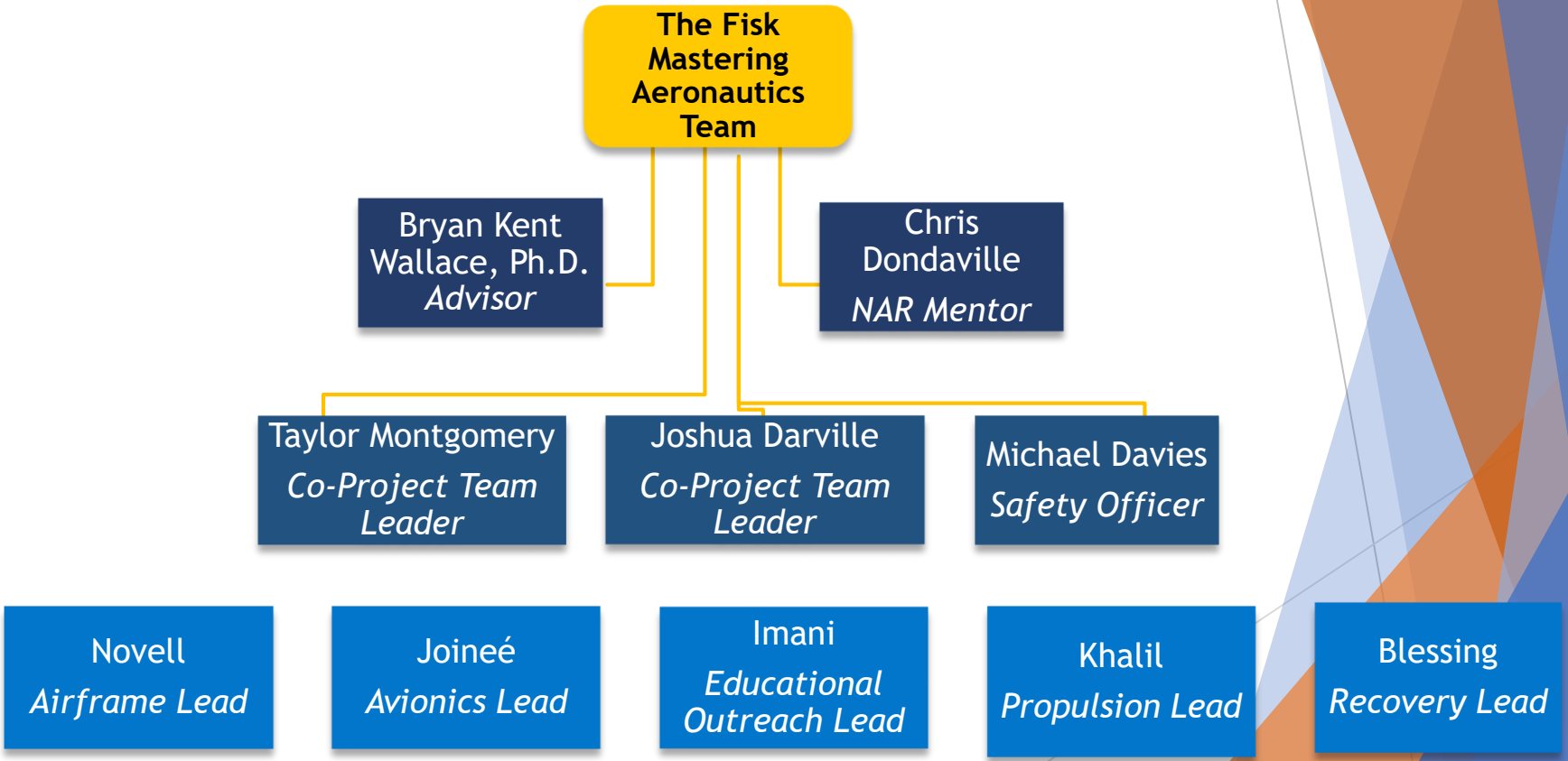
Fisk University Mastering Aeronautics Team

