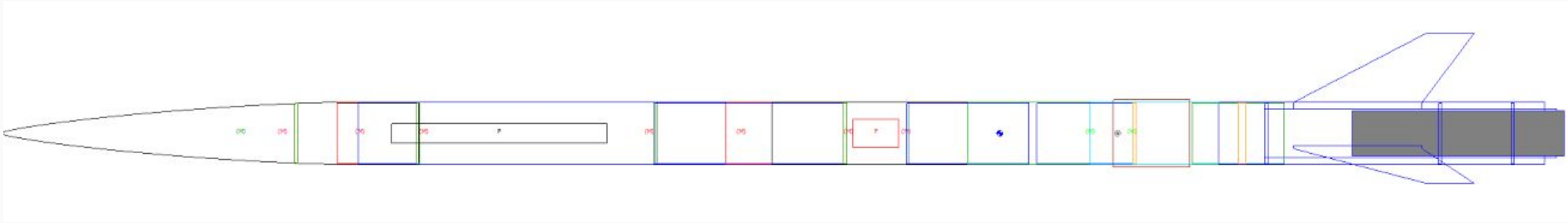
Flight Readiness Review (FRR) Presentation

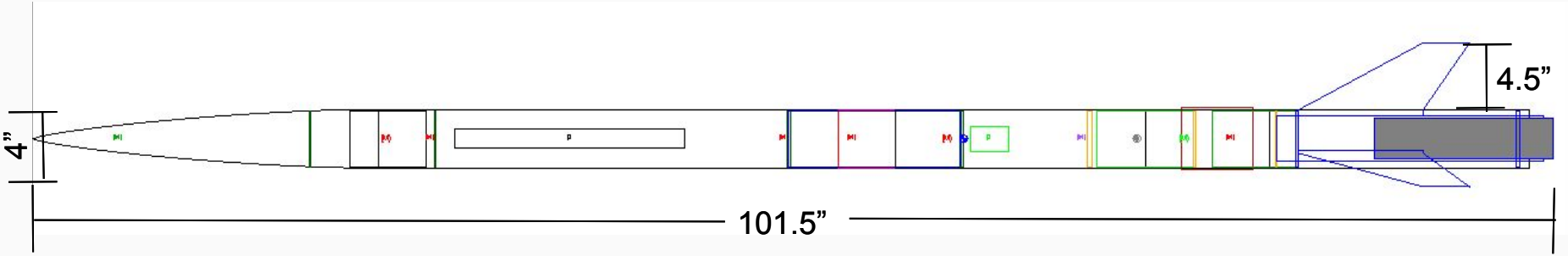
AIAA OC Section 2016-2017
March 20, 2017

Launch Vehicle Design and Dimensions



Launch Vehicle Design and Dimensions

- Length: 101.5 in
- Diameter: 4 in
- Semi Span of Fins: 4.5 in
- Total mass: 11345.2524 or 25.012 lbs



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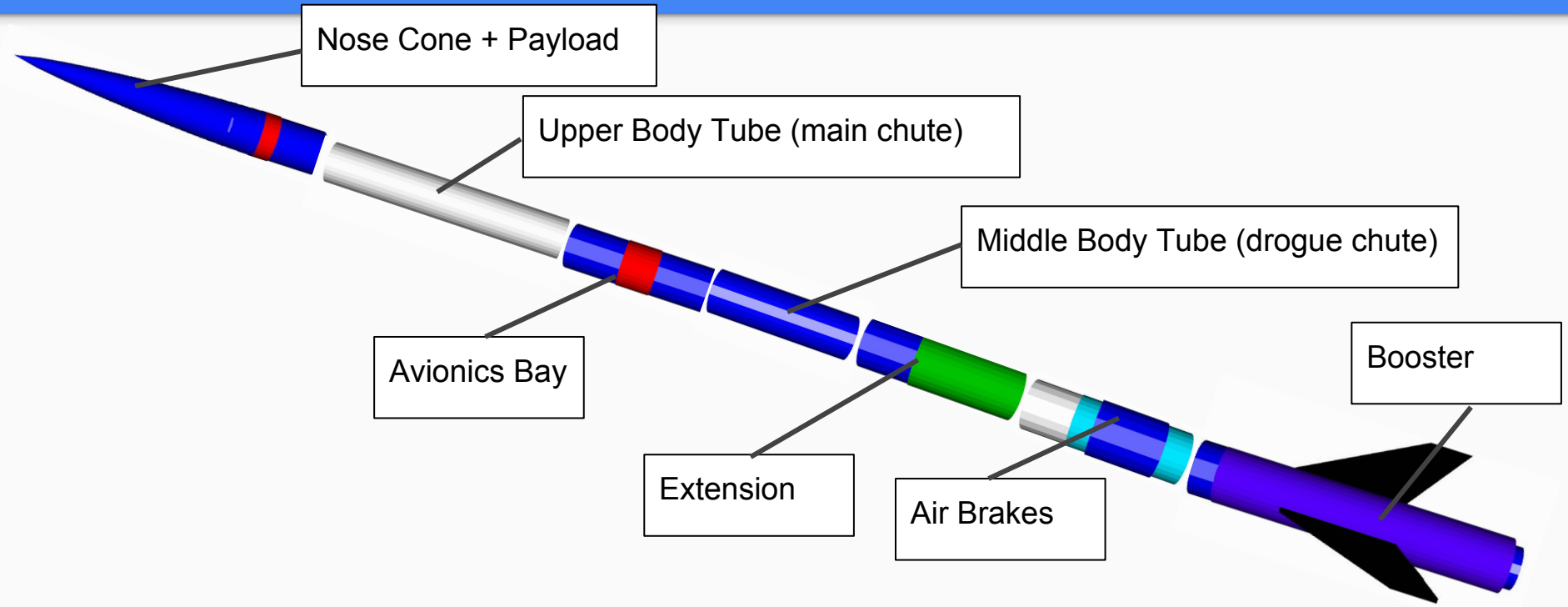

