Project: Simple Complexity Preliminary Design Review

Presented by:

Georgia Institute of Technology

Team A.R.E.S.

Agenda

1. Team Overview (1 Min)
2. Changes Since Proposal (1 Min)
3. Educational Outreach (1 Min)
4. Safety (2 Min)
5. Project Budget (2 Min)
6. Launch Vehicle (10 min)
7. AGSE & Flight Systems (13 Min)
8. Questions (15 Min)

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TEAM OVERVIEW

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- 15 person team composed of both undergraduate and graduate students
  - Graduate Students: 1
  - Undergraduates: 14
- Highly Integrated team across several disciplines

Field	No. of Students
Aerospace Engineering	8
Mechanical Engineering	2
Electrical Engineering	2
Computer Engineering	1
Chemical Engineering	1
Industrial Engineering	1

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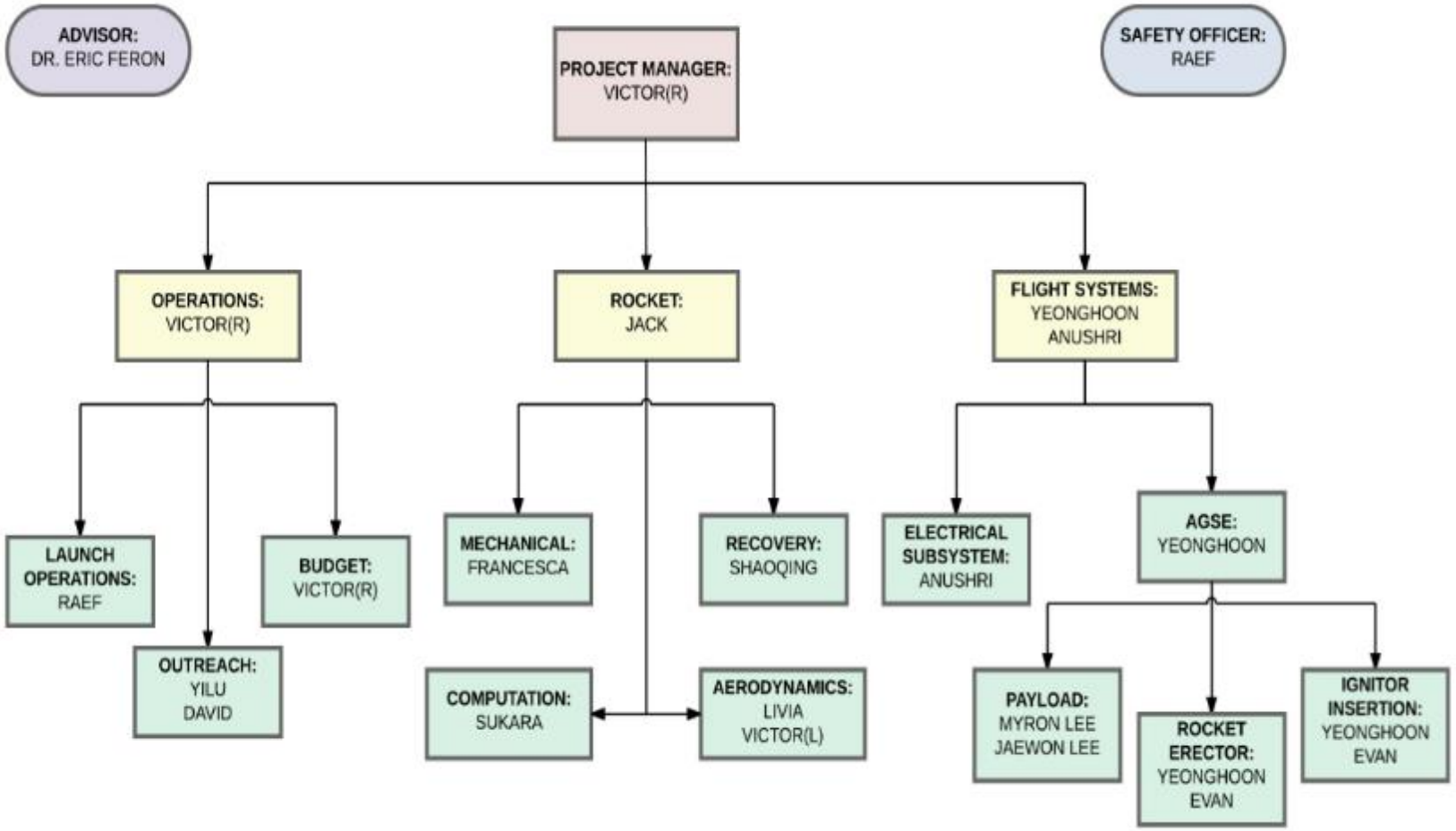
Work Breakdown Structure



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CHANGES SINCE PROPOSAL

Changes Since Proposal

Rocket:

- No changes since proposal

AGSE & Flight Systems:

- Elimination of environment mapping and payload localization (SLAM techniques) via sensors for payload retrieval: team will instead exploit hard-coded positions and a known starting location of the payload.
- Selection of core designs for the robotic arm, Vehicle Erector System (VES) and Igniter Insertion System (IIS).

Activity Plan:

- New Douglass High School Outreach/funding plan

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EDUCATIONAL OUTREACH

Educational Outreach

- Goal: *Promote Interest in the Science, Technology, Engineering, and Mathematics (STEM) fields.*

- As of PDR, Team A.R.E.S. have planned two (2) Educational Outreach Events

- Douglass High School
  - Work in conjunction with the Douglass High School doing projects related to the competition
- FIRST Lego League
  - Engineering competition held for Middle School students to build and compete with autonomous MINDSTORMS robot.

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SAFETY

Risk Assessment

- Hazard Identification
  - What has the potential to become a safety hazard?
- Risk and Hazard Assessment
  - What are the potential consequences of the hazard?
- Risk Control and Elimination
  - What can be done to mitigate the risk?
- Reviewing Assessments
  - Are the mitigations working?
  - Are there any new safety hazards to address?

