



Mars Rover Rocket Safety Document

Spring Grove Area High School &
Dover Area High School

York Area Rocketry Team

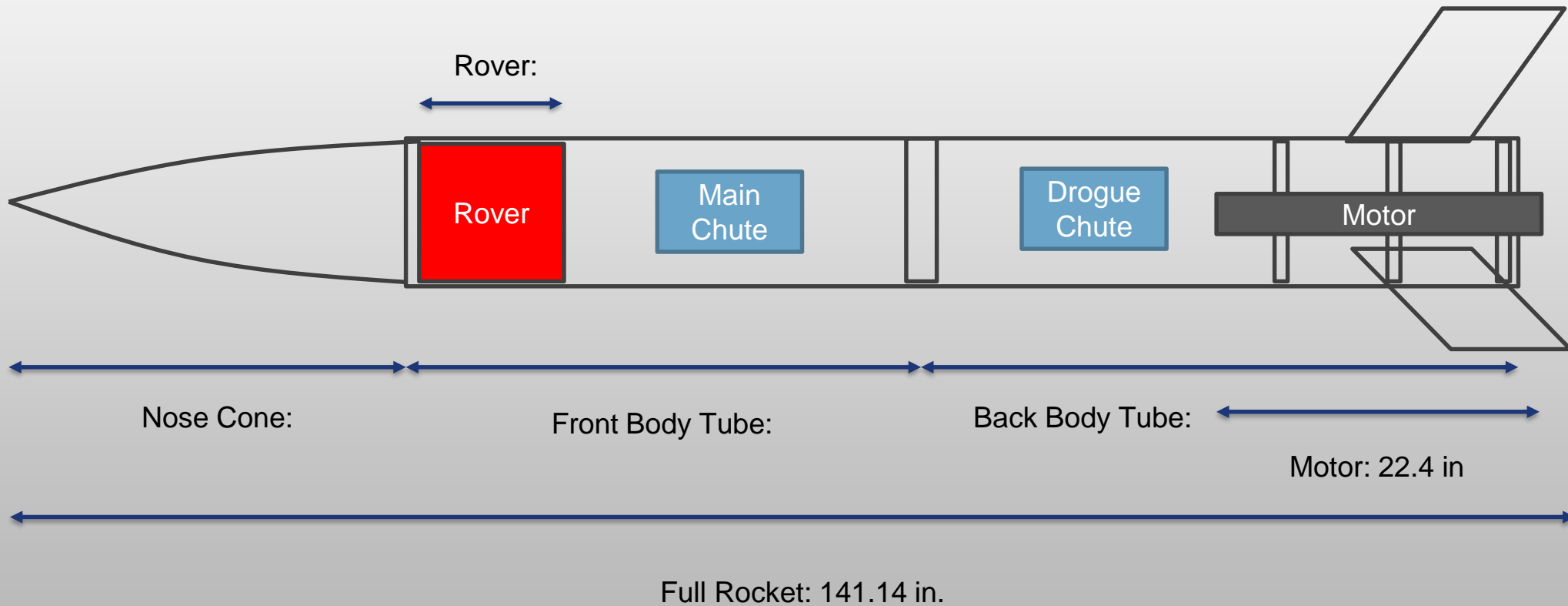
Rocket Design



- Airframe Material - 1/8 inch Phenolic Tubing
- Fin Material – 1/8 inch fiberglass fins
- Nosecone material – Fiberglass
- Adhesives Used - Rocket-Poxy, 5-Minute Epoxy, and JB Weld.
- Rail Guides - Unistrut Rail Buttons
- Bulkheads – 1/2 inch plywood
- Motor Tube – 1/8 inch Phenolic Tubing
- Parachute selection- 10 ft Iris Ultra parachute from Fruity Chutes for main parachute, and 72 inch elliptical for drogue parachute. They're protected by Nomex heat shields and Nomex shock cord sleeves.
- 7/16 inch tubular Kevlar (50 feet)
- 880 lb. limit quick links and swivels
- Key Switch - Type 2, made by CNK
- U Bolts
- Wires
- Ejection Wells – 1" PVC caps

Rocket Design

- A drawing of the rocket identifying all of its components and their dimensions



Rocket Design (cont.)



- Total on the pad weight of rocket
 - With Primary Motor: 52.70 lbs
 - With Secondary Motor: 53.96 lbs
- Location of Center of Pressure (CP) from the tip of the nose cone
 - 101.14 inches
- Location of Center of Gravity (CG) from the tip of the nose
 - With Primary motor: 79.92 inches
 - With Backup motor: 81.43 inches
- Stability Margins
 - With Primary motor: 1.86
 - With Backup motor: 1.73

Primary and Secondary Motors



- Primary motor selection – Aerotech K1440
- It will be using active motor retention with an Aeropack Motor Retainer
- TWR = 6.2:1 (on pad with motor and using average thrust of motor)
- Secondary motor selection – Cesaroni 2000 VMAX
- It will be using active motor retention with an Aeropack Motor Retainer
- TWR = 8.6:1 (on pad with motor and using average thrust of motor)

