Hybrid Rocket Competition

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Motivation

Our team possesses a passion and drive for aerospace and mechanical engineering; as graduating seniors, we aim to learn more about these growing, and expansive industries. Having the opportunity provided by NASA and the Florida Space Grant Consortium to build a rocket and compete is a great opportunity to gain hands on experience and develop our collaborative communication skills.

Project Scope & Background, Goal

Our project is to develop a hybrid rocket capable of reaching an altitude of 2,000 feet from launch using a G class motor or lower. This rocket will be used to compete in the NASA Florida Space Grant Consortium's Hybrid Motor Rocket Competition to be the closest to 2,000 feet. Additionally, as part of the competition, we must submit other materials such as biweekly updates, a Hazard Analysis report, an FMEA and an Engineering Notebook. We aim to place first in the competition and help future teams at the FAMU-FSU College of Engineering to compete.

Future Work

1. Compete in Competition on April 15th, 2018
2. Engage AIAA interest in project
   - Invite to competition and launches
   - Present project
3. Set-up for next year
   - Reports and documentation

Acknowledgements

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- North East Florida Association of Rocketry

The Airframe

The airframe, or "body", of the rocket keeps the rocket together and ensures structural integrity is maintained during launch, flight and landing. It is important to ensure the center of gravity is above the center of pressure to ensure flight stability, see fig. 1. Our airframe is constructed of Bluetube. Bluetube has a high strength and has the ability to survive many launches, yet still able to be modified easy.

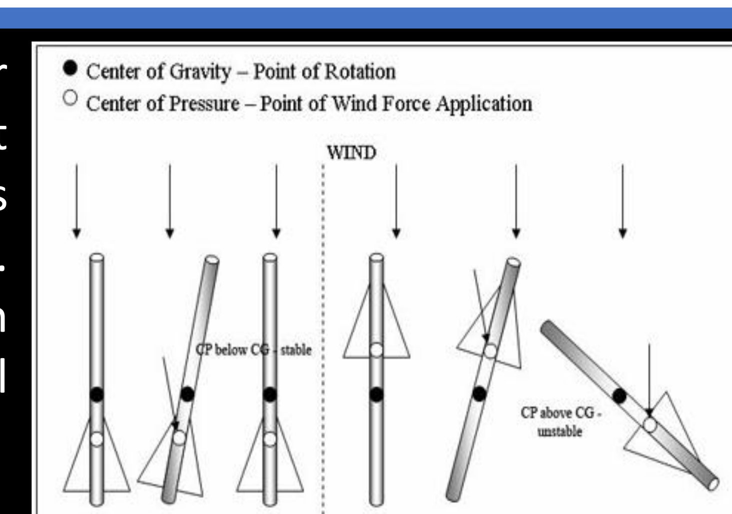


Figure 1. Location of Center of Gravity and Pressure Affect Stability

The Fins

The fins of the rocket provide stability during flight to ensure that the rocket stays to its trajectory. Our fin is a clipped delta, teardrop airfoil shape due to its aerodynamic efficiency. Due to its complex shape, the fin is 3D printed, see fig. 2.

Figure 2. 3D Printed Fin

The Motor

The motor provides the thrust to launch the rocket. A hybrid rocket consists of a solid fuel grain and a gaseous or liquid oxidizer, see fig. 3. As we are required to us a "G" Class Motor, we are restricted to a motor providing 160 Ns.