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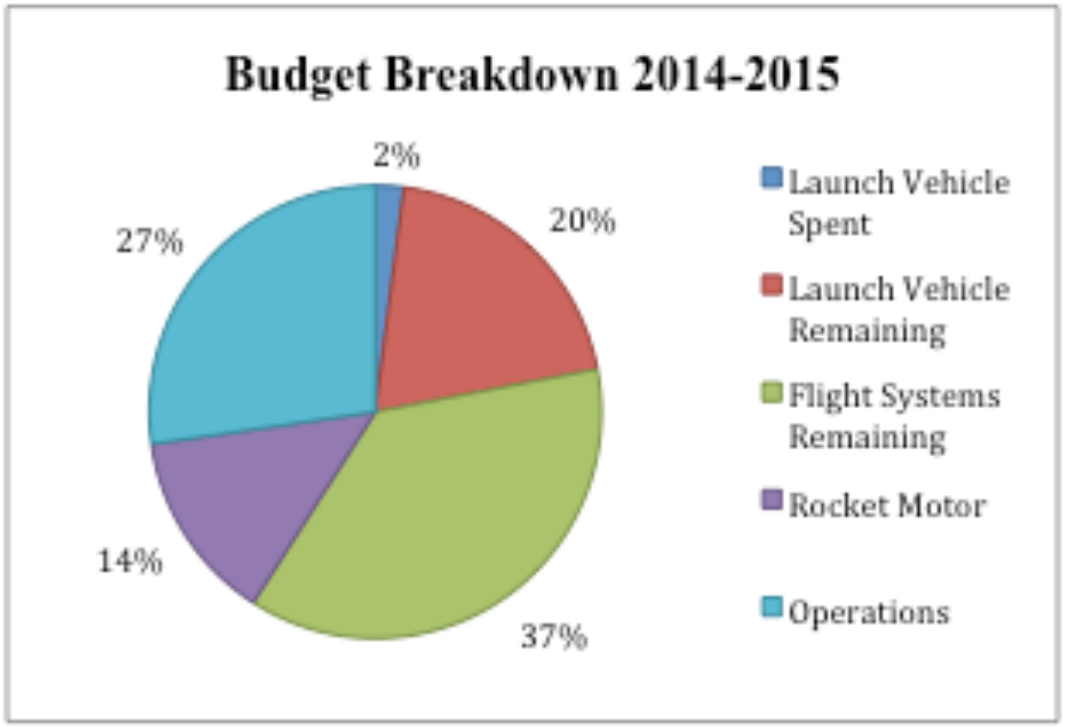
PROJECT BUDGET

Project Budget Summary

Table 1: Estimated Budget for the 2014-2015 Project

Subsystem	*Amount ($)*
Launch Vehicle & Motors	1,461.83
Flight Systems	2,721.18
Operations	2,000.00
Total:	6189.01



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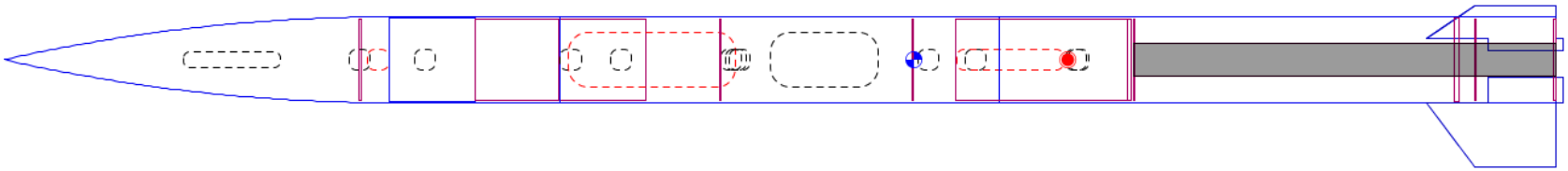
LAUNCH VEHICLE

Vehicle Summary

- Predicted apogee: 3,082 ft.
- Stability margin: 1.54 calibers
- Motor: Cesaroni J530
- 76 fps at 96 inches up the rail
- Max Mach 0.41
- Thrust to Weight Ratio: 7.93
- Total weight: ~10 lbs
- Dual deployment



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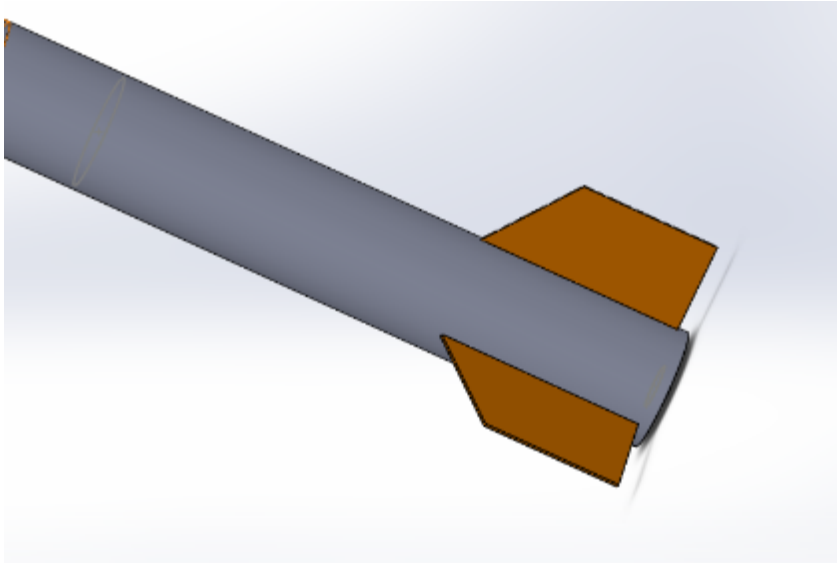
Rocket Fins

- Material: G10 Fiberglass sheets
- Attachment: Epoxy

Variable	Value
Number of fins	3
Root chord	6 in
Tip chord	3.75 in
Height	3 in
Sweep Angle	36.9˚
Sweep Length	2.25 in



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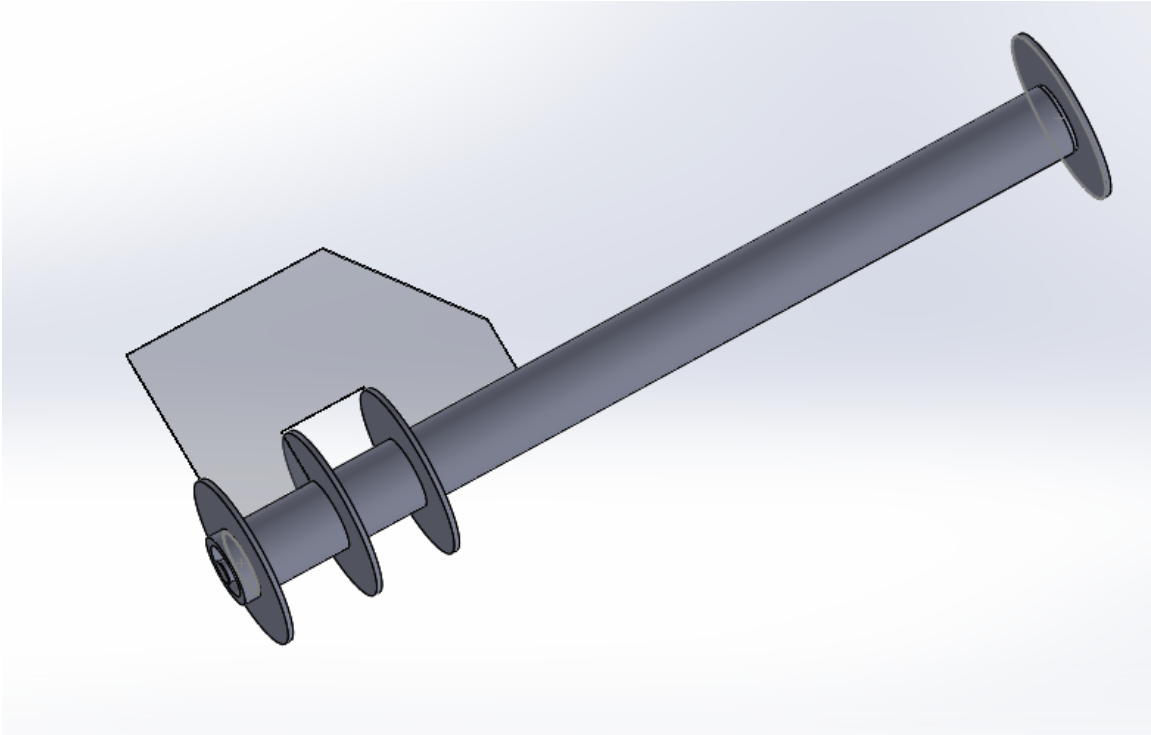
Booster Section