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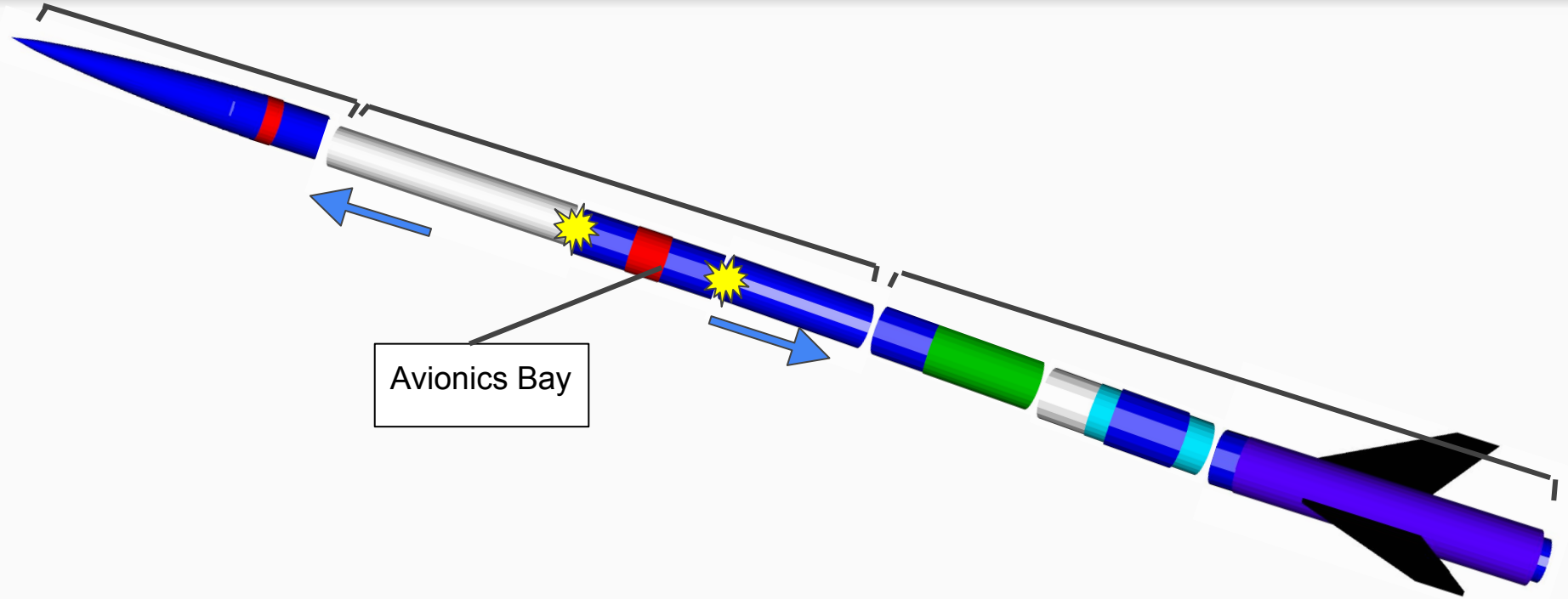

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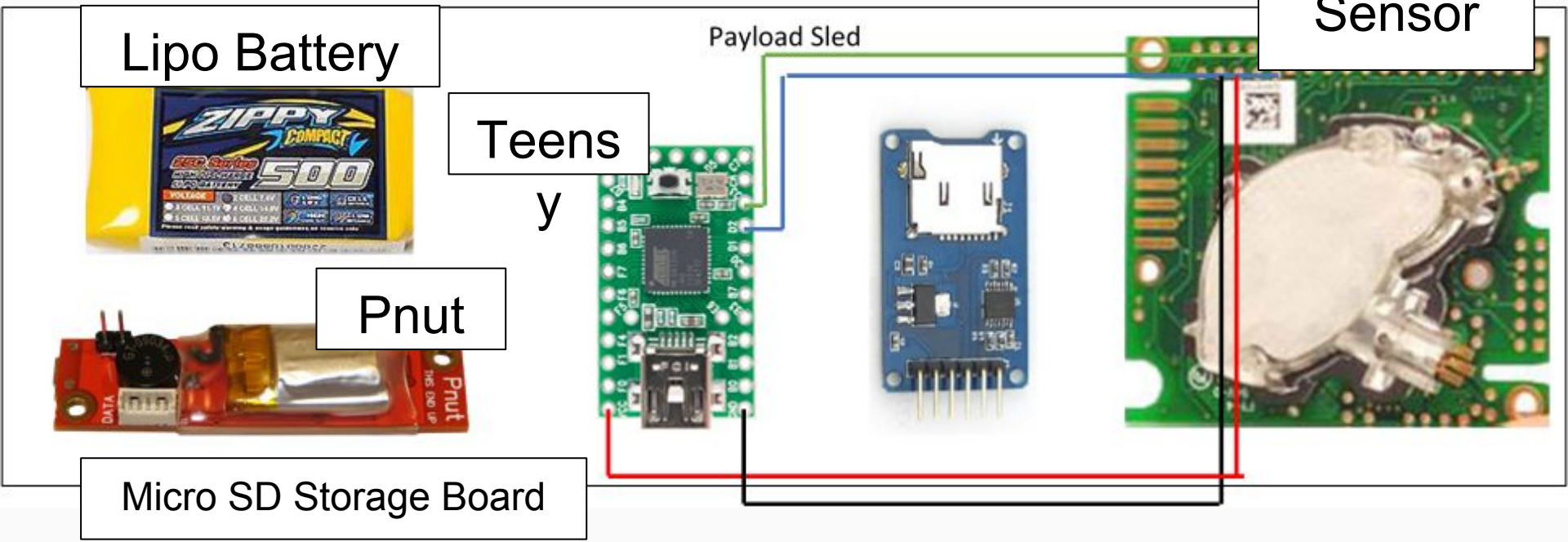
Payload Design and Dimensions



Payload Design and Dimensions

- Length: 8.375 inches
- Diameter: 3.875 inches
- Mass of Electronics + Board: 142 g or 0.31 lbs

