicted and actual flight data.

Figure 3 displays the predicted and actual acceleration data. This data was found by differentiating the altitude data a second time. Thus, noise was amplified and, although smoothed, oscillations and exaggerated spikes in the data were present. Large acceleration readings at launch were seen as expected. The expected spike in acceleration at main deployment was not seen in the actual data, possibly due to over efficient data smoothing. Again, note that most oscillations occur during drogue descent, when the majority of altitude data noise occurred.

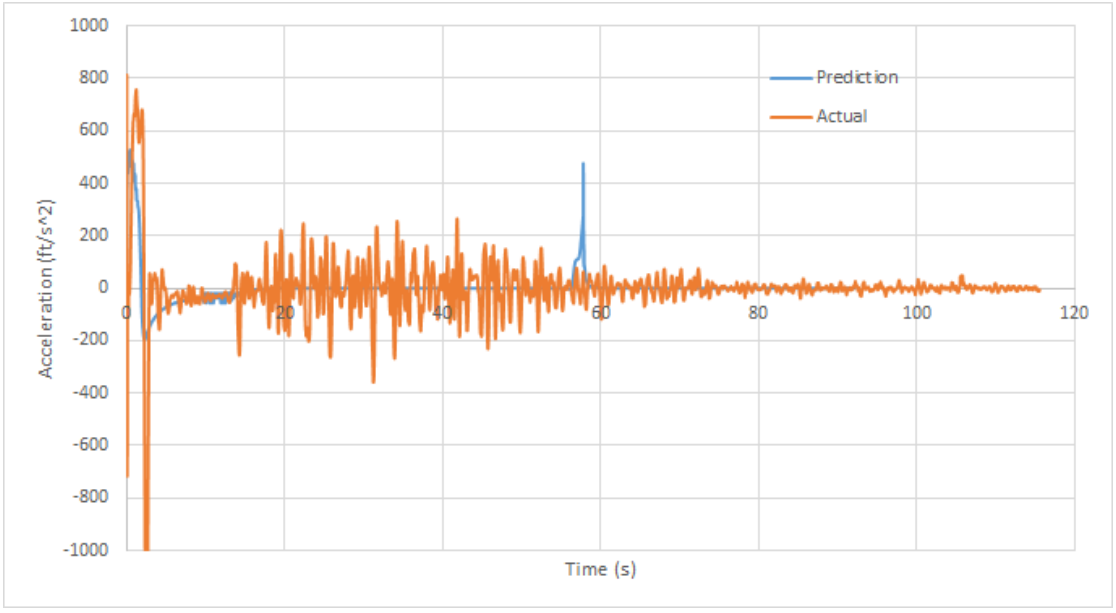

Figure 3. Acceleration comparison of predicted and actual flight data.