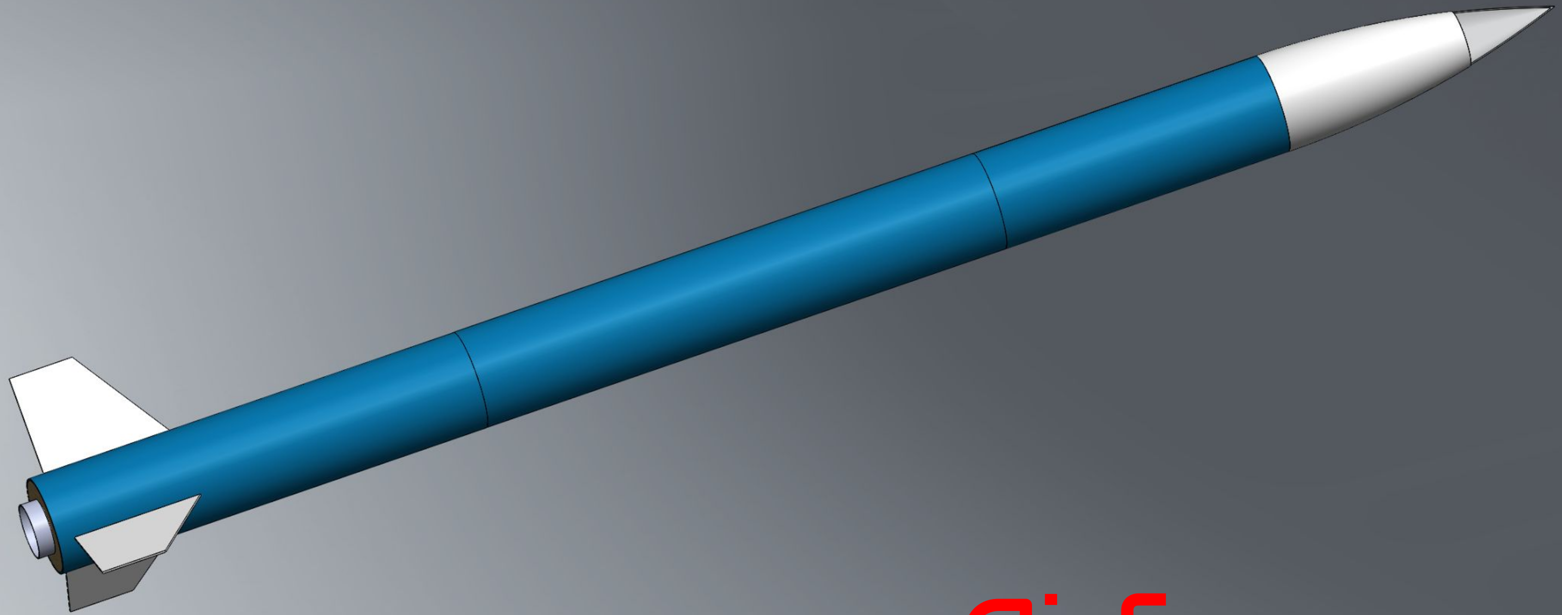
STAR



Airframe

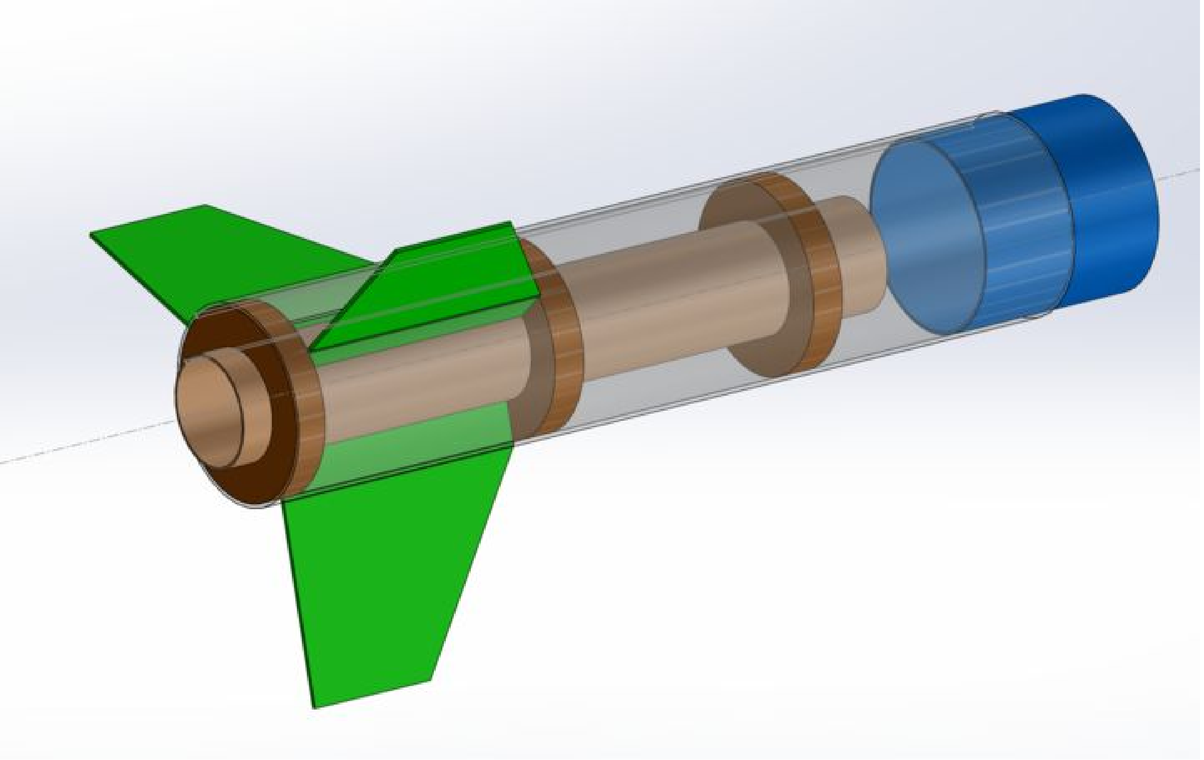
Summary

- Overall length: 8’ 1”
- Nose cone diameter: 6”
- Nosecone length (ogive): 18”
- Payload section diameter: 6”
- Payload section length: 24”
- Booster section diameter: 4”
- Booster section length: 4’
- Motor size: Aerotech L1150 motor
- CG: 39.7” from rear
- CP: 25.7” from rear