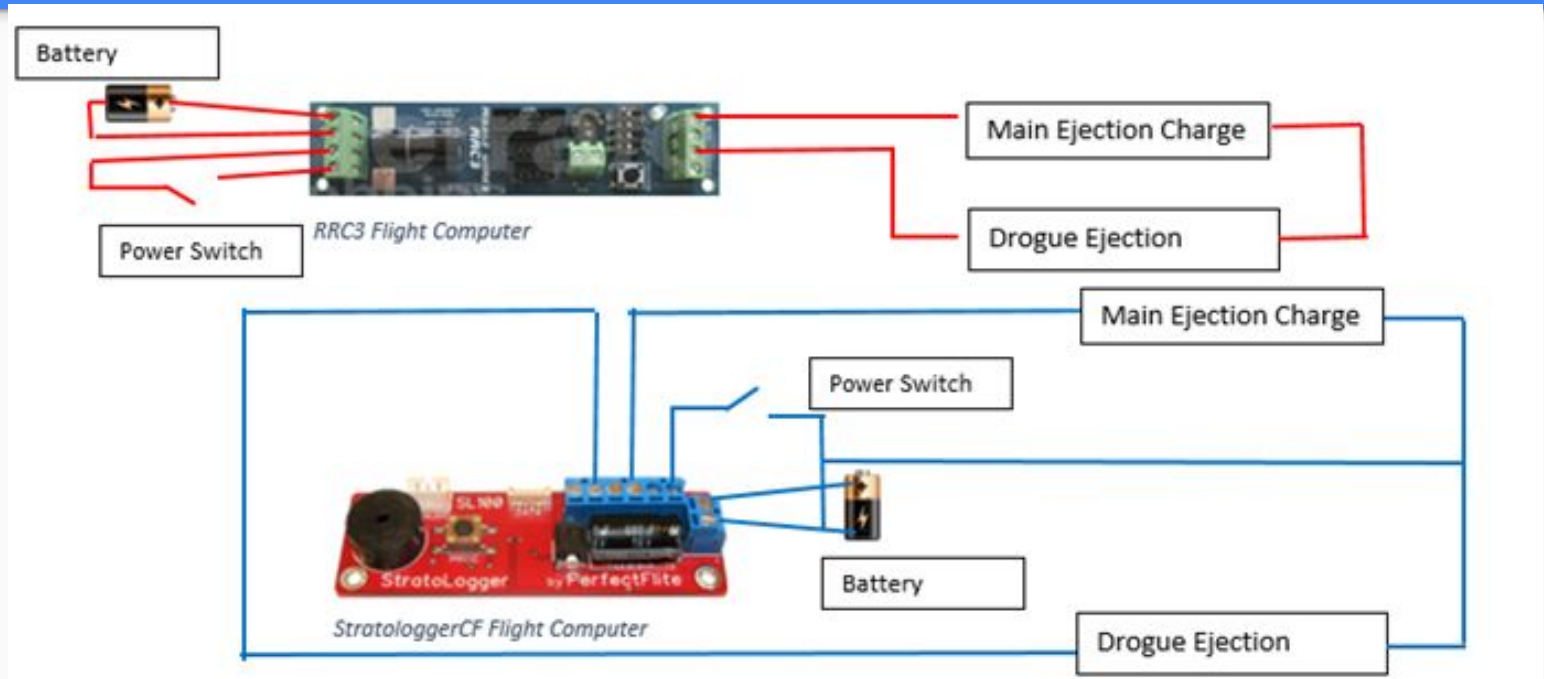
Key Design Features of Launch Vehicle

- Avionics
  - Redundant System
- Payload
- Airbrakes

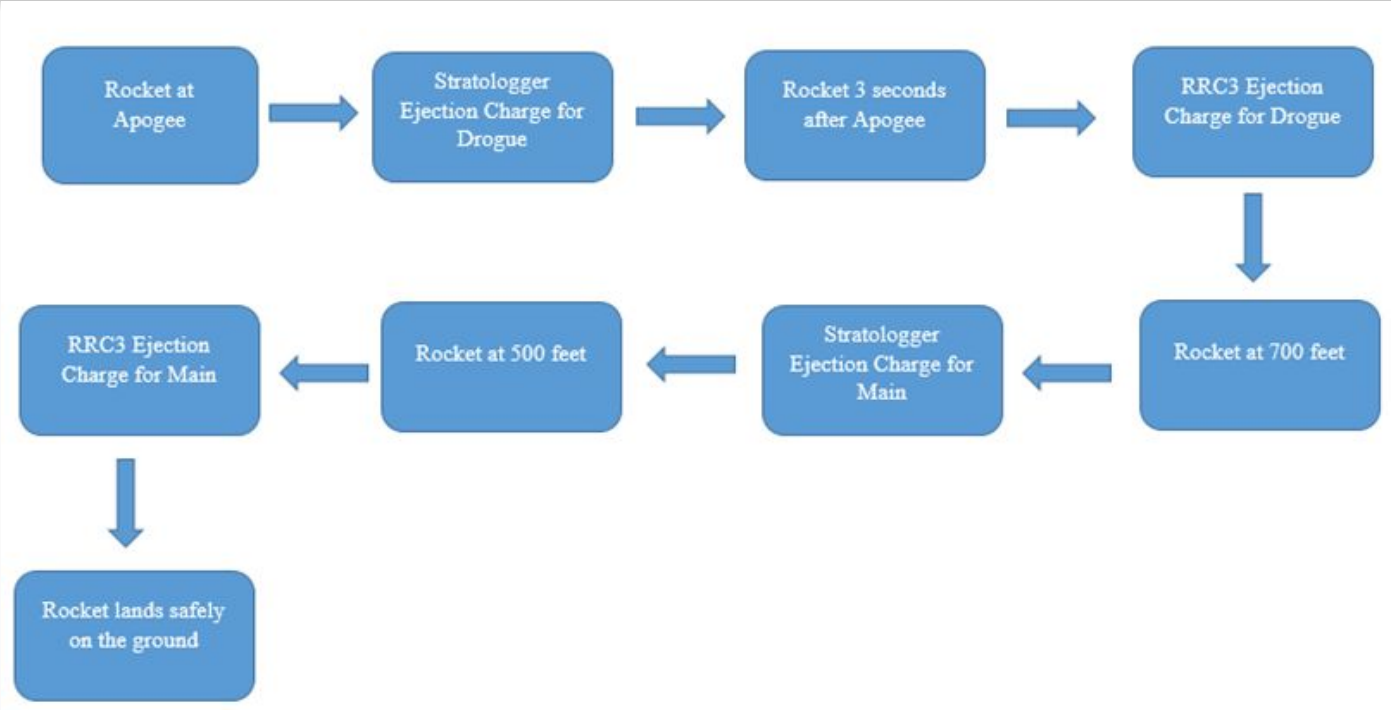
Key Design Features of Avionics

- Stratologger CF (primary)
- RRC3 (backup)
- 2 9V batteries
- 4 Terminals in the bulkheads
  - 2 for main Stratologger and main RRC3
  - 2 for drogue Stratologger and drogue RRC3