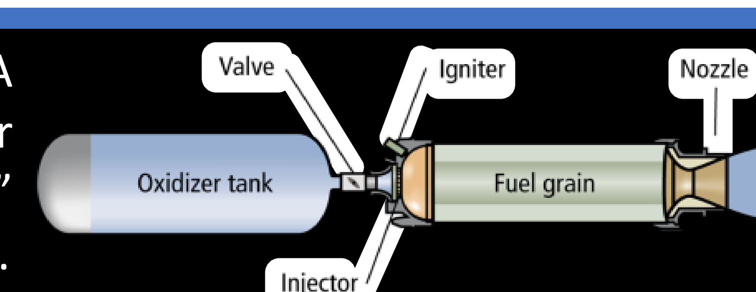
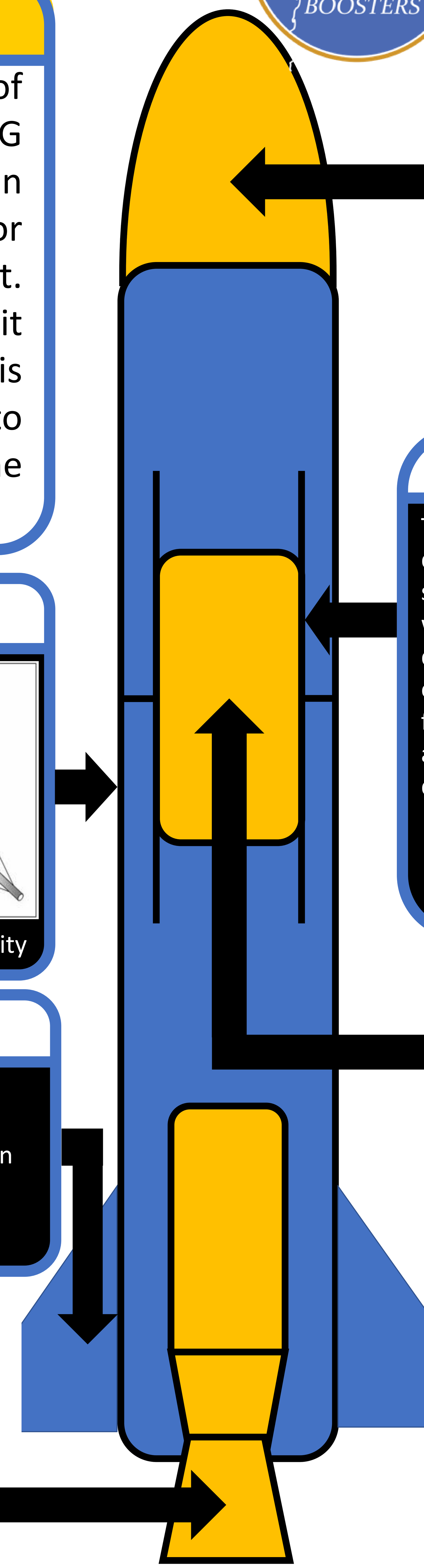


Figure 3. Hybrid Rocket



The Nose Cone

The nose cone ensures smooth aerodynamic flow around the rest of the rocket and can be used to house the recovery system or payload. We decided to go with a spherically blunted cone which was designed to fit our rocket body tube, see Figure 4. It is a hollowed plastic cone which can add weight if needed.

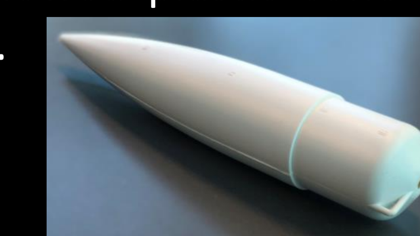
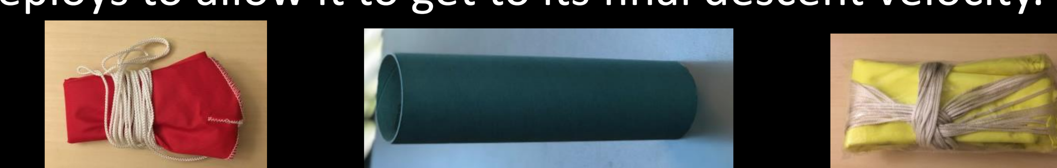


Figure 4. Plastic, Ogive Nose Cone.

The Recovery System

The recovery system consists of 3 sections: The payload, the drogue chute, and the main chute all housed in the coupler, see fig.'s 5-7. The payload consists of the Easy Mini board which will read and record altitude data. With its dual deployment system, it will be programmed to detonate the ejection charges at two different stages, apogee, and at 600 feet. The drogue chute deploys at the maximum altitude and once the rocket has reached 600 feet the main chute deploys to allow it to get to its final descent velocity.



Figures 5-7. Drogue Chute, Coupler, Main Chute.

The Electronics

The electronics system is the payload of our rocket and activates the dual deployment parachute in the rocket and reads data from the on-board altimeter, as required by the competition. The major component of the electronics subsystem is the board and after further design specifications were agreed on, the Easy Mini was chosen, see fig. 8. This board comes with an altimeter and has pre-loaded code on the system for an integrated deployment system.

Figure 8. Easy Mini