# Post-Flight Performance Report

## UWRF


## Student Team

**Andrew Larson**
**Austin Dreher**
**Jacob Hanson-Flores**
**Grace Zeit**

## Advisor

**Dr. Glenn Spiczak**

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**Flight Performance**

Upon take-off our rocket flew great, stable and straight, with the lower-power configuration J135 motor and reached an apogee of approximately 3150 ft. (just below cloud altitude) compared to our simulated prediction of 3380 ft (updated based on measured pre-launch weight). This altitude was estimated from the measured 14 sec time-to-apogee determined by viewing the on-board Mobius mini-cam video.

Unfortunately, after apogee, the rocket's drogue parachute did not deploy when the rocket failed to separate, despite clearly hearing both the altimeter initiated charge canister explosion at the pre-set 1.5 sec after apogee followed almost immediately the un-modified delayed motor backup ejection charge explosion. Furthermore, the main parachute also did not deploy when the rocket failed to separate, despite that charge going off at the pre-set altitude of 500 ft. The result was a rocket that turned into a lawn dart causing a near total loss to our rocket and data collecting electronics. The lower section consisting of the motor mount and attached fins survived in fine condition, as it was the only portion sticking up above ground! With no data to compare other than our video footage, the main thing to take away from this is lessons learned.

**Lessons Learned**

We have concluded that we need to factor in a larger safety margin for black powder calculations. Simple online calculators (www.insanerocketry.com/blackpowder.html or the site www.rockethead.net/black_powder_calculator.htm) both rec ommended 1.2g for a 4" diameter x 11.5" long chamber for 16psi. We used 1.5g of powder, 25% extra for safety, measured and confirmed to fill a small ejection canister to the 1.5g level. This amount is recommended using the more accurate excel Ejection Analysis spreadsheet from Dr. Gary Stroick, accounting for fiberglass material friction, vent holes, sheer pin material and size (4 pins, nylon, 4-40), safety margin contingency (1.51g for 10%, 1.65g for 20%). One less sheer pin was likely what we needed, if not a smidgen more of powder.

Considering this, we've thought of two additional variables that could affect pressurization of the parachute volume. One idea is that the bulkhead above the motor, to which the lower tether anchor is attached, may allow for air infiltration to the volume below acting like a vent that should be considered. A second idea is that we did not pack as much fireproof cellulose insulation (aka “dog barf”) into the parachute chambers for competition, which separated using 1.5g.

Perhaps we have discovered something. The volume occupied by dog barf can be significant, so this must at some level affect the amount of powder needed. Extra insulation during our test made it seem fine, but having significantly less for competition increased the effective volume beyond what could be pressurized for separation. One take away from this high-powered rocket competition is that we should do more thorough ground charge tests, using different charges and different amounts of dog barf to be sure that we understand the full behavior of our rocket. This may be another variable worth adding to the excel program.