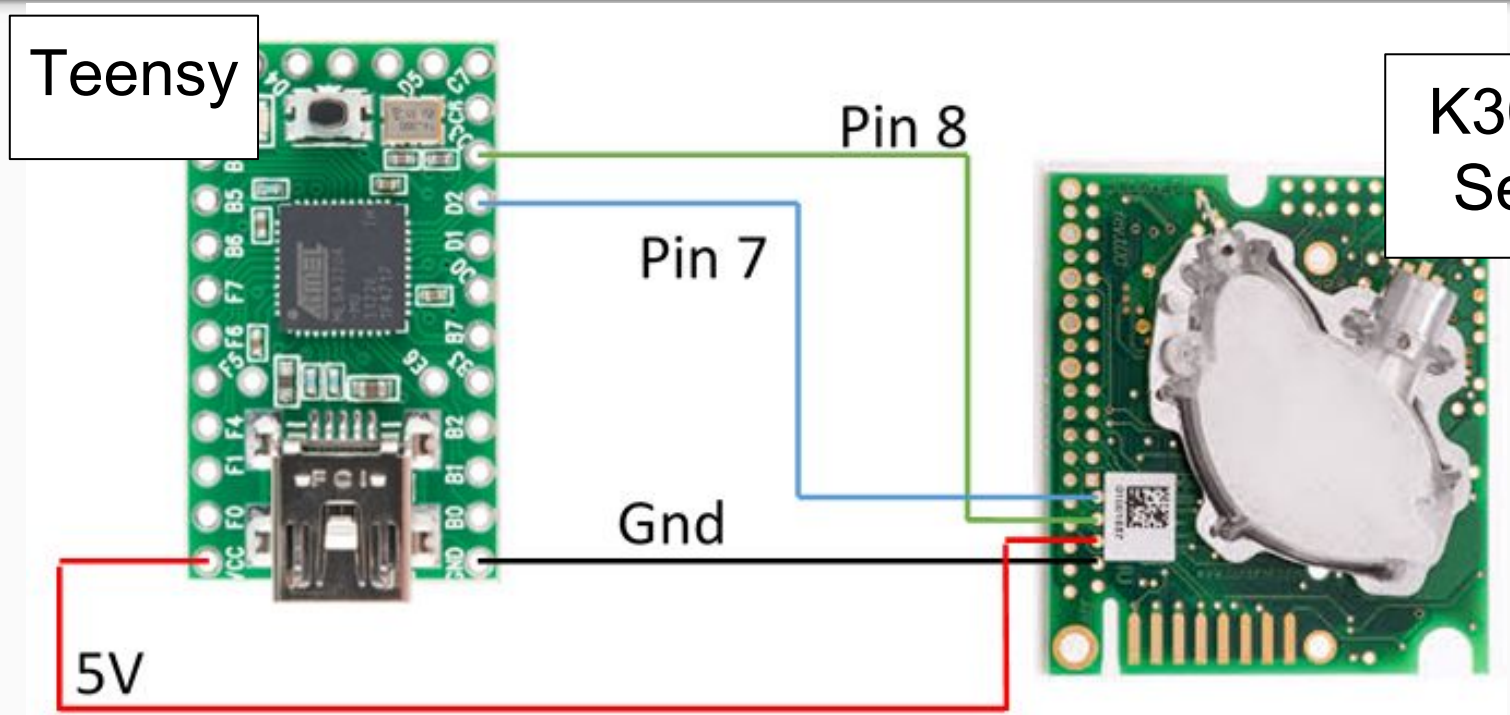
Proof of Redundancy



Recovery Algorithm Flowchart



Key Design Features of Payload

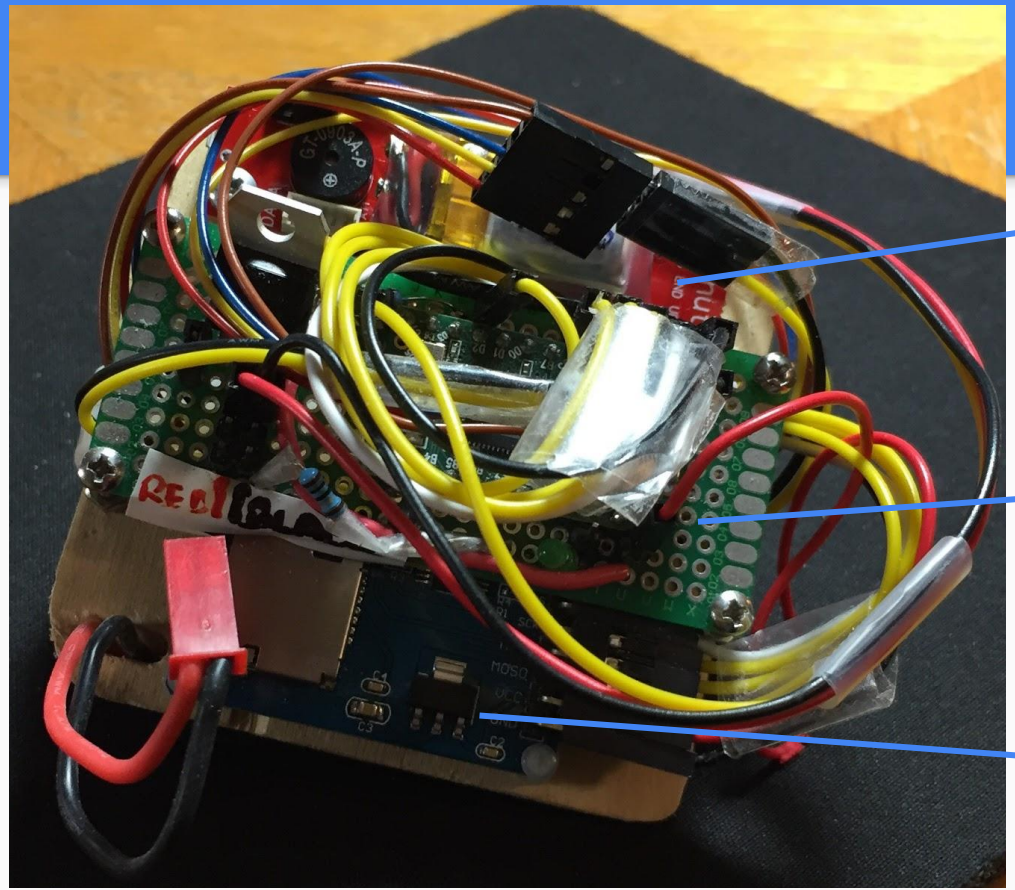


Key Design Features of Air Brakes

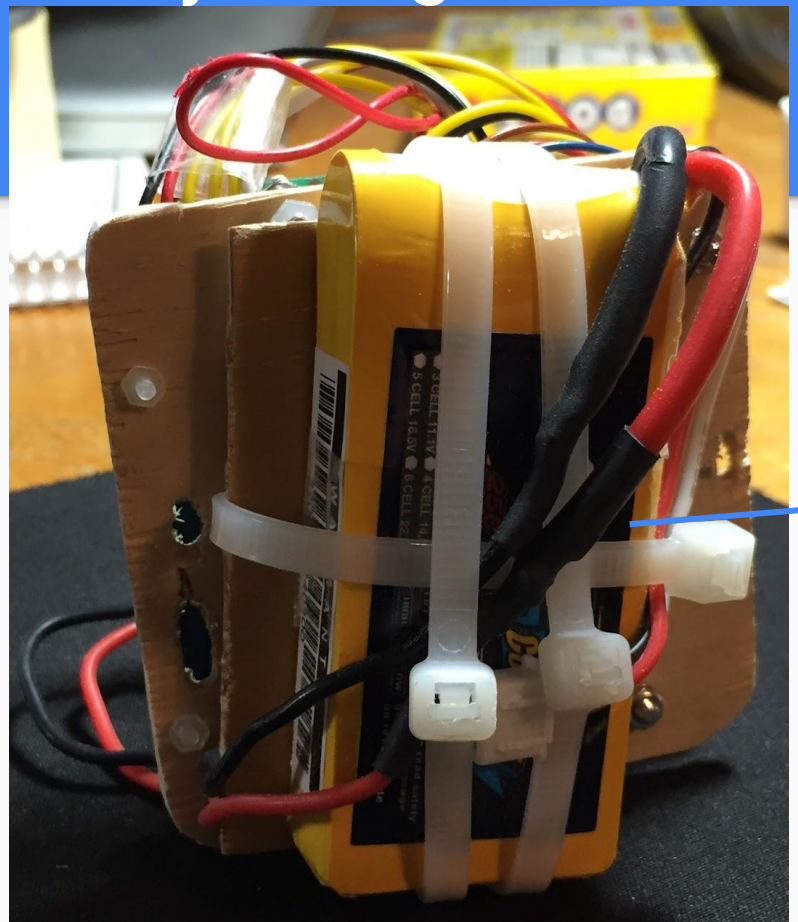
- Air Brakes (mechanism)
- Electronics Board
  - Algorithm