NASA SLI Preliminary Design Review Presentation 2017-2018

Team Structure



Overview

I. Launch Vehicle

i. Materials
ii. Launch Vehicl Dimensions
iii. Motor Selection
iv. Launch Vehicle Statistics

II. Payload Bay

i. Preliminary Design
ii. Camera Housing Subsystem
iii. Recovery Subsystem
iv. Integration of Payload Board

III. Project Plan

i. Requiement Verifications

Material Composition

- **Rocket Body** – Fiberglass

Justification – Good chemical resistance, dimensionally stable, high tensile strength, high thermal properties, relatively inexpensive and low electric conductivity

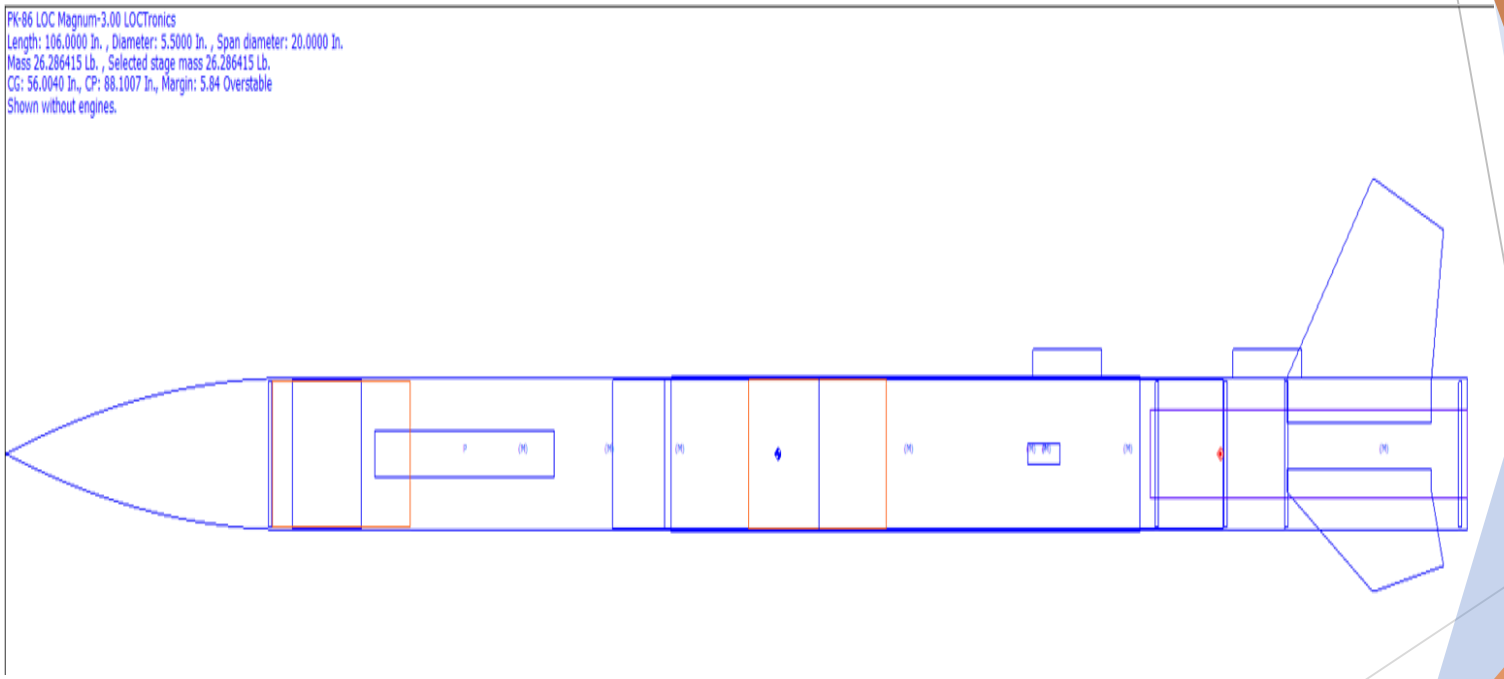
- **Collar** – Polylactic acid

Justification – Does not dissolve in water; most common polymer used in 3D printing

