Student Space Systems

Final Report

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Summary

While we successfully flew and recovered two flights while in Minnesota we were unsuccessful in meeting three of the main competition goals: readying our rocket for its second flight in one hour, obtaining video footage of the drag systems operation and controlling the apogee of the second flight to 75% of the first flight's.

Both of these failures were results of our own shortcomings and have highlighted areas that we need to improve upon as engineers.

Flight 1

Flight 1 was a successful recovery with the following data:

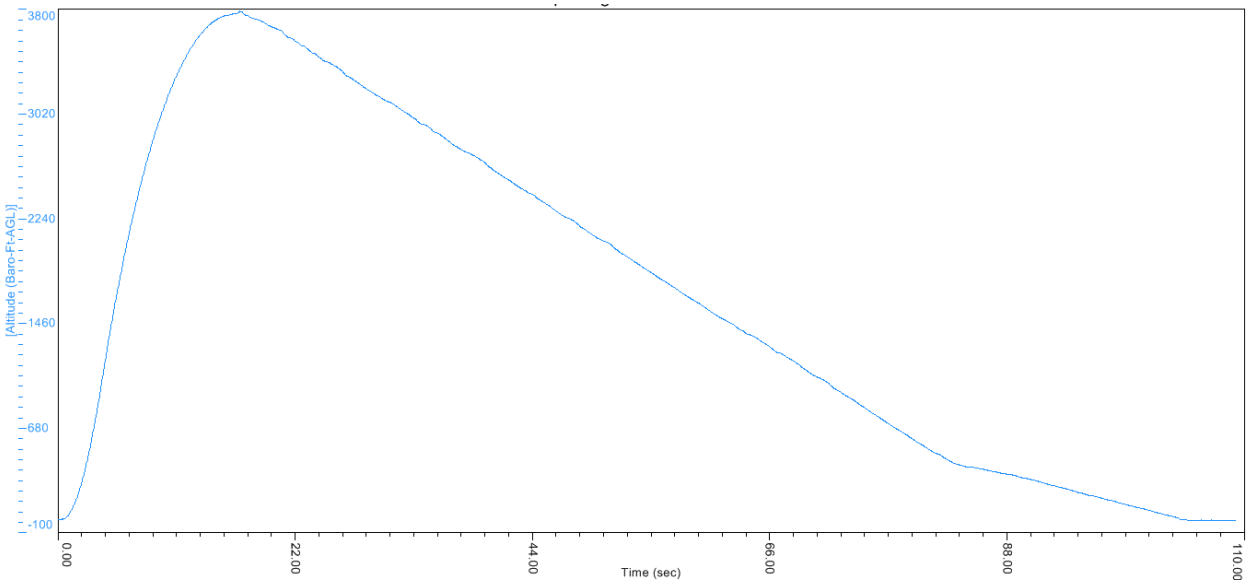
Apogee: 3788ft

Max velocity: 568ft/s

Max acceleration: 21.67g

Flight time: 16.93s

Altitude AGL (ft) vs. Time (s)



Flight 2

Flight 2 was a successful recovery and our attempt at utilizing our active drag system. We were unable to make the one hour turn-around time due to the laptop that we used to interface with Arduino dying at the launch site. We spent over an hour in between flights attempting to salvage that computer's data and then eventually coding a simplified version of our control algorithm on site. Flight 2's data is as follows:

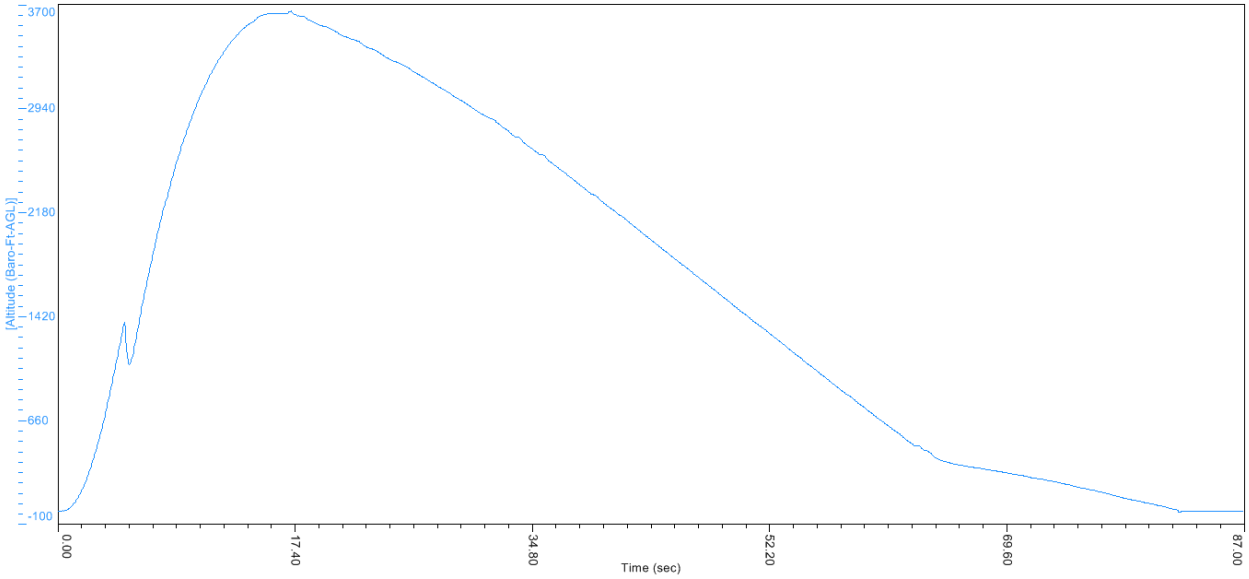
Apogee: 3638ft

Max velocity: 565 ft/s

Max acceleration: 32.07g

Flight time: 16.73s

Altitude AGL (ft) vs. Time (s)



Flight 2's apogee is 96% of Flight 1's which is well short of the goal of 75%.

Conclusion

Flight 2's altitude vs. time plot clearly shows the deployment of the active drag system right after motor burnout but with only a four percent change in apogee, which can easily be attributed to discrepancies in the manufacturing of the motors, it is unlikely that it remained deployed for the entirety of the rocket's coast. Since our camera system was not functional during flight (due to our own errors in designing its housing) we are unable to verify the exact amount of time the drag system was deployed.

One interesting note that we believe deserves more investigation on our part is that the altimeter we obtained this flight data from is located aft of the drag system and therefore is downstream of the brake fins when deployed. It is evident from the plot that upon deployment the altimeter immediately believes it is at a lower altitude; meaning that the pressure downstream of the brake fin is greater than the pressure upstream of it! As of right now without further analysis and testing it appears that our active drag system generates lift.