Key Design Feature

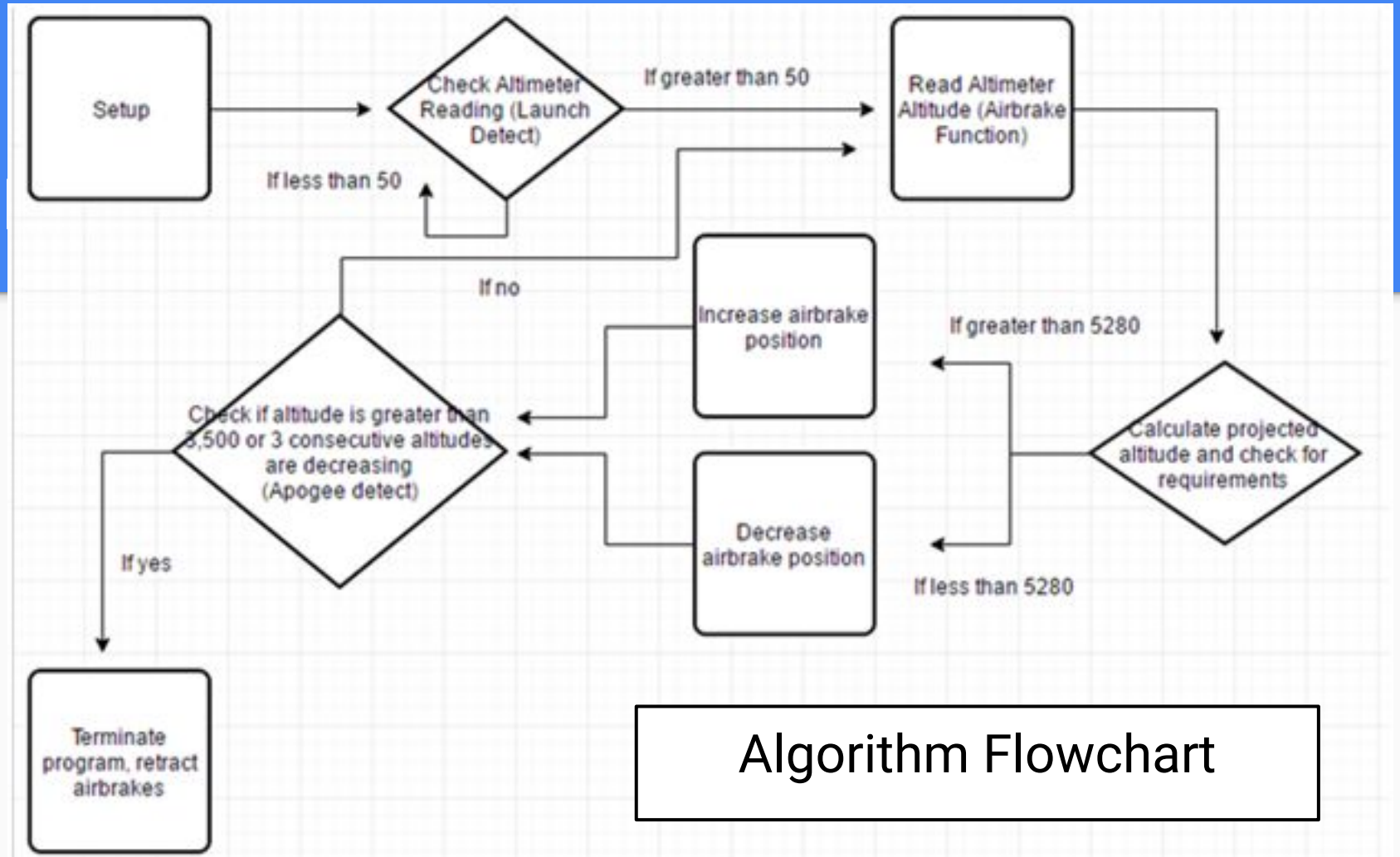
Key Design Features of Air Brakes



Key Design Features of Air Brakes



Lipo Battery



Algorithm Flowchart

Algorithm's Predicting and Actions

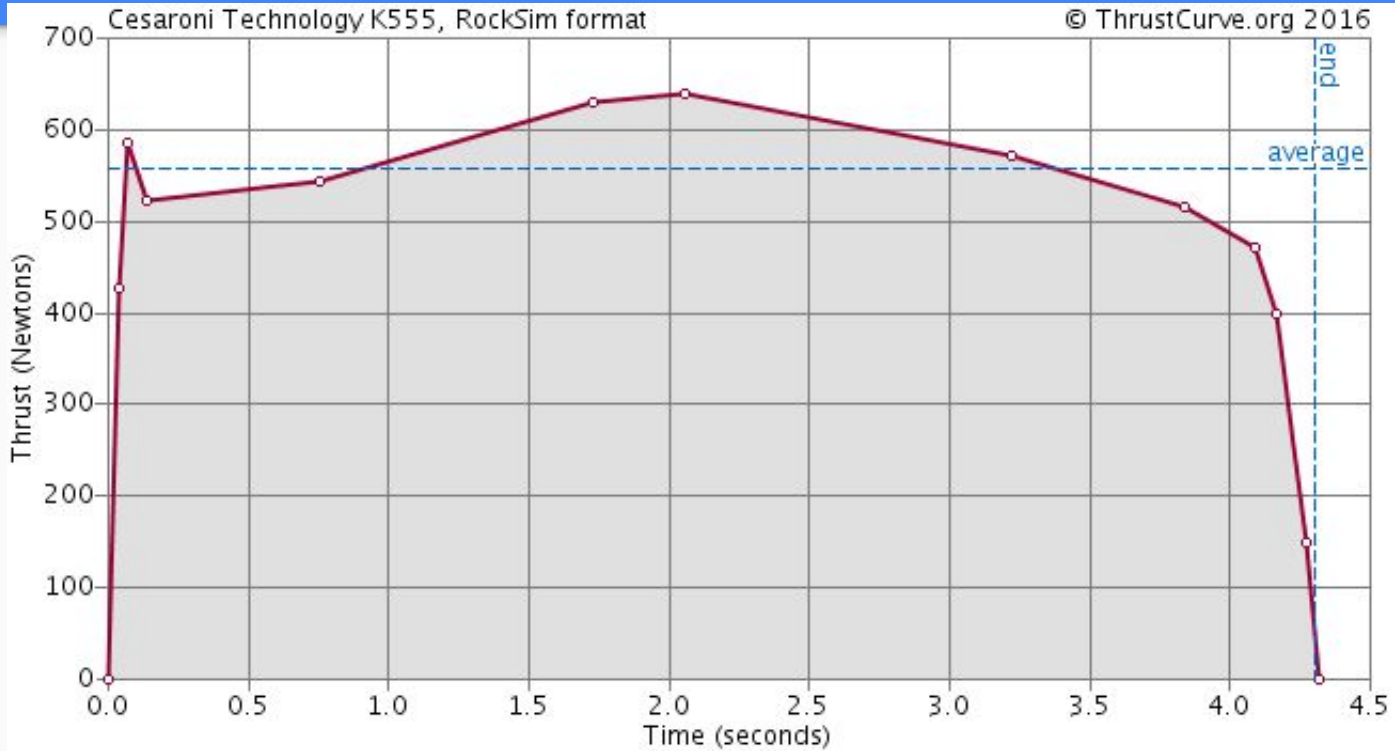
- Conservation of Energy
  - $U_0 + K_0 = U_f + K_f$
  - $mgh_0 + \frac{1}{2}mv_0^2 = mgh_f + \cancel{\frac{1}{2}mv_f^2}$
    - $v_f = 0$ mph at apogee
    - $v_0, h_0 > 0$