- **Parachutes** – Rip Stop Nylon

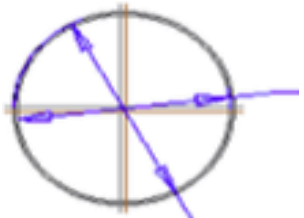
Justification – Resistant to tearing and ripping. Favorable strength-to-weight ratio to prevent small tears from spreading

Launch Vehicle



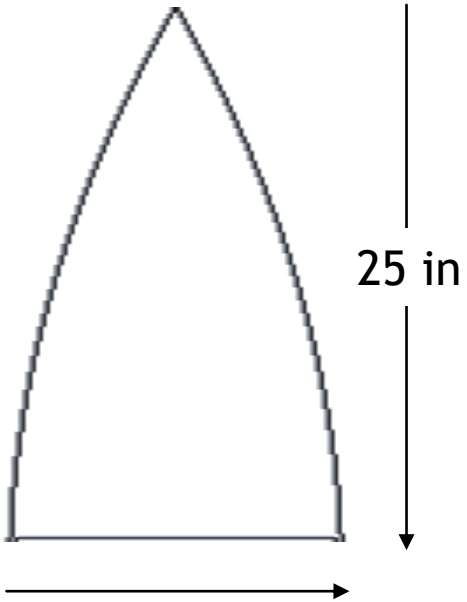
Launch Vehicle

Nose Cone



5.37 in

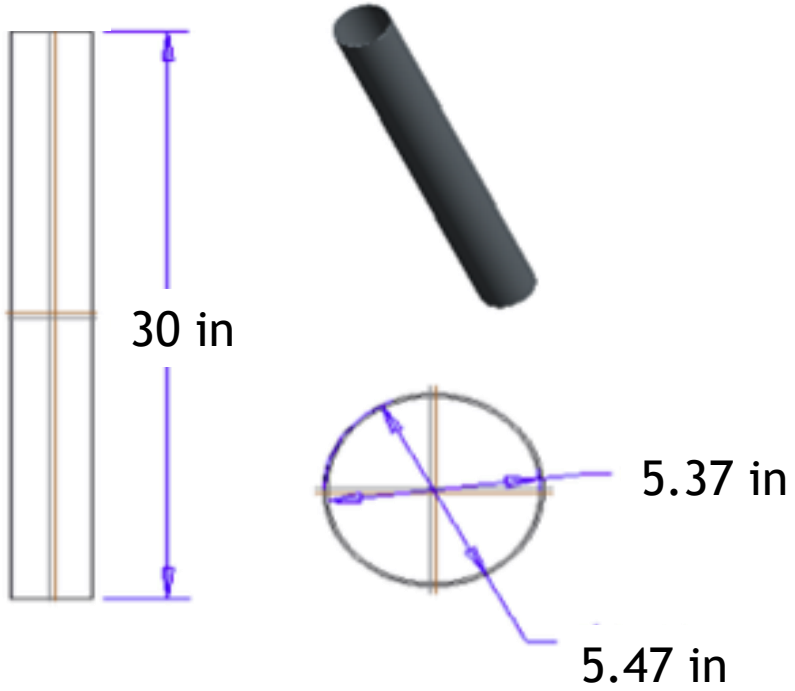
5.47 in