- Stability margin: 2.34 cal

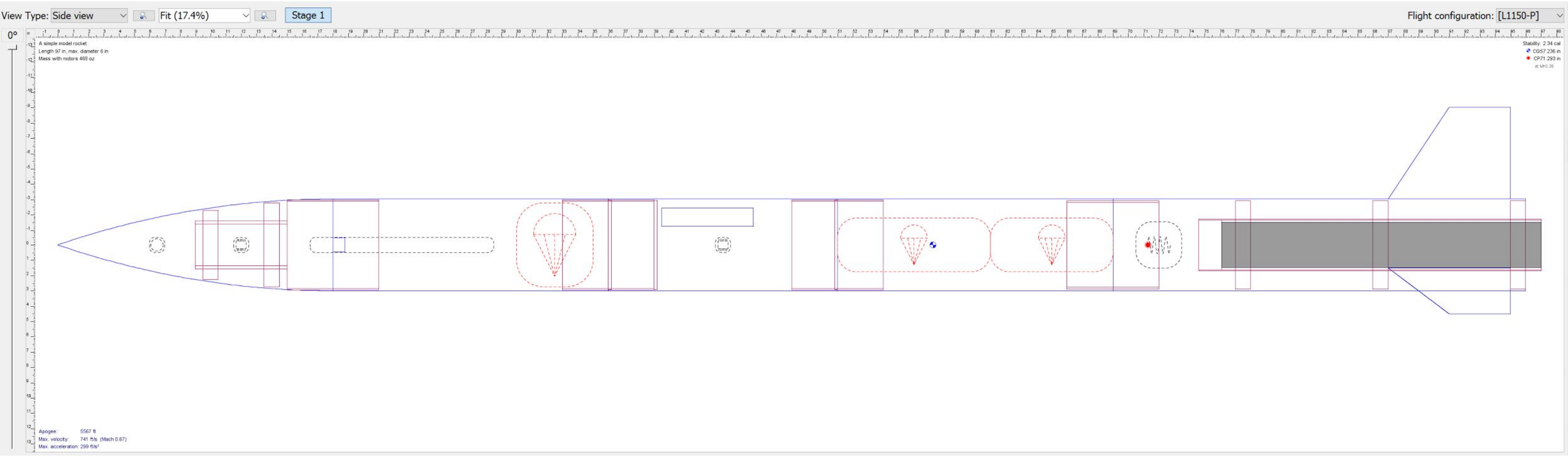
Materials

- Main body
  - BlueTube
- Nose cone
  - Upper-half polycarbonate
    - To facilitate camera viewing through the nose cone, as required by our payload experiment.
  - Lower-half fiberglass
- Fins
  - Fiberglass with carbon fiber reinforcement
- Motor Mount Tube
  - Phenolic
  - Wood centering rings