- Material: G10 Fiberglass
- Attachment: Epoxy

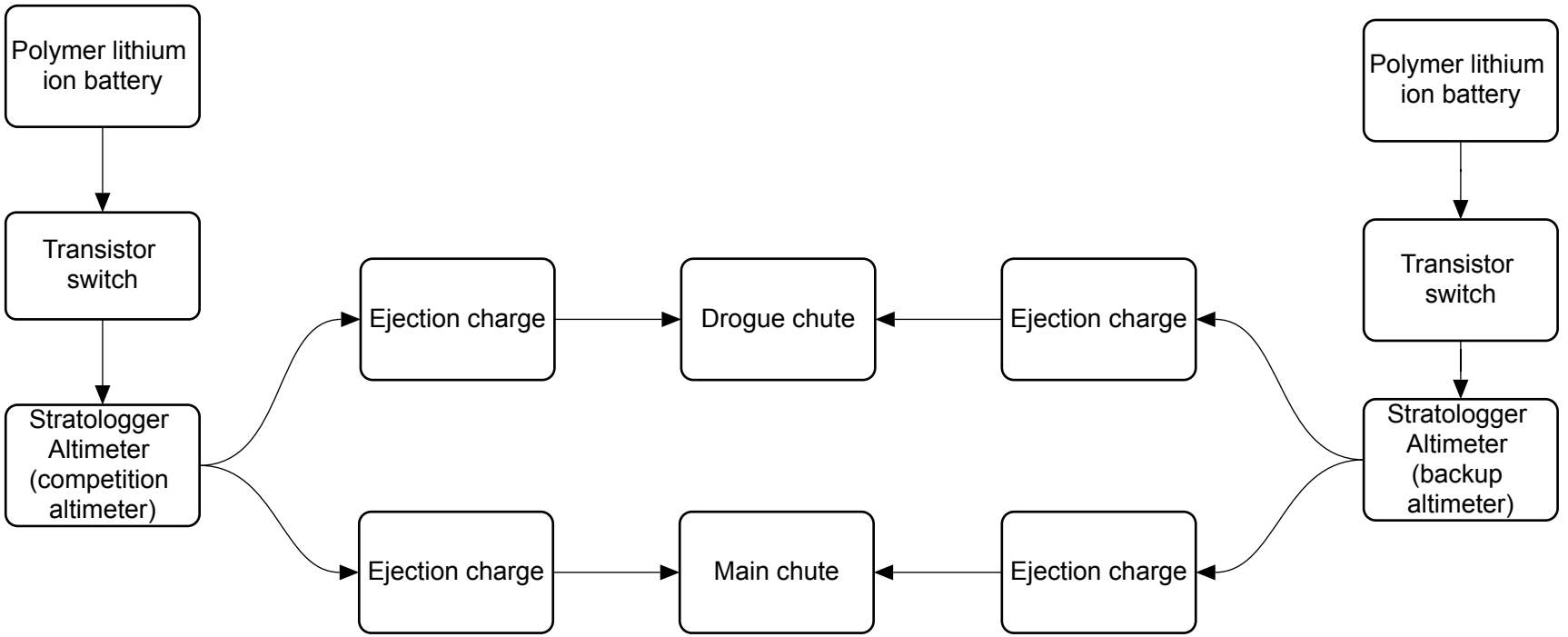


FEA Analysis & Testing Plan

- Plan to do FEA Analysis through Solidworks
- Perform structures drop test on the body tube structure
- Static loading test on the thrust plate
- Static loading at fin attachment