25 in

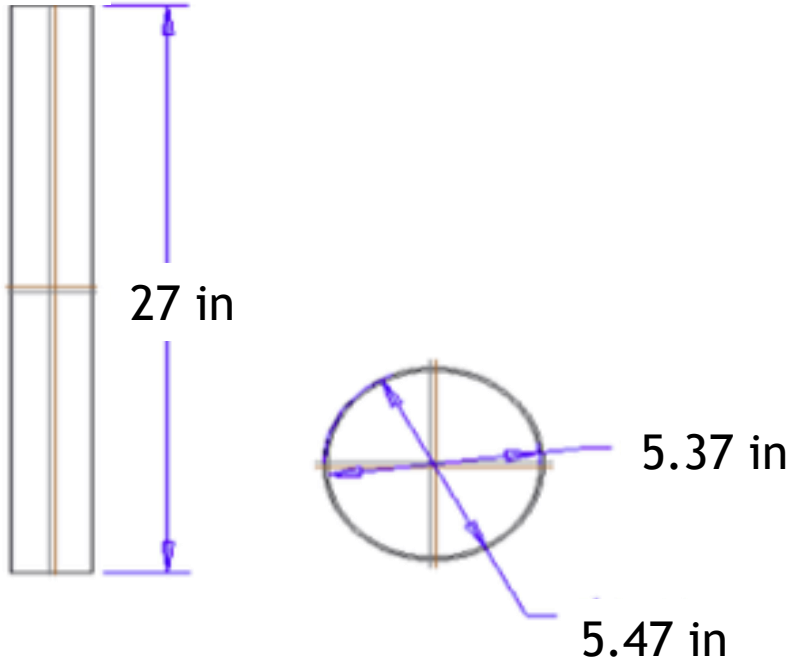
Launch Vehicle

Upper Section



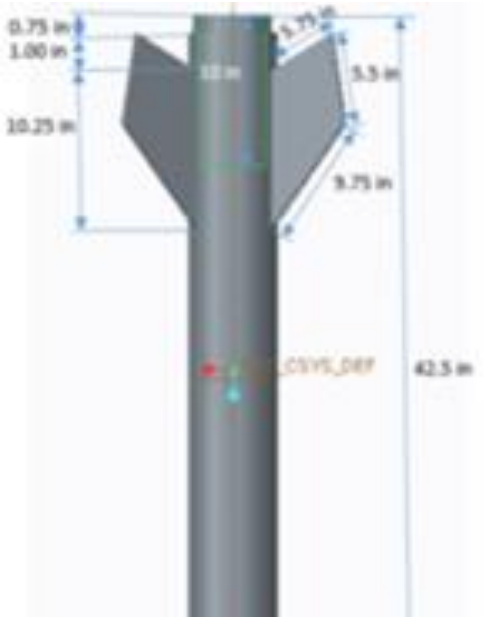
Launch Vehicle

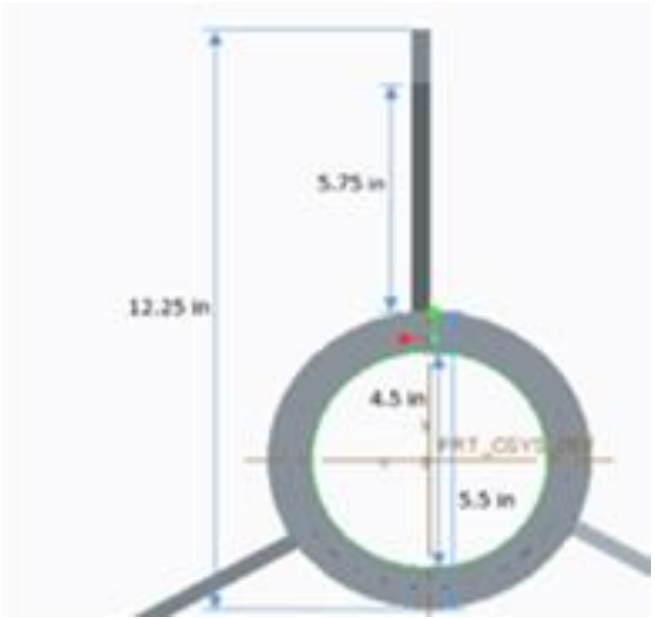
Payload Section



Launch Vehicle

Booster Section





Motor Selection

Motor Brand	Cesaroni
Motor Type	L1720 Reload type
Diameter	75.0mm
Length	48.6cm
Total Weight	3.341Kg