Booster Section



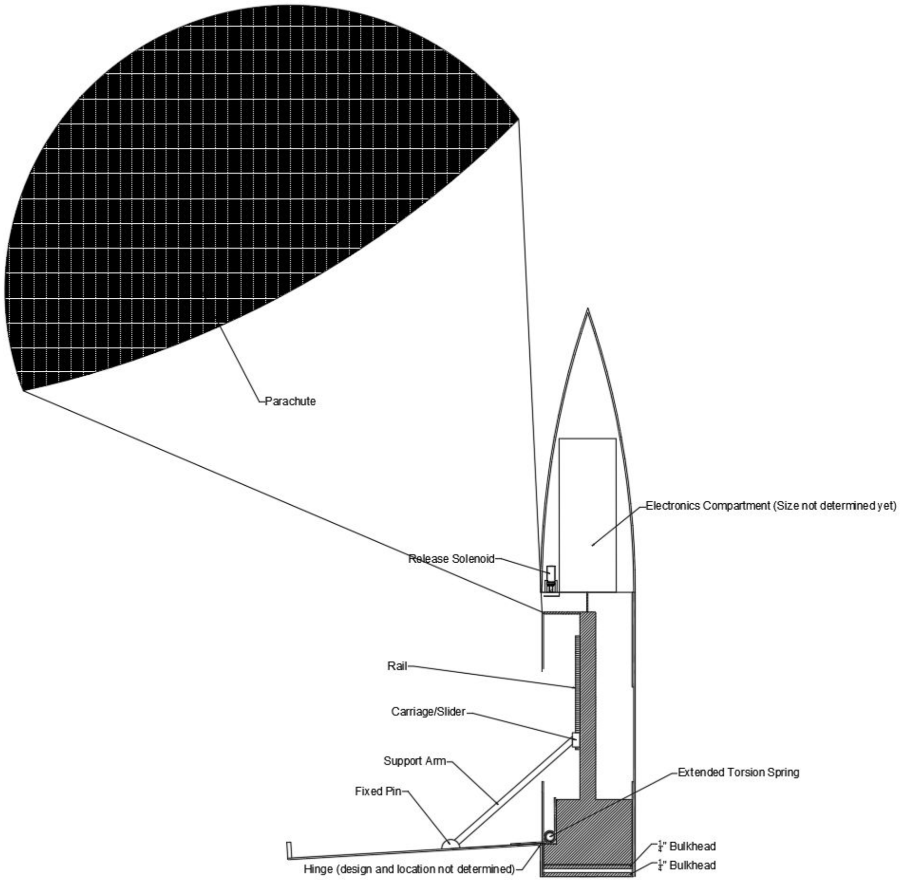
OpenRocket Diagram



Payload

Target Detection and Upright Landing

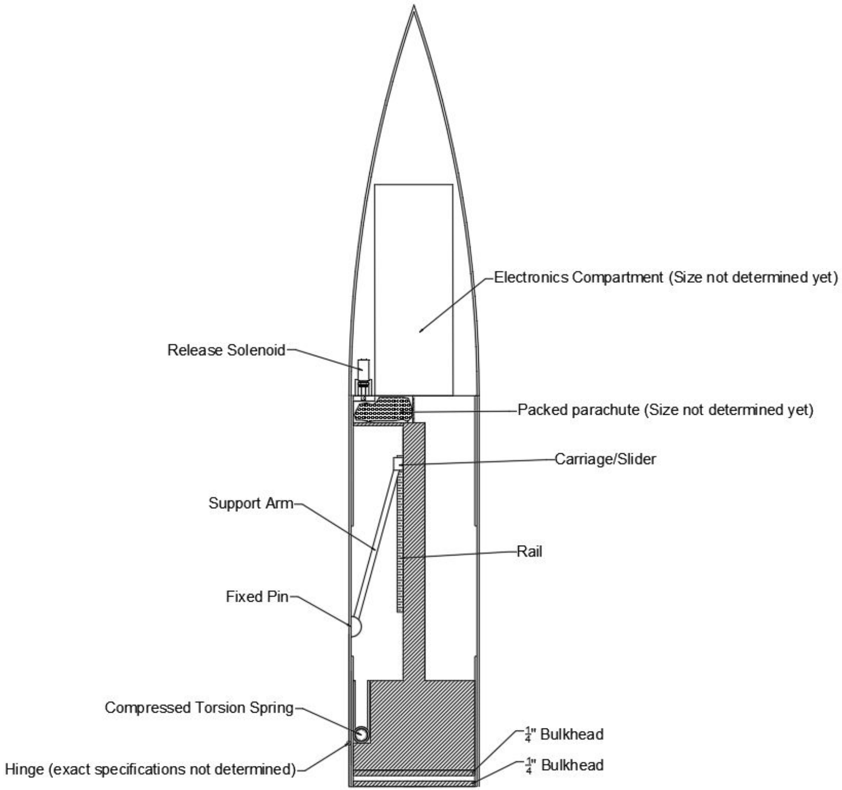
- Detect and differentiate ground targets with camera mounted in nose cone
- Deploy landing legs
    - Simultaneously deploy three parachutes