Recovery

- Dual deployment system
- Altimeter: 2 StratoLoggers for redundancy

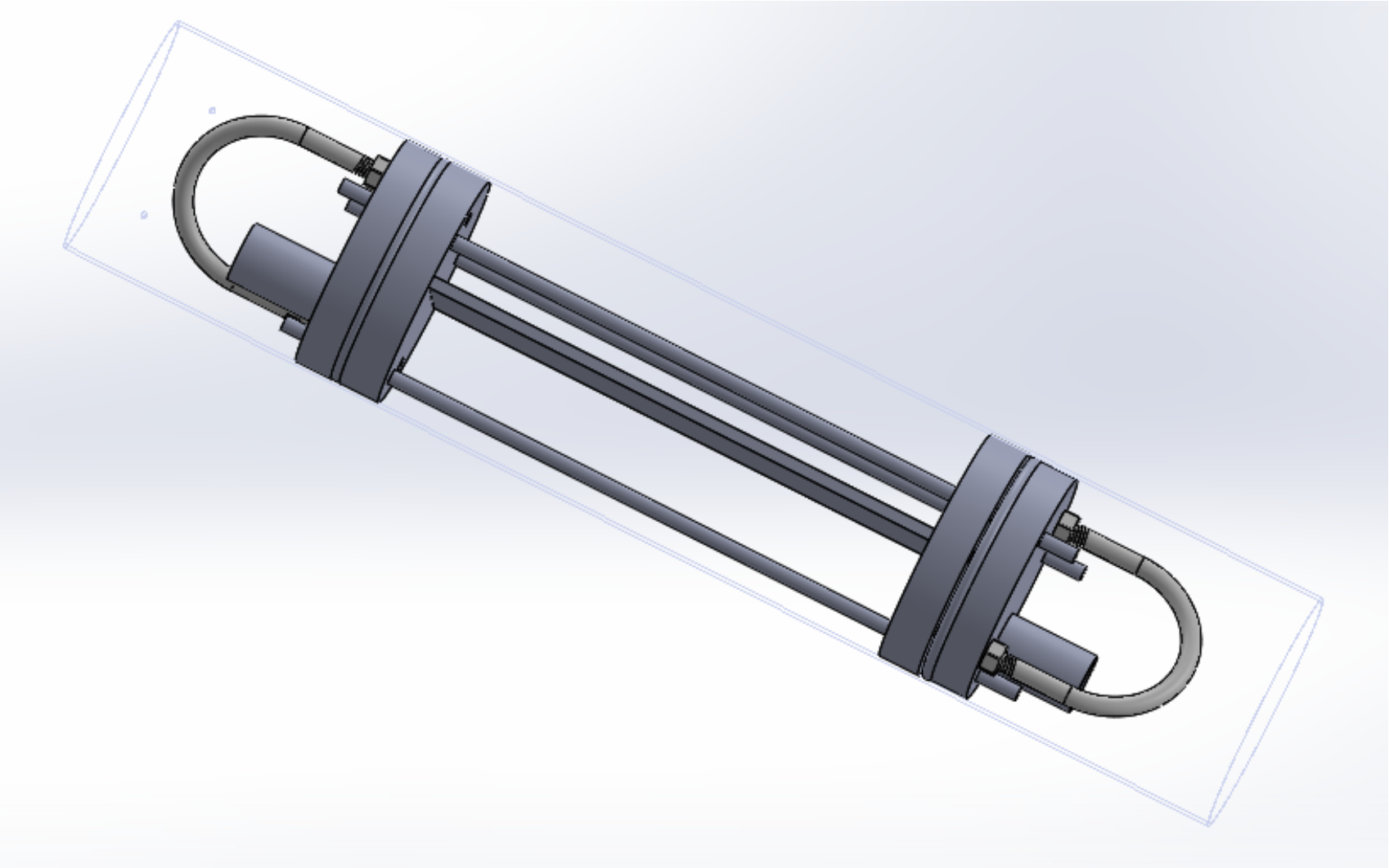


Ejection Charges

- Black powder ejection charges
- Ground testing will be perform prior to CDR

	Main Parachute	Drogue Parachute	Payload Parachute
Total Pressurization	26.7 psi	26.7 psi	22.7 psi
Differential Pressurization	12 psi	12 psi	8 psi
Amount of black powder	0.788 grams	0.867 grams	0.245 grams

Recovery – Main



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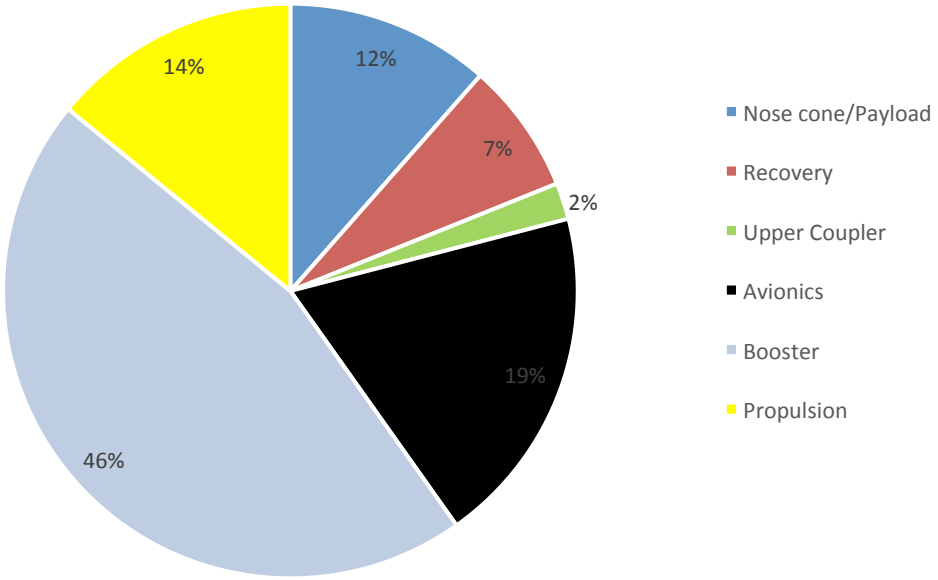
Mass Breakdown

Parameter	*Mass (lbs)*
Nose cone/Payload	1.2
Recovery	0. 7
Upper Coupler	0.2
Avionics	1.9
Booster	4.6
Propulsion	1.4