  - $mgh_0 + \frac{1}{2}mv_0^2 = mgh_f$
  - $h_f = h_0 + v_0^2/(2g)$
- Coarse tuning and fine tuning
  - High velocity affects altitude predictions

Air Brakes Tested!

https://youtu.be/u1mE3KyIx3E

Motor Description

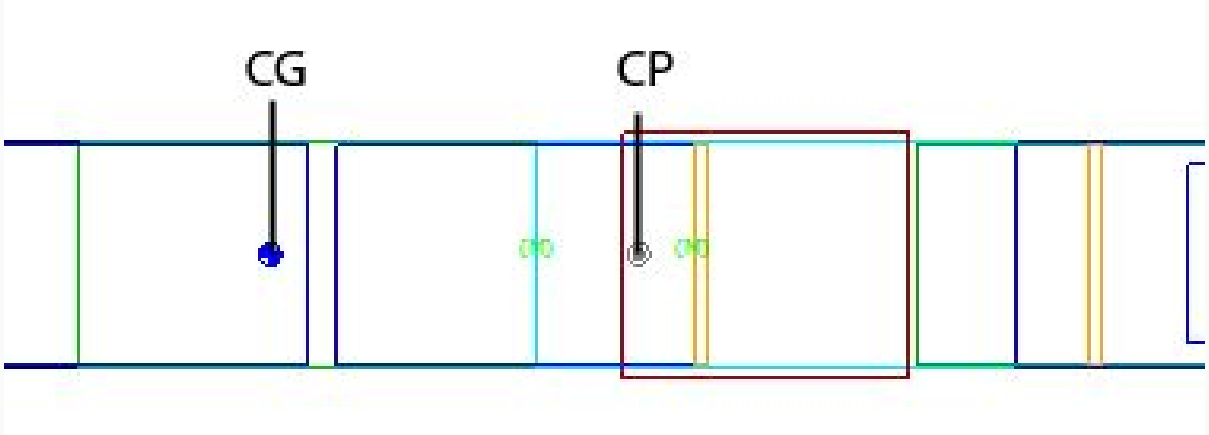
Cesaroni K555



Motor Description

Name	Total impulse (Ns)	Total Mass (g)	Max Altitude (ft), no air brake function	Max velocity (ft/s)	Max acceleration (ft/s^2)
K555	2400.688	2759.0	5451	661.14	615.88