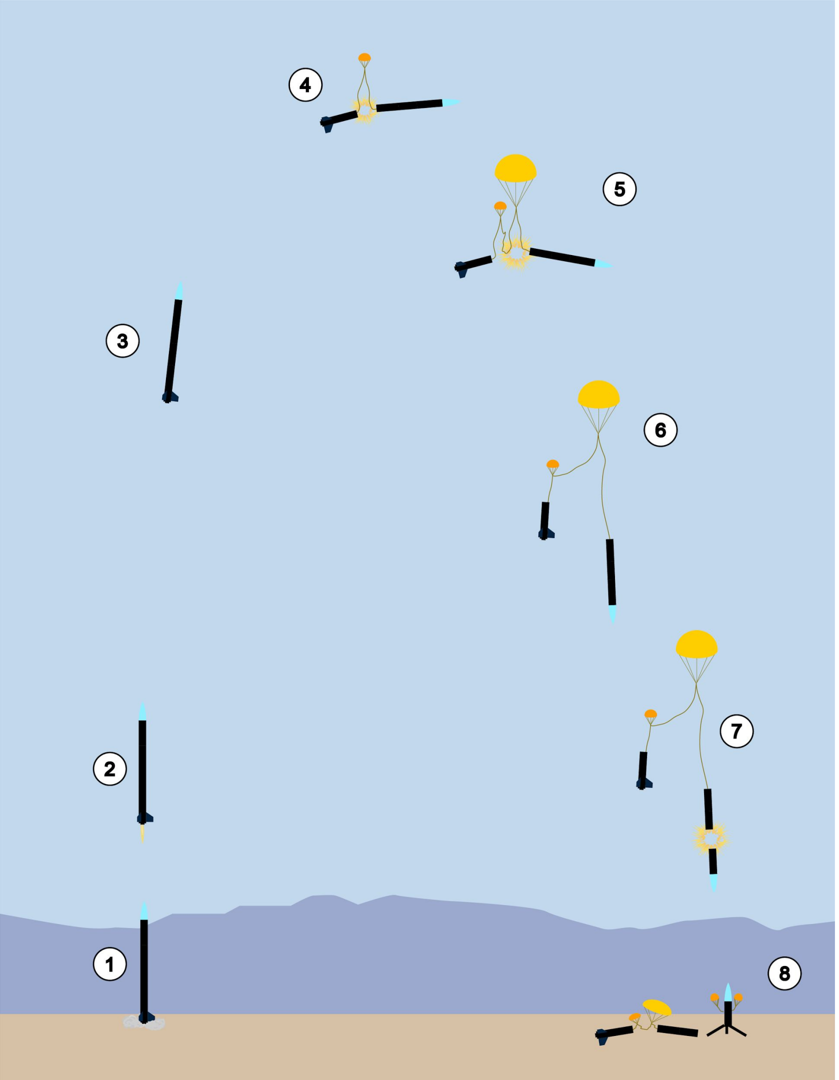


Payload

Target Detection and Upright Landing

- Legs mounted within airframe wall, pin-closure
  - Spring-loaded hinge
    - Alternative: gas-spring deployment