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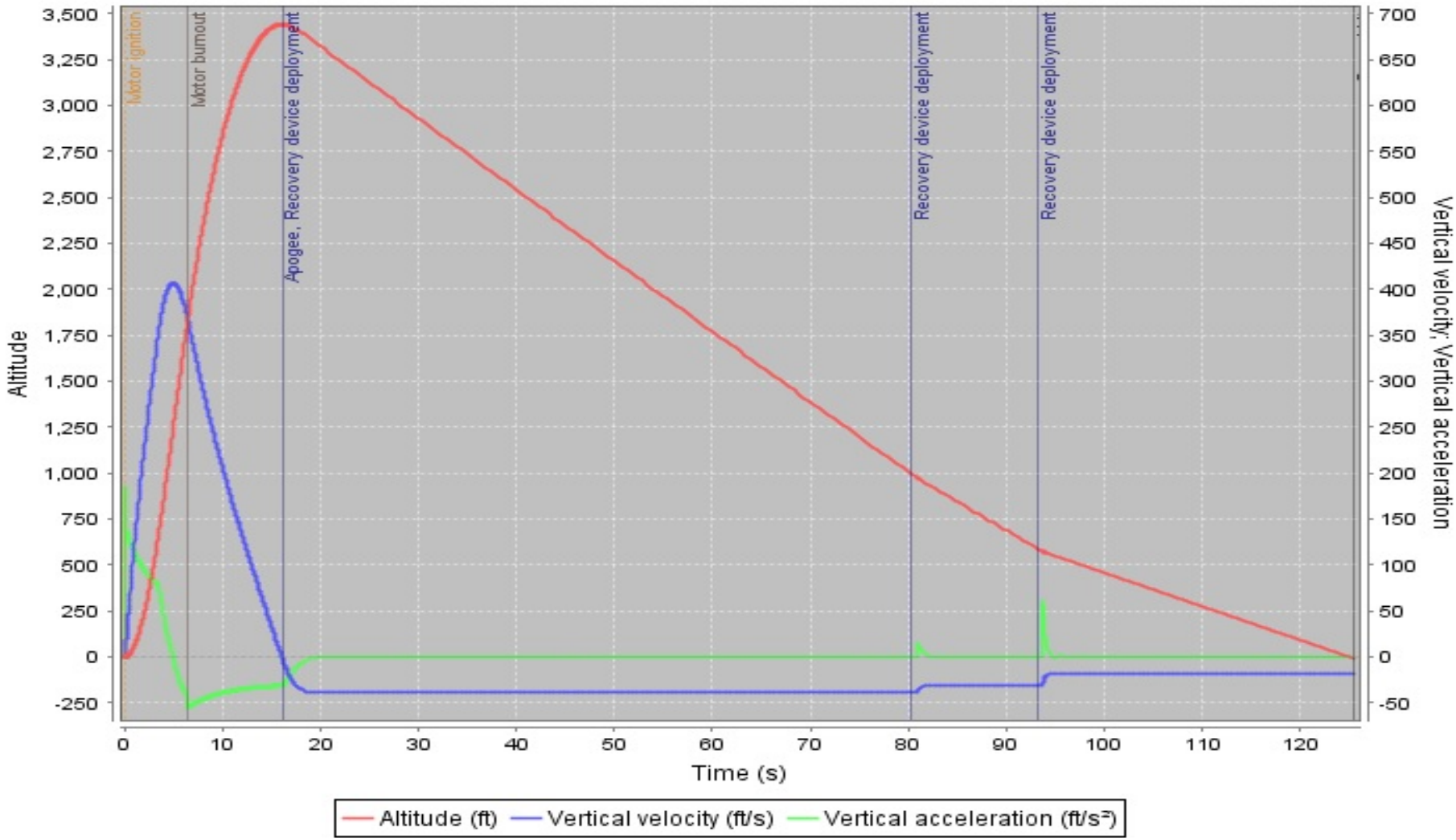
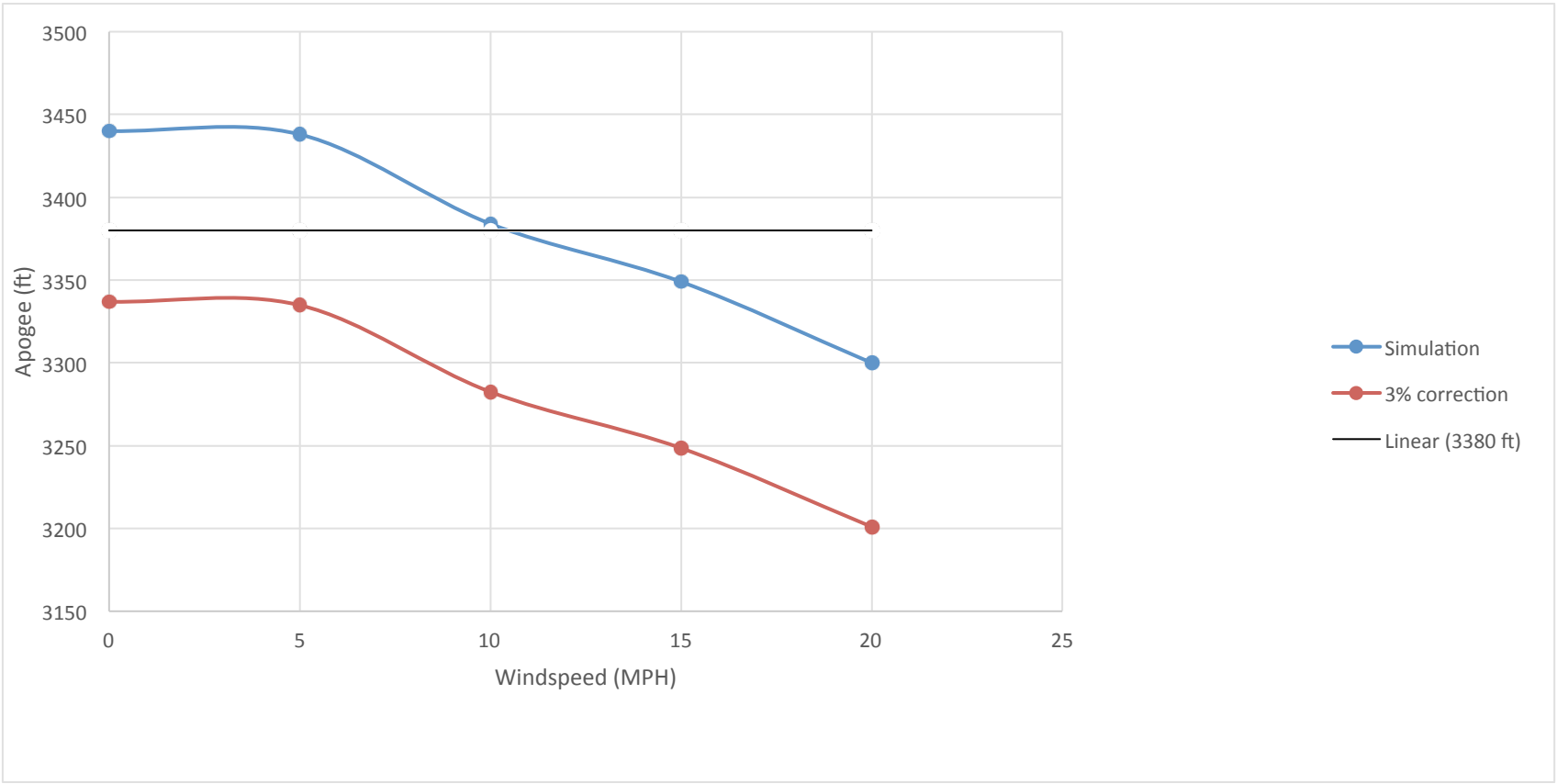
Flight Profile



Drift Profile



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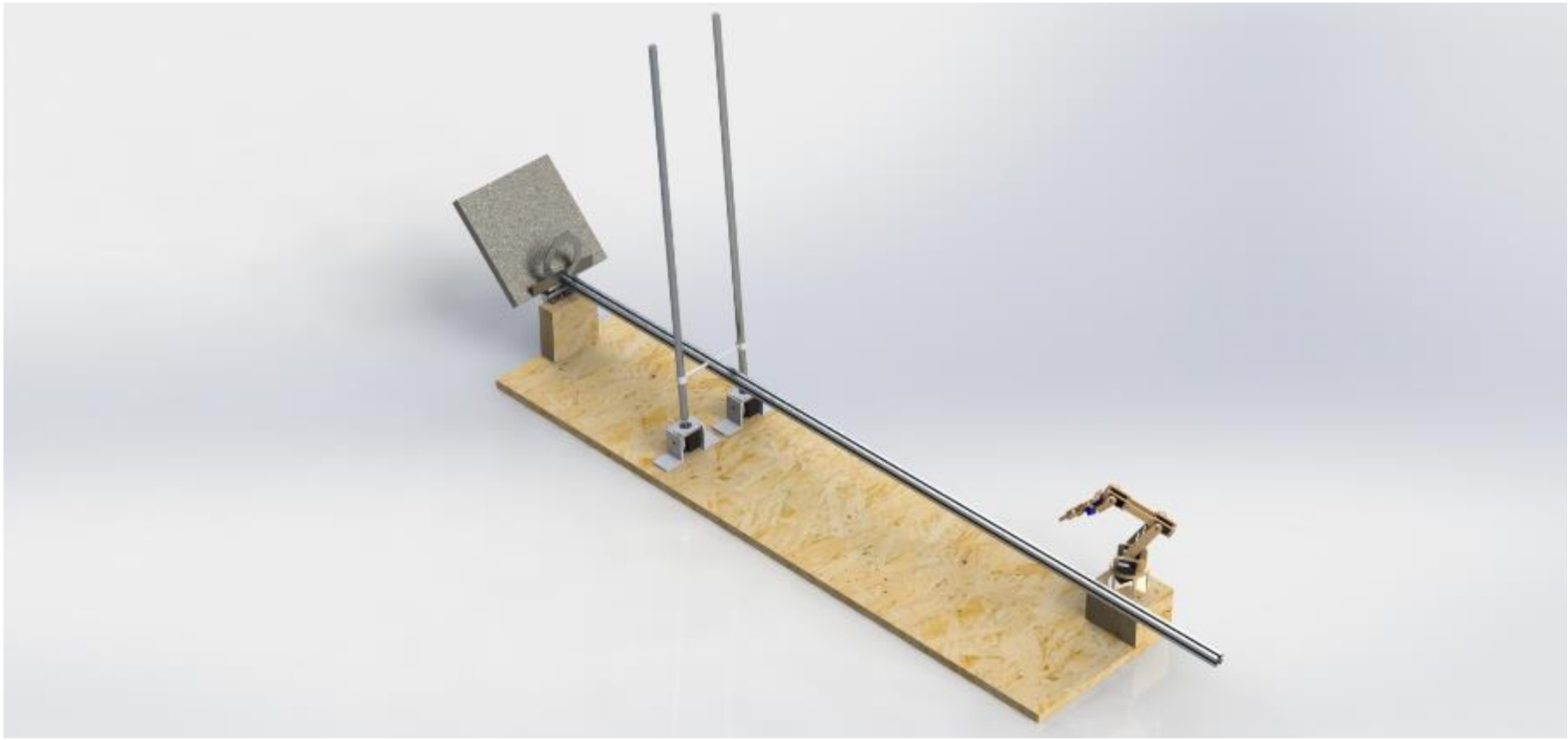
FLIGHT SYSTEMS