Vehicle Statistics

Stability Analysis

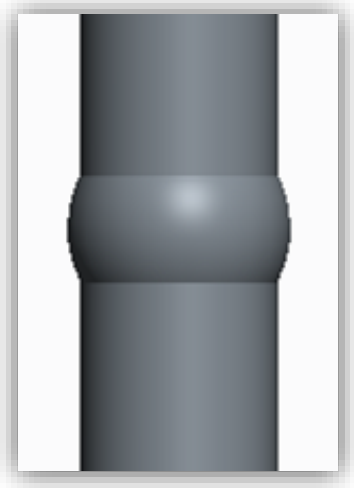
Center of Pressure (in from nose)	88.101
Center of Gravity (in from nose)	61.286
Static Stability Margin (on pad)	4.23 Calibers
Static Stability Margin (at rail exit)	4.97 Calibers
Thrust-to-Weight Ratio	75.3
Rail Size/Type and Length (in)	96
Rail Exit Velocity (ft/s)	73.4

Payload Bay

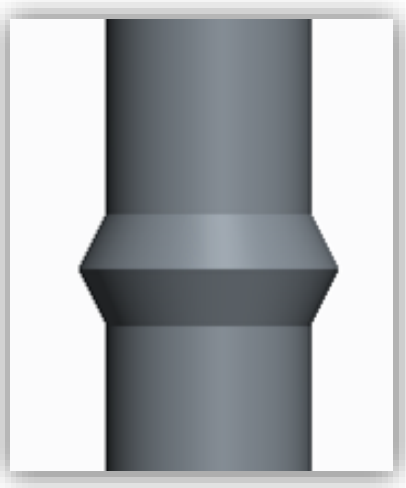
The goal of the target detection payload is to identify and collect data about three randomly placed targets, using an onboard camera system. The successful system will clearly identify and analyze targets in real time regardless of the rocket's orientation.