Rocket Flight Stability in Static Margin Diagram



CG: 66.4569 in from nose cone

CP: 72.8941 in from nose cone

Launch thrust to weight ratio and rail exit velocity

Thrust to weight ratio

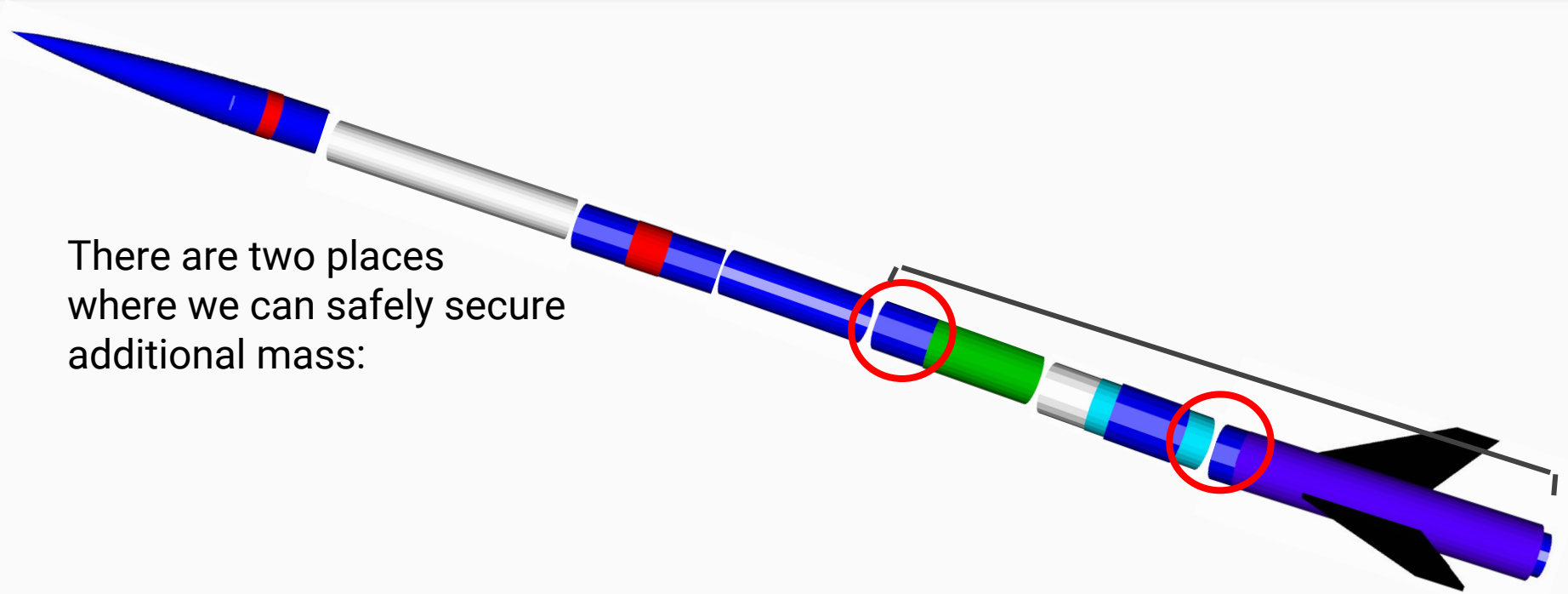
- 6:1

Rail (12 ft) Exit Velocity

- 57 ft/s

Mass Statement

There are two places where we can safely secure additional mass:



Parachute sizes and descent rates

Drogue Chute

- 18” diameter
- Descent rate: 81 ft/s

Main Chute

- 84” diameter
- Descent Rate: 10 ft/s

Kinetic Energy at key phases of mission

With drogue chute out:

- Section 1: 299.27 lbf
- Section 2: 806.12 lbf
- Section 3: 1109.10 lbf

With main chute out:

- Section 1: 4.56 lbf
- Section 2: 12.29 lbf
- Section 3: 16.90 lbf

Predicted altitude at 5, 10, 15, 20 mph winds

Without the aid of air brakes:

- 5 mph--5606 ft
- 10 mph--5492 ft
- 15 mph--5302 ft
- 20 mph--5048 ft

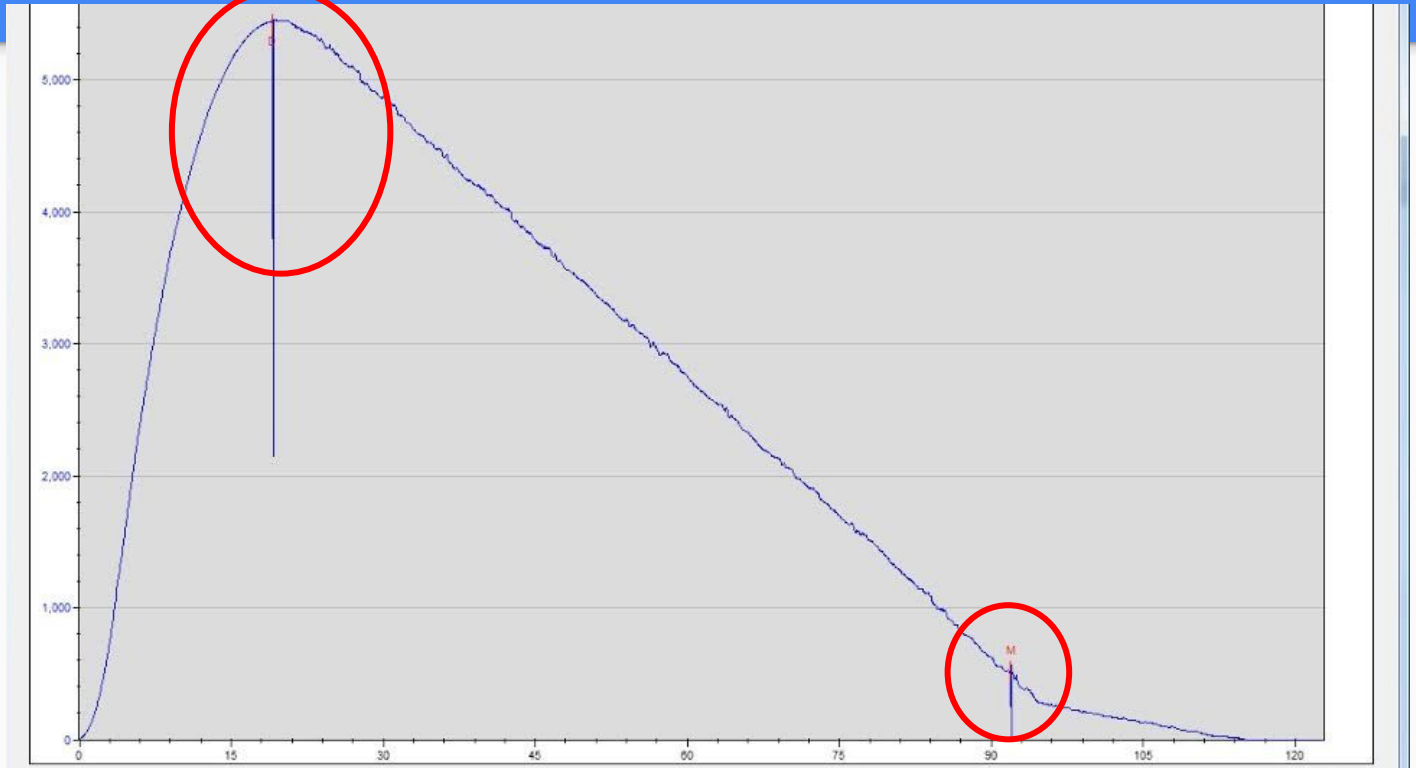
Predicted drift from launch pad

- 5 mph wind--829 ft
- 10 mph wind--1658
- 15 mph wind--2487 ft
- 20 mph wind--3316 ft