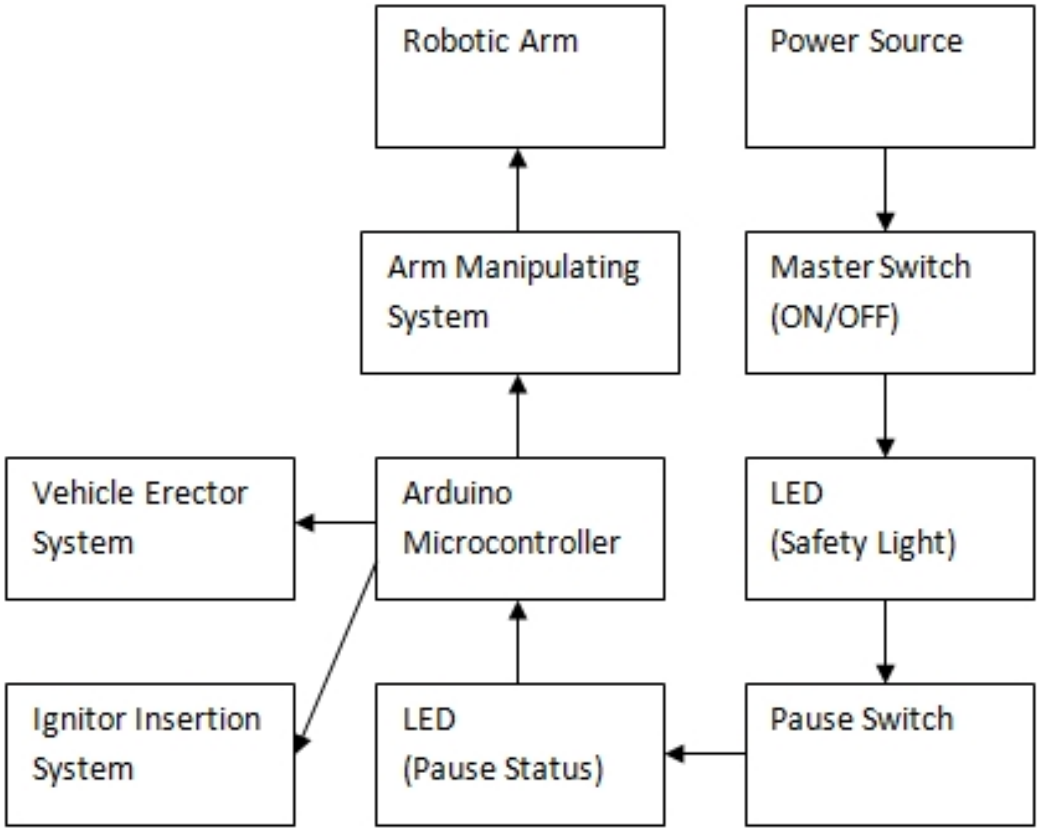
Flight Systems: AGSE

- Overview



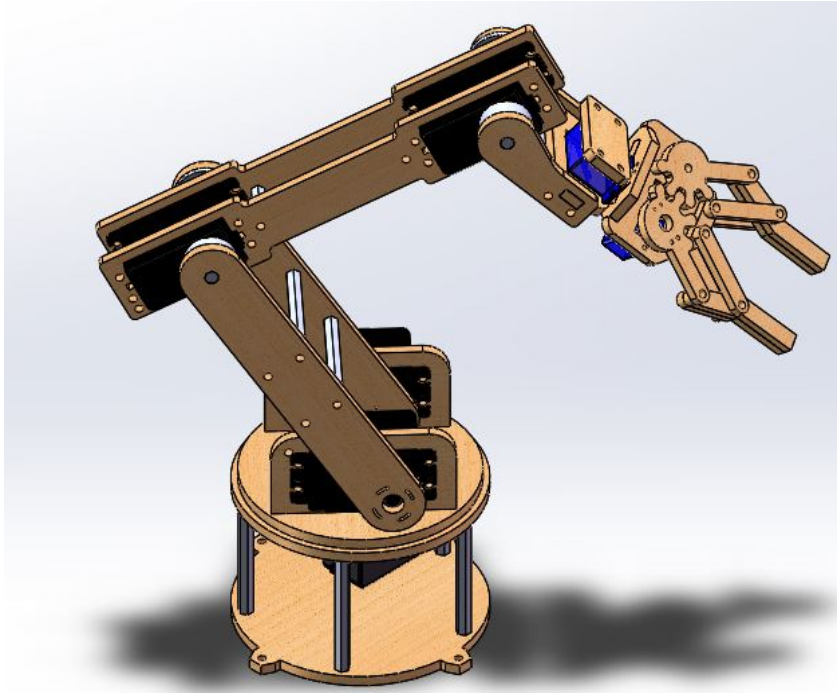
Flight Systems: AGSE

- Schematic



Flight Systems: AGSE

- Payload Insertion System (PLIS)
- Autonomously retrieve and insert payload in nosecone
- Robotic Wooden Arm with 6 deg Freedom and 7 servo motors