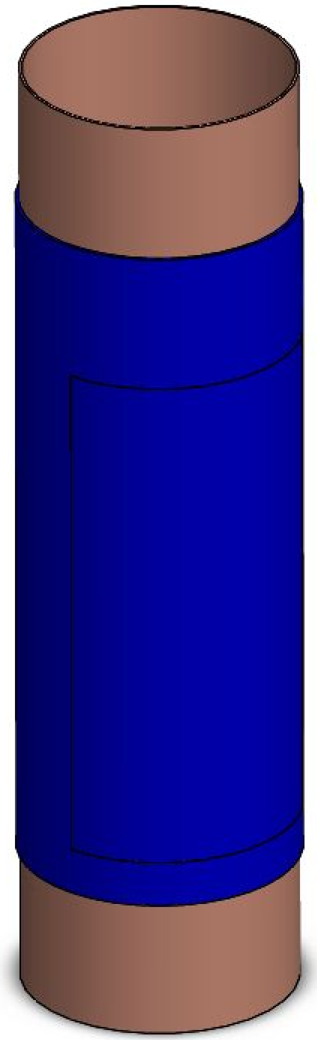


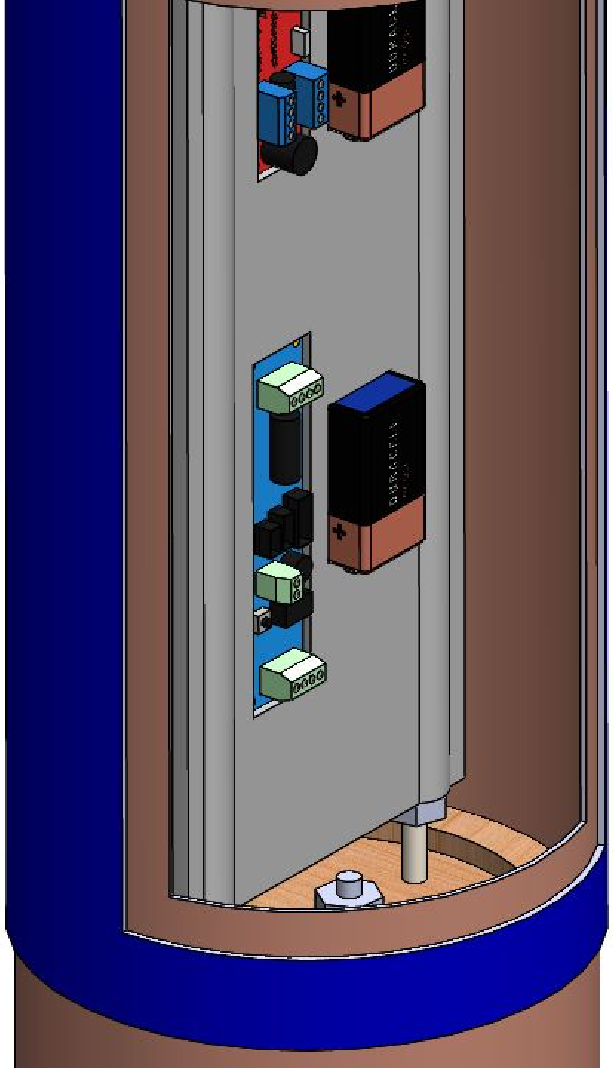


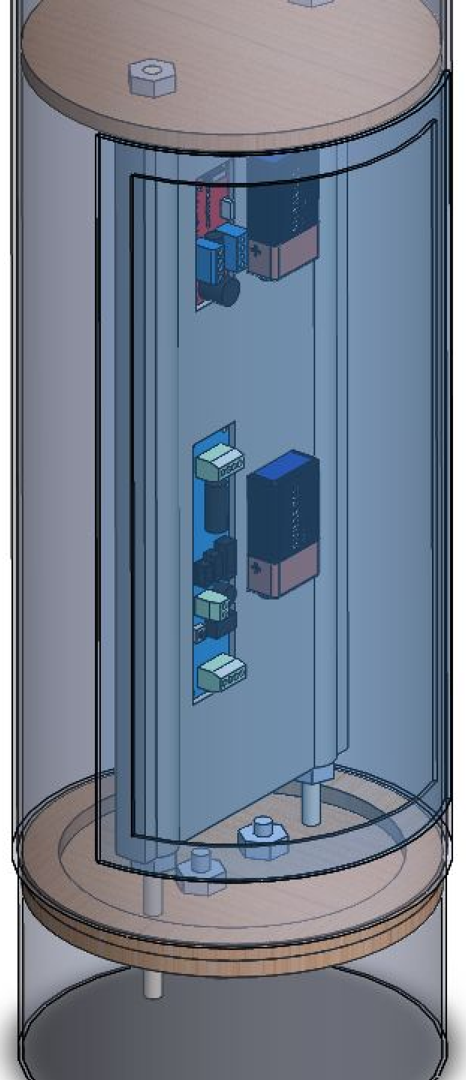
PHASE	EVENT
1	Ignition.
2	Powered flight.
3	Coasting.
4	Drogue parachute deployed at an apogee of 5,567 ft. AGL.
5	Main parachute deployed at an altitude of 1,000 ft. AGL.
6	Camera in the nosecone of the rocket begins target spotting.
7	Payload section deploys itself from rocket and deploys its legs and three parachutes.
8	All sections of the rocket land with a KE under 75 ft-lbf.