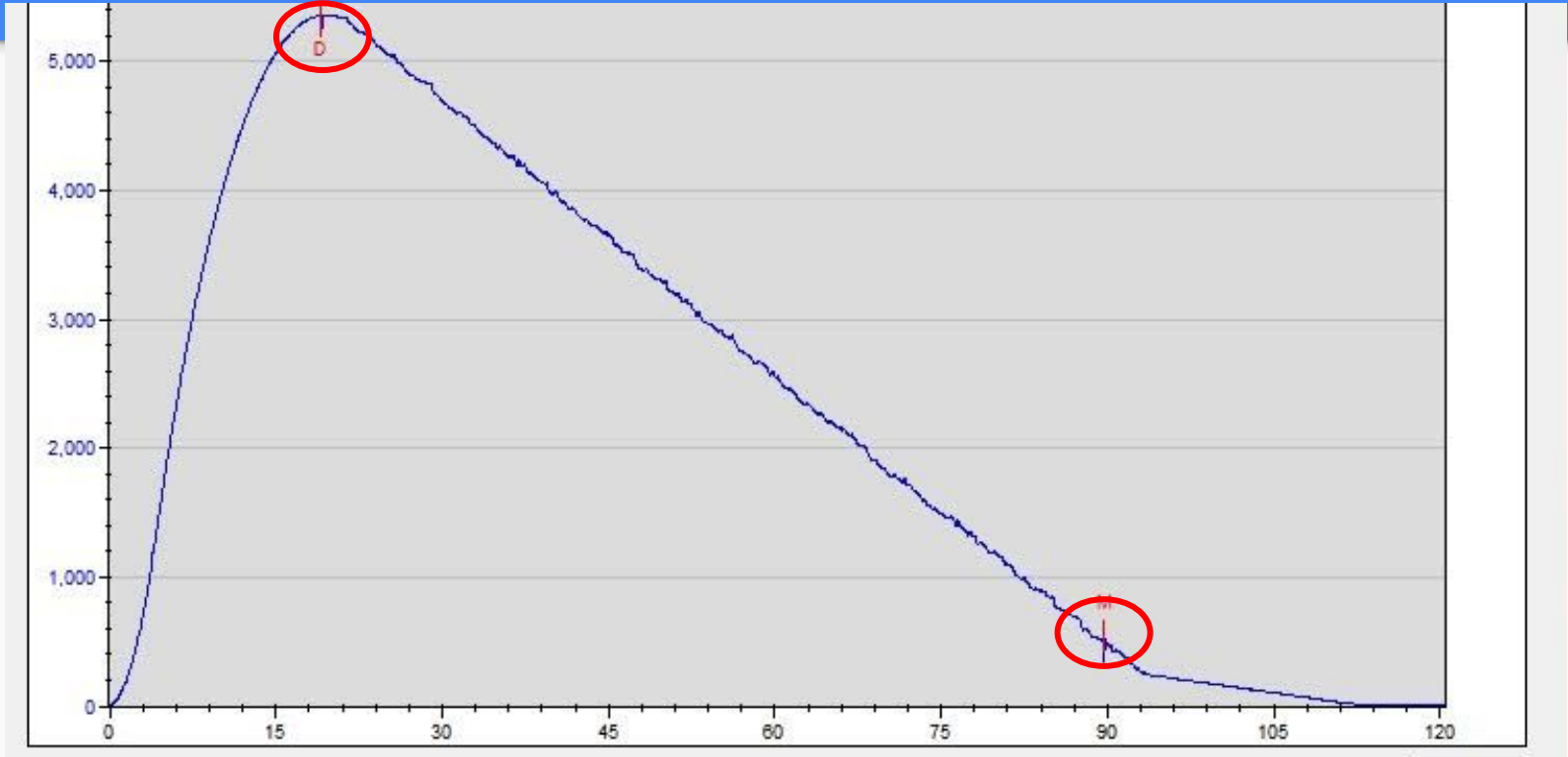
Test plans and procedures

- Vehicle
- Recovery and energetics
- Air brakes
- GPS
- Payload

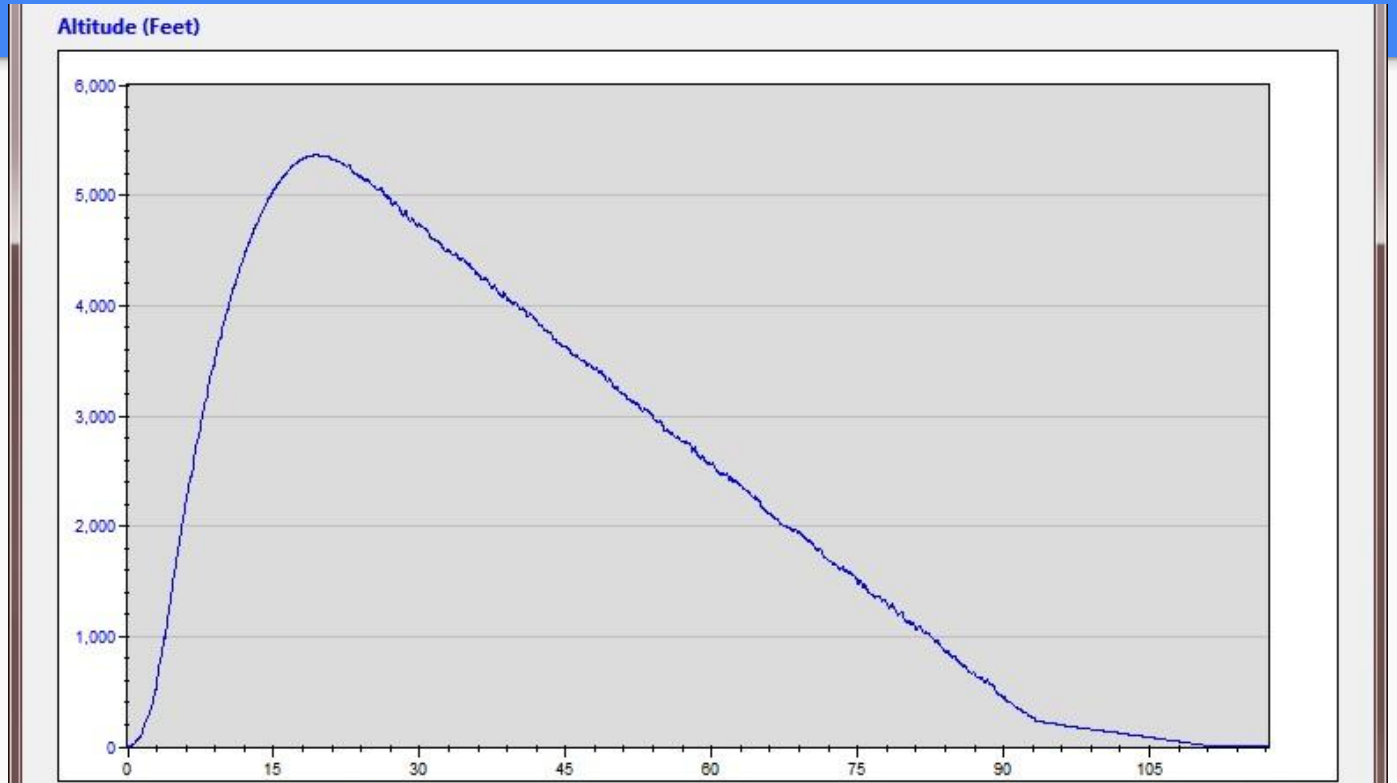
Full scale flight test: Feb. 4



Full scale flight test: March 4



Full scale flight test: March 4, Air Brakes



Recovery System tests

- Black powder tests
  - Need to test for 1-hour wait before launch

Summary of Requirements Verification

- Cross Reference

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Payload integration

Interfaces with grou