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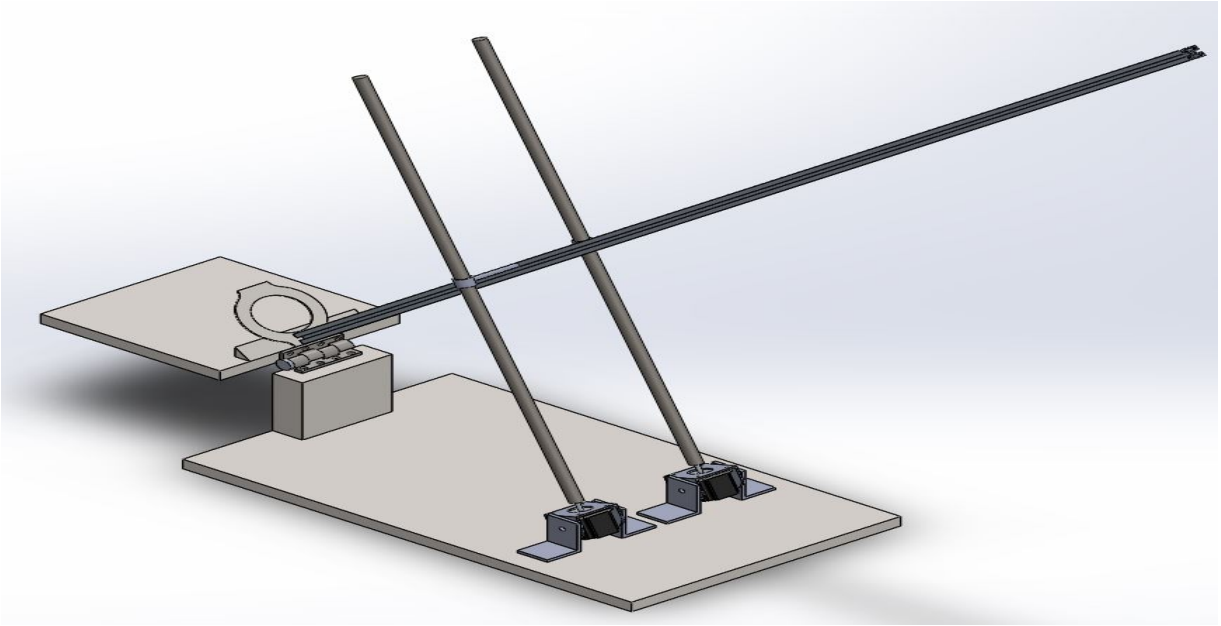
Flight Systems: AGSE

- Vertical Erector System (VES)
- Successfully lift the rocket to the predetermined 5 degrees from vertical.
- Stepper Motor and Worm Screw Assembly



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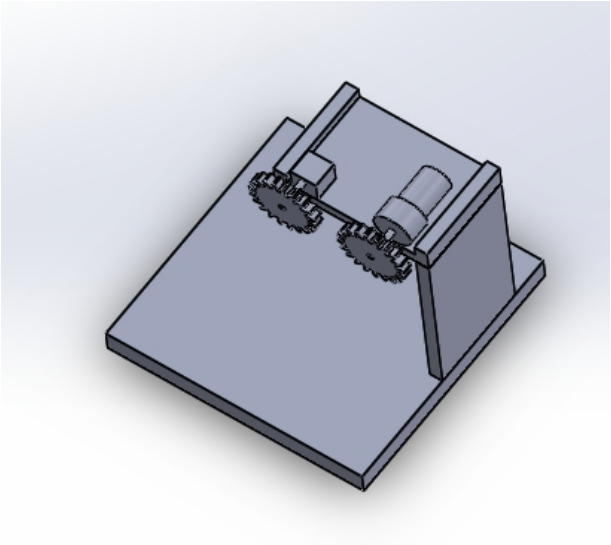
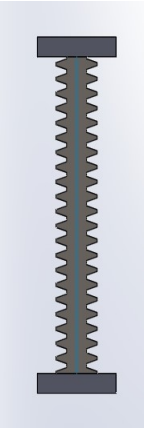
Flight Systems: AGSE

- Igniter Insertion System (IIS)
- Insert Igniter into Solid Rocket Motor Cavity
- Rack and Pinion System





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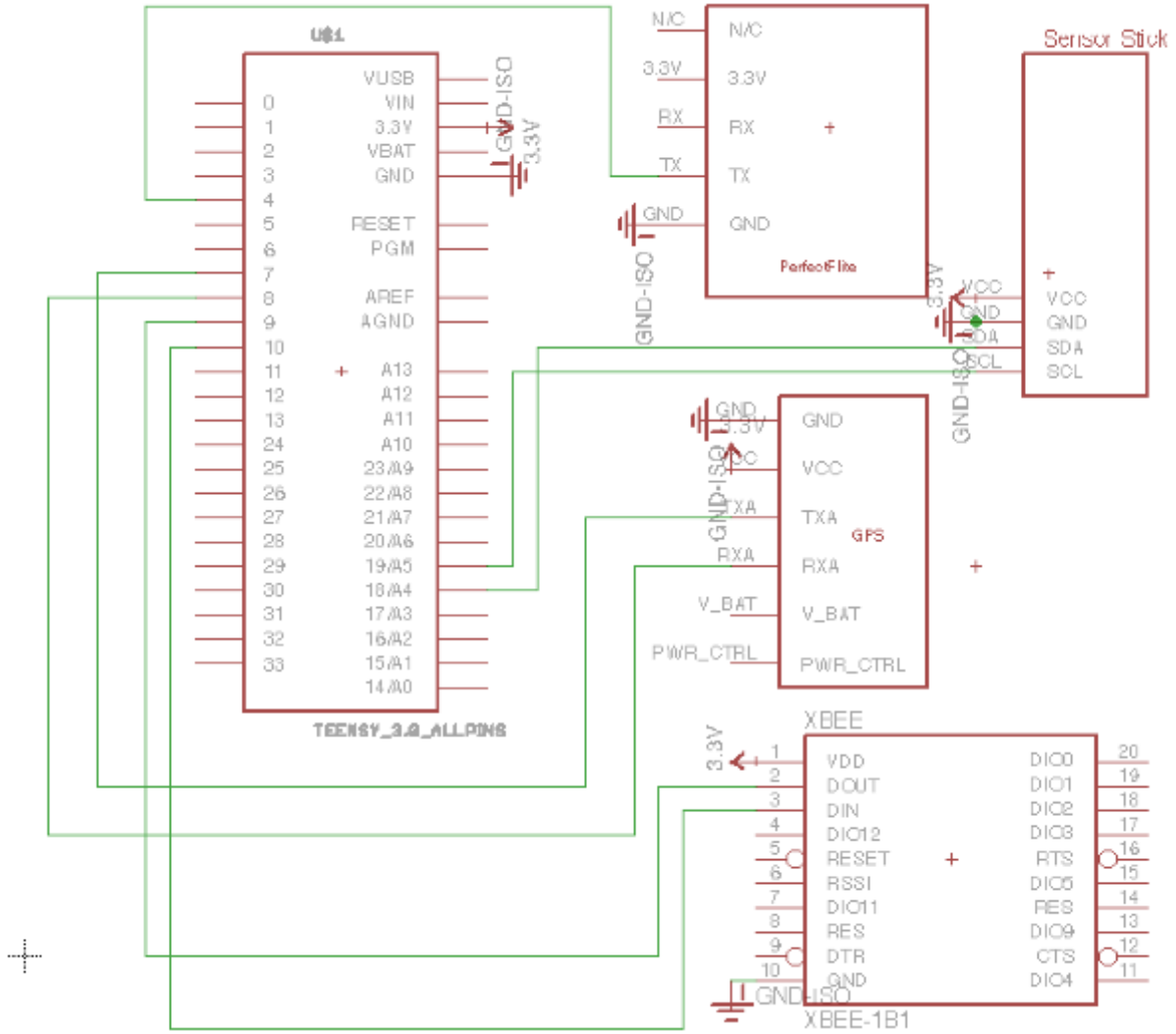
Flight Systems: Main System