Camera Housing

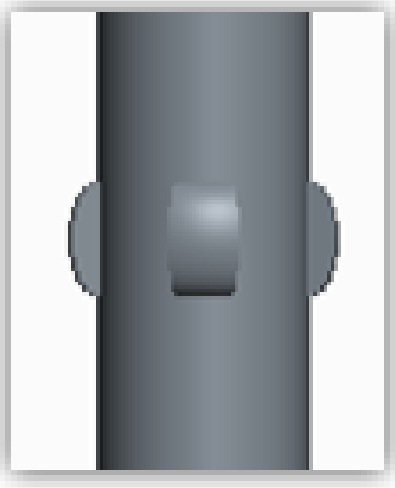
Design Options



Cylindrical collar

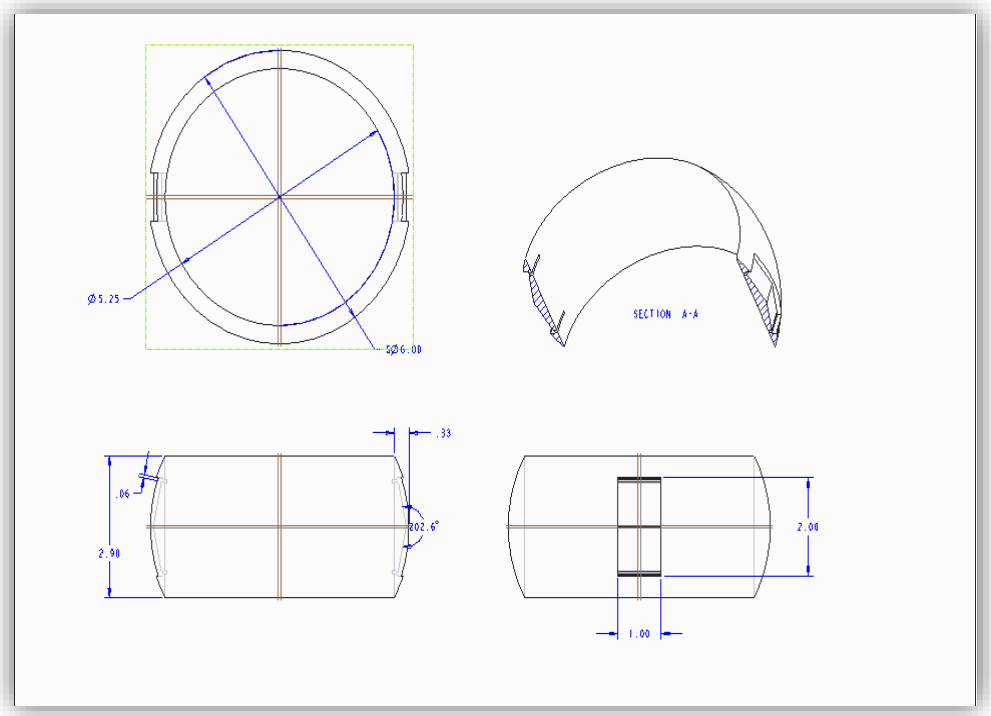


Diamond collar



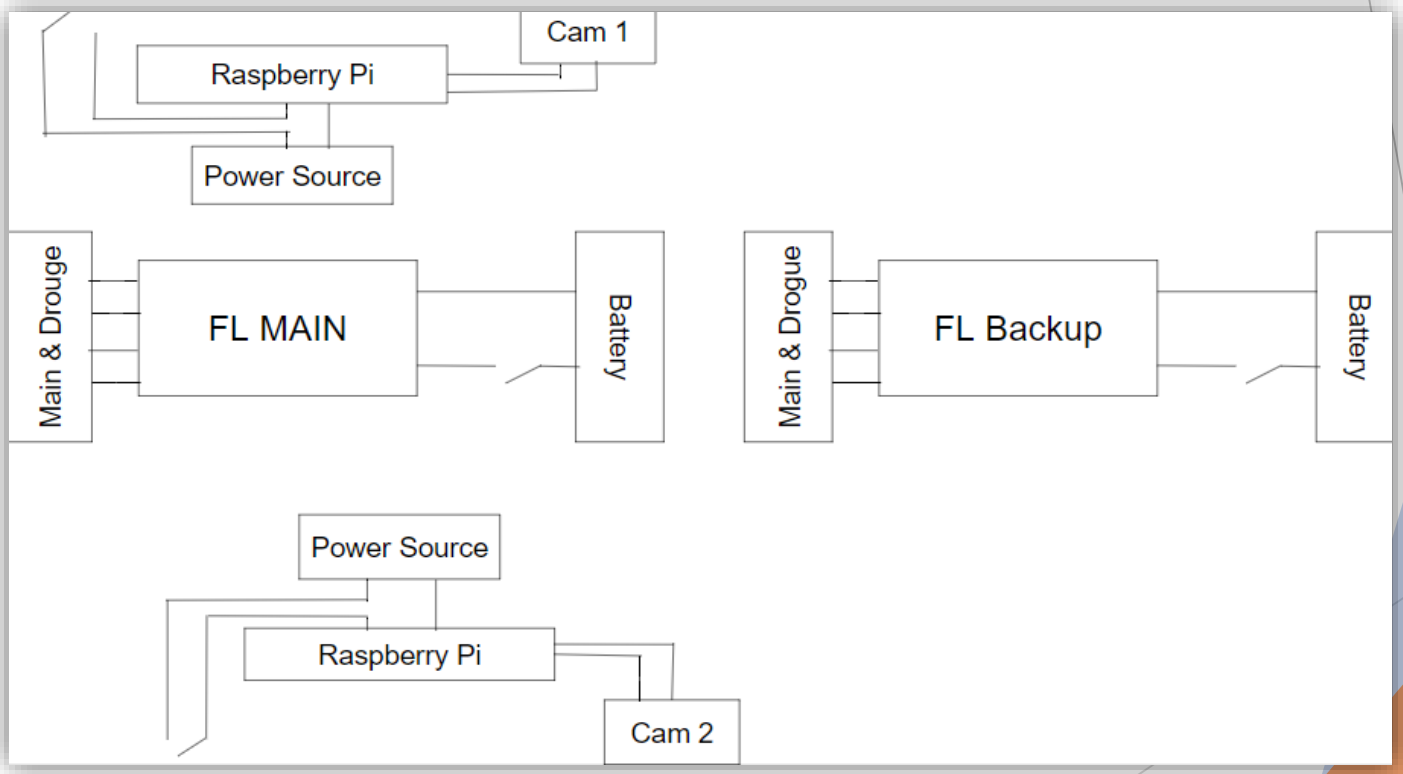
Point Protrusion

Collar Design

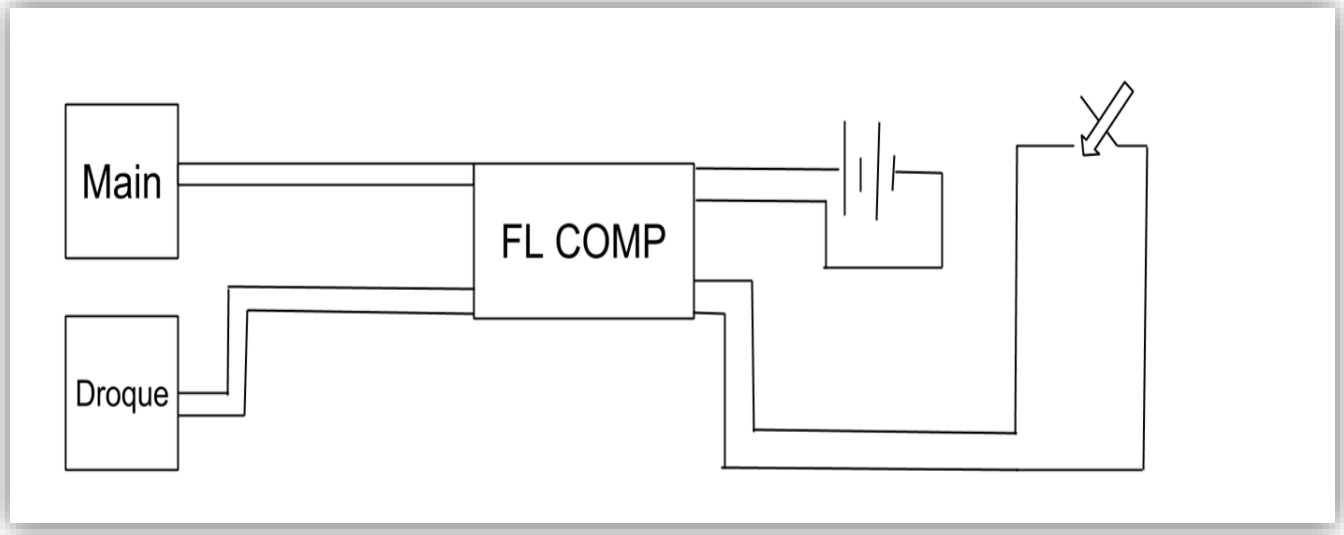


- Distributes stress on rocket body
- Redirects forces smoothly
- Symmetry has little effect on rocket dynamics during flight

Payload Board Schematics



Recovery Subsystem



Project Plan

Requirements Verification I

Team	Requirements	Verification Plan
General	Team completes the entire project including but not limited to written reports and presentations, vehicle design and construction, and successful vehicle launches	Following the project plan and timeline in concurrence with the advisor and mentor's suggestions.
Vehicle	Design and construct the rocket ensuring the structural integrity Ensure all the rocket is concurrent with payload section designs	Mentor will inspect on the final constructed vehicle along with guidance throughout construction of advisor
Safety	Oblige by local rocketry club regulations when in flight. During construction, working in accordance to the Safety Officer's checklist and precautions.	The Safety Officer will oversee processes that are deemed dangerous or hazardous, especially on launch days.

Project Plan

Requirements Verification II

Teams	Requirements	Verification Plan
Payload	The payload should complete the target detection task in the proposal.	Detection is verified by the analysis done by the raspberry pi to store the captured images.
Recovery	Ensuring that the electronic ejection goes off at the correct altitudes to minimize drift. Creating redundancies within the system as a backup precaution.	An altimeter will be use tell the flight computer when set off the ejection. There are multiple independent circuits in the system.
Target Detection	Program cameras to detect differences in colors.	The differences in the colored targets will be detected using RBG values the raspberry pi can interpret.

Conclusions and Future Work

- We were able to select materials, dimensions, and a motor that would provide acceptable statistics for the vehicle.
- A camera subsystem was designed that would not impede the aerodynamics of the rocket.
- A recovery system was designed with redundancy in case of failure

Questions?

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