Hybrid Rocket Competition

Team 7: James Beattie, Chris Bredberg, Ryan Dwyer, Kjell Gordon, Cedryc Midy

FAMU-FSU BOOSTERS

Project Scope

Develop a hybrid rocket capable of reaching an altitude of two thousand feet from launch using a G class motor or lower.

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 industry. 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 lay a foundation for future aerospace competitions for the FAMU-FSU College of Engineering.

Future Work

1. Create CAD models
2. Perform Simulations
   - FEA, RockSim
3. Finalize Design
4. Manufacture and Order Parts
5. Build and Test Rocket

Acknowledgements

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- FAMU-FSU AIAA
- NASA Florida Space Grant Consortium
- North East Florida Association of Rocketry

Goal

- Design, build and test a Rocket that is capable of reaching 2000 ft.
- Place first in the competition.
- Provide the AIAA club with relevant information and resources to continue competing.

Project Background

Our competition requires a biweekly update. Hazard Analysis and FMEA are also required to make sure we are meeting the competition and safety standards.

The Body

The 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. Body materials range from different thickness of cardboards, fiberglass and Bluetube. We have selected a Bluetube body due to its high strength and ability to survive many launches, yet still able to be modified relatively easy.

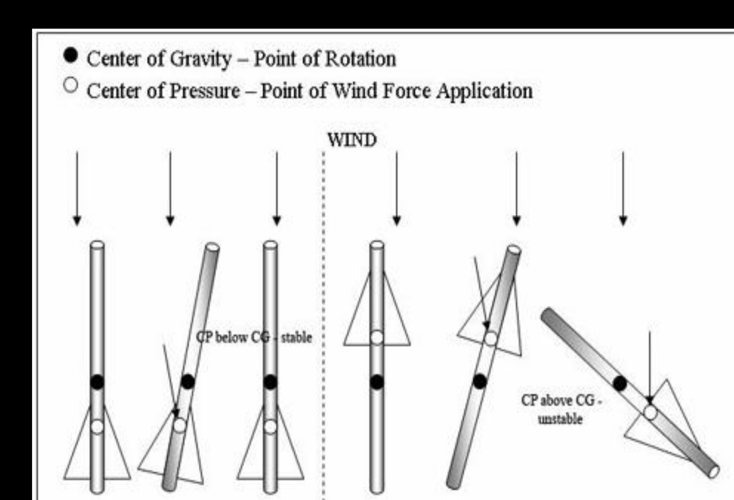


Figure 1. Location of Center of Gravity and Pressure Affect Stability

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. 2. As we are required to us a "G" Class Motor, we are restricted to a motor providing 160 Ns.

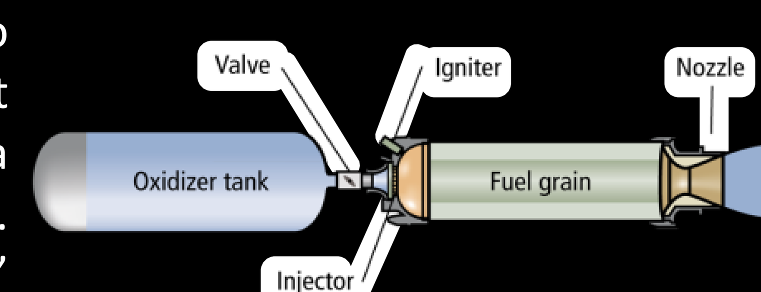
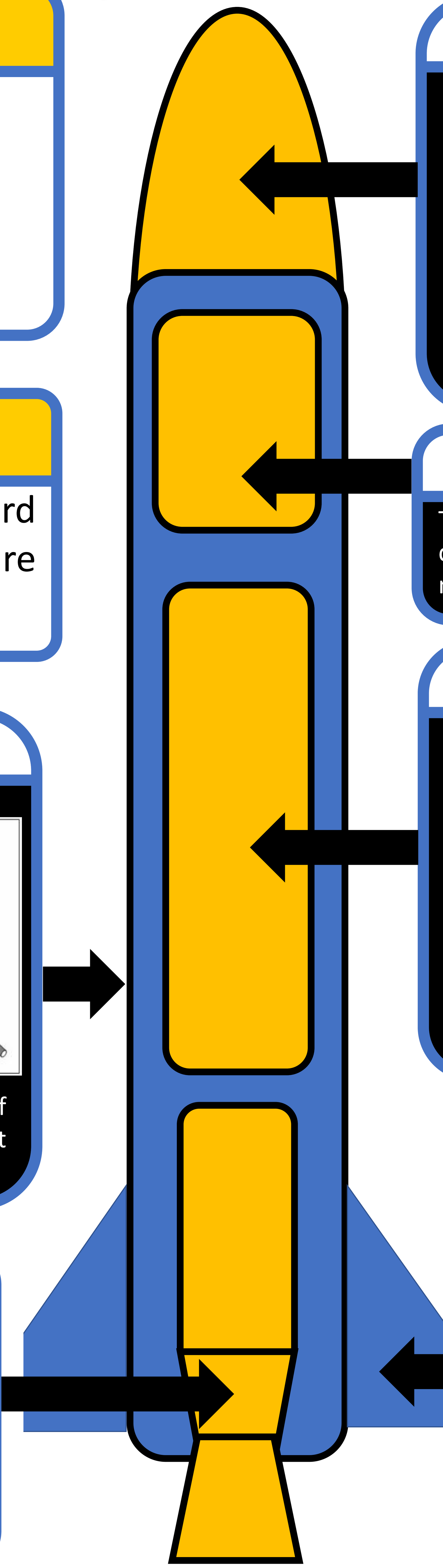


Figure 2. Hybrid Rocket



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. Different nose cones can vary largely in shape (see fig. 3 below) and material. We have selected the Spherically Blunted Cone as it is simple, commonly used and readily available.

Figure 3
Various Nose Cone Designs

The Recovery System

The recovery system is the rocket's parachute which deploys at the apex of flight and slows descent to minimize damage.

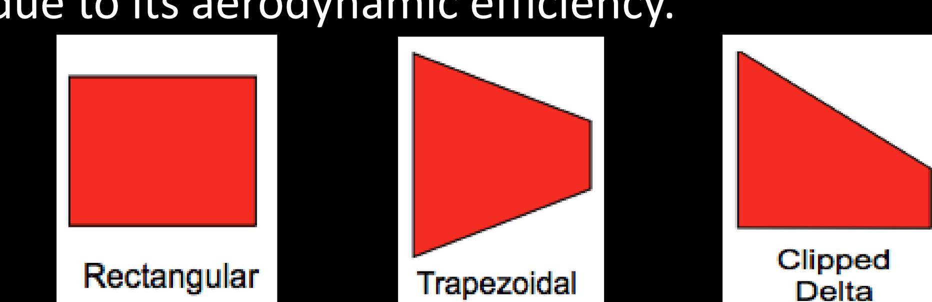
The Electronics

The electronics activate other subsystems in the rocket and read data from the altimeter. The board is the brains of the system. It is common to use a BeagleBone Blue, MyRio or Arduino board for our application, but we have selected an Arduino due to its adaptability, ease of incorporation and small footprint, see fig. 4 below.

Figure 4
Arduino Board

The Fins

The fins of the rocket provide stability during flight to ensure that the rocket stays to its trajectory. Differently shaped and composed fins (see fig. 5-7 below) provide different pros and cons; we have selected a 3D printed clipped delta due to its aerodynamic efficiency.



Figures 5-7 Different Fin Geometries