



CALIFORNIA STATE SCIENCE FAIR 2015 PROJECT SUMMARY

Name(s) Benjamin Kolland	Project Number S0308
Project Title Separation Anxiety: A Plan for Safer Model Rocket Deployment	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Current model rocket deployment systems are limited to single motor ejection charges or separate explosive charges controlled by electronics. The purpose of this project is to design a non-pyro parachute deployment system (because minors cannot handle regulated explosives).</p> <p>Methods/Materials A 90cm booster was constructed from 98mm cardboard tubing. The 110cm long payload section had two hatches actuated by model aircraft retract servos. An Eggtimer altimeter I soldered triggered the servos at specified points in the rocket's flight. The final design's 40cm payload had an altimeter bay and single servo released parachute compartment. The hatches were ground tested but when flown they experienced multiple failures. The system was redesigned to use gravity to release the main parachute after a small drogue parachute was ejected at apogee using an explosive charge built into the motor.</p> <p>Results The initial design testing went well, so the hatch setup was flown. However, the hatches didn't stay closed during boost or deploy as planned. A new design was built and first RC ground tested, and then flight-tested to 166m with the main parachute RC released at approximately 75m. The motor eject worked to deploy the drogue parachute, and the gravity release design for the main parachute worked perfectly. Three flights using Eggtimer altimeter control were not successful due to altimeter problems, but debugging and five more vacuum tests confirmed the system was functional and deployed the main release at 45m. Two successful flights to 148m and 151m using Eggtimer altimeter control deployed the main parachute as planned at 45m. A high altitude flight to 782m with winds of 12kph landed within 100m of the launch site after successful main deploy at the planned altitude of 102m. Two final flights deployed early due to failure from coupler fatigue.</p> <p>Conclusions/Discussion My initial design failed due to gravity and aerodynamic issues, so I debugged and built a new design. It worked after some additional modifications to altimeter programming. I ran multiple static (vacuum) and flight tests, which showed very promising results. In the end, I was able to build a non-pyro deployment release for the main parachute that worked reliably and was easy to prep for flight. This system enables a lower cost, simple alternative to handling black powder charges for parachute deployment.</p>	
Summary Statement This project demonstrates an innovative design for model rocket dual deployment using a safe, non-pyrotechnic system.	
Help Received David Raimondi for suggestions based on his experience with parachute systems, Dave Cornelius for failure analysis help on my initial design, my dad for driving to launches and ground support at launches.	