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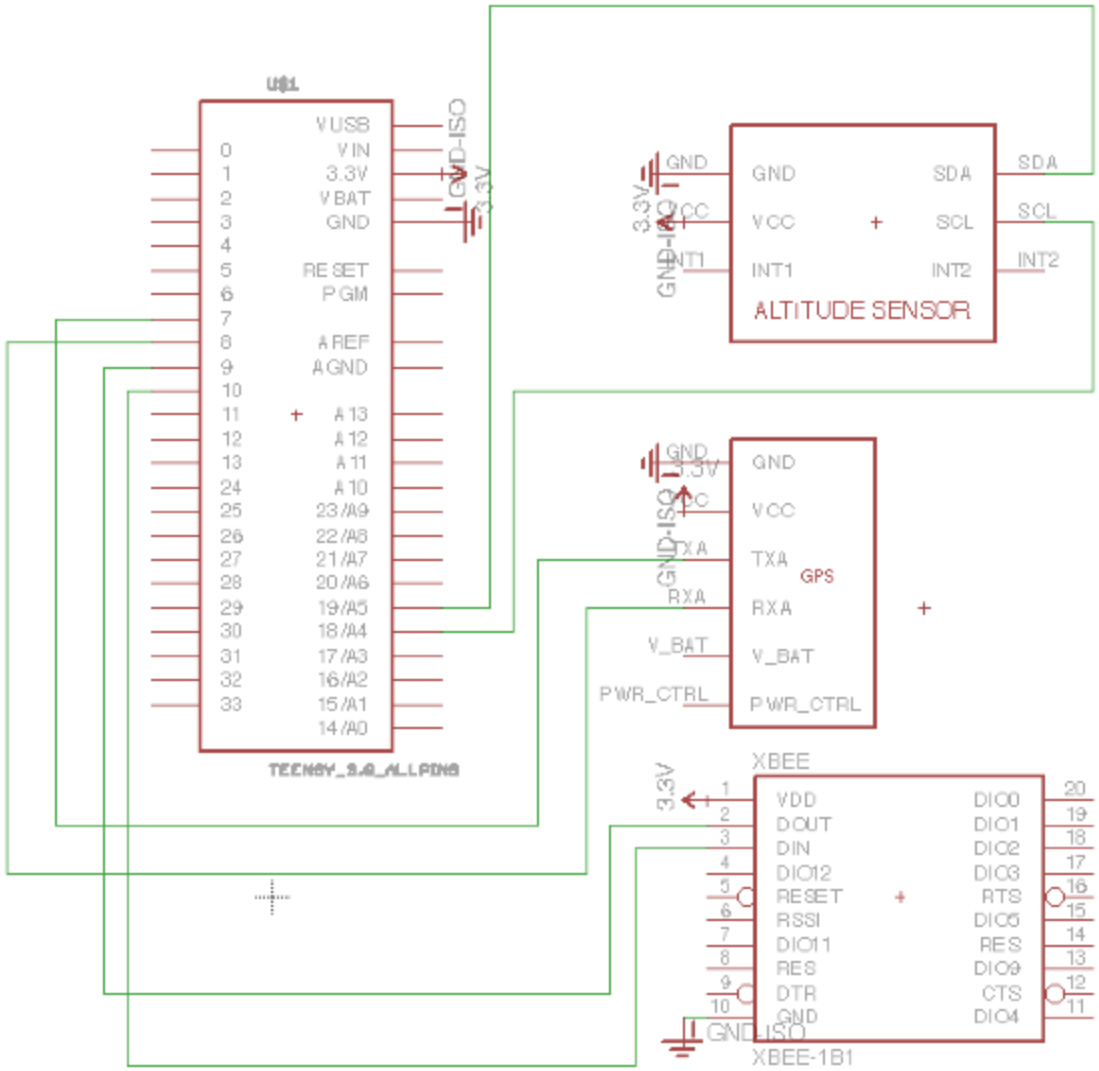
Flight Systems: Payload Recovery



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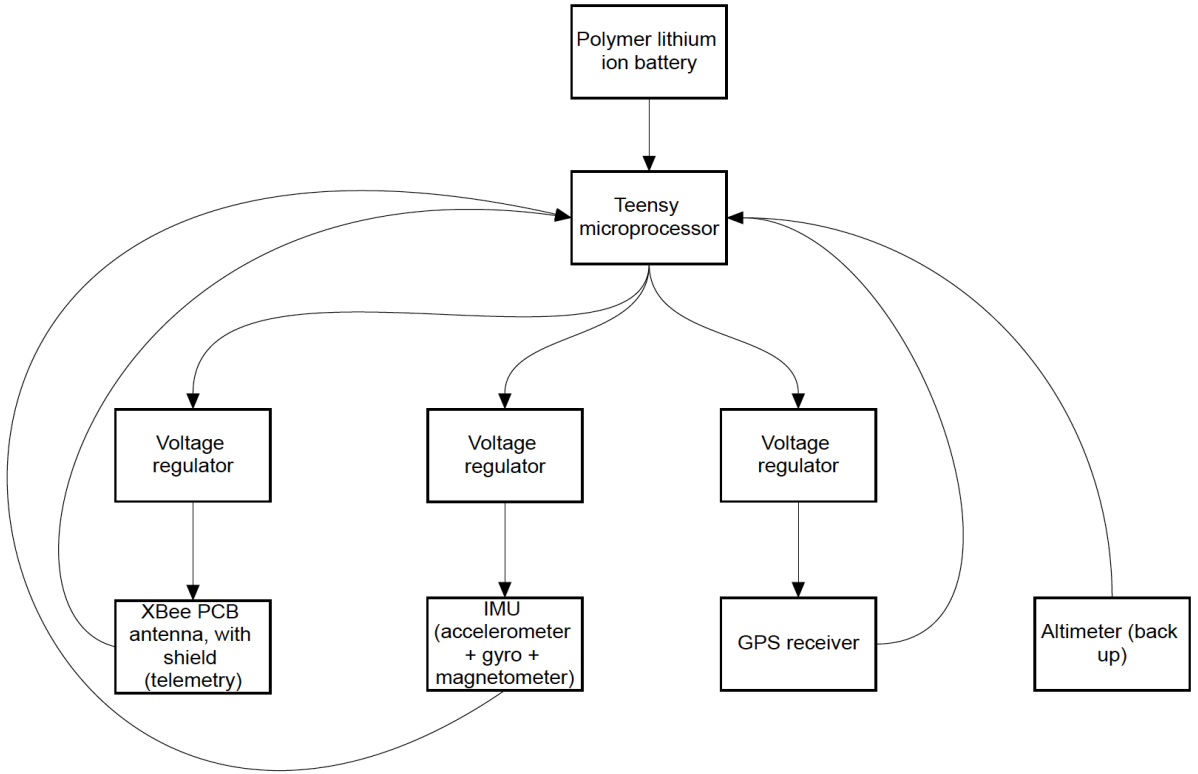
Flight Systems: Avionics - Recovery

Custom flight computer board

- Teensy Microprocessor
- Stratologger
- Micro SD Card
- Xbee Pcb Antenna
- Sensors



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Questions?