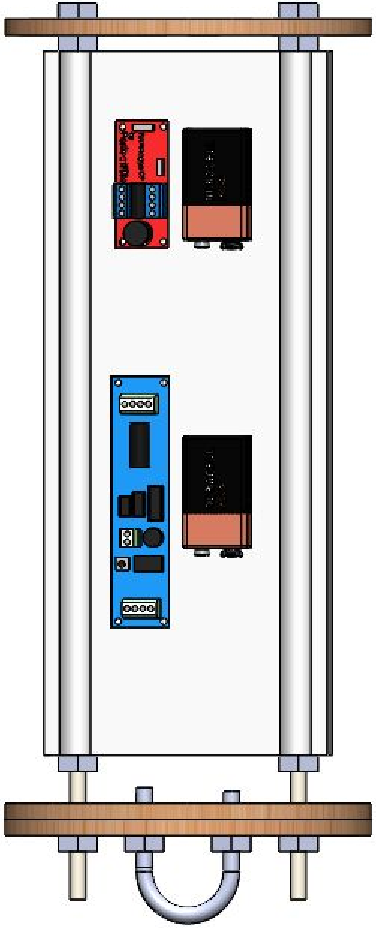
Recovery

Avionics Bay









Calculating Parachute Sizes

- Drogue Parachute
  - Optimally main parachute opens with a velocity around 50mph or 73.333 ft/s
  - Equation for terminal velocity
  - 24’’ diameter elliptical parachute with C_d = 1.5

$$V_{Terminal} = \sqrt{\frac{(2m_{total}g)}{\rho C_1 A_1}}$$

- Main Parachute
  - Payload will detach before rocket lands
  - $KE=(0.5)mv^2$ and heaviest component’s mass → must land slower than 20.501 ft/s
  - Increase safety margin → land with about 15 ft/s
  - Equate force of gravity to force of drag

$$m_{total(w/o\ payload)}g = \frac{1}{2}\rho v_{max}{}^2 C_1 A_1 + \frac{1}{2}\rho v_{max}{}^2 C_2 A_2$$

  - 72’’ diameter toroidal parachute with C_d = 2.2
- Payload Parachute
  - 3 parachutes for stabilization
  - $KE=(0.5)mv^2$ and mass → must land slower than 22.552 ft/s ft/s → safety margin of 15 ft/s
  - 42’’ diameter elliptical parachute with C_d = 1.5

Calculating Final KE

- Avionics Bay and Booster
  - Terminal velocity equations → land at a velocity of 13.988 ft/s
  - Kinetic Energy equations
    - Avionics bay lands with 12.416 ft-lbf
    - Booster lands with 34.918 ft-lbf
- Payload
  - Lands at a velocity of 13.578 ft/s
  - Kinetic Energy equations
    - Payload lands with 27.1856 ft-lbf

Safety

We make sure the team follows codes and regulations, and maintains safety, throughout construction, testing, assembly, and launch.

- Teaching/reinforcing proper safety protocols
- Maintaining MSDS, and explaining relevant information in them
- Maintaining team procedures and hazard analyses

Safety

Mentor duties:

- Supporting the team (or multiple teams) throughout the project year
- Individual owner of the rocket for liability purposes
- Must travel with the team to launch week
- Designated for purchase, store, transport, and use of rocket motors and energetic devices

Requirement Compliance Plan

- Have complied with all design requirements
- Delegation of responsibility for complying with requirements distributed among multiple team leads
- Redundancy: When possible, use both verification by test or analysis and by demonstration or inspection
- Track progress of verifications throughout year (Completed, In Progress, Planned, Not Started)
- Team Derived Requirements: Must meet/adhere to in order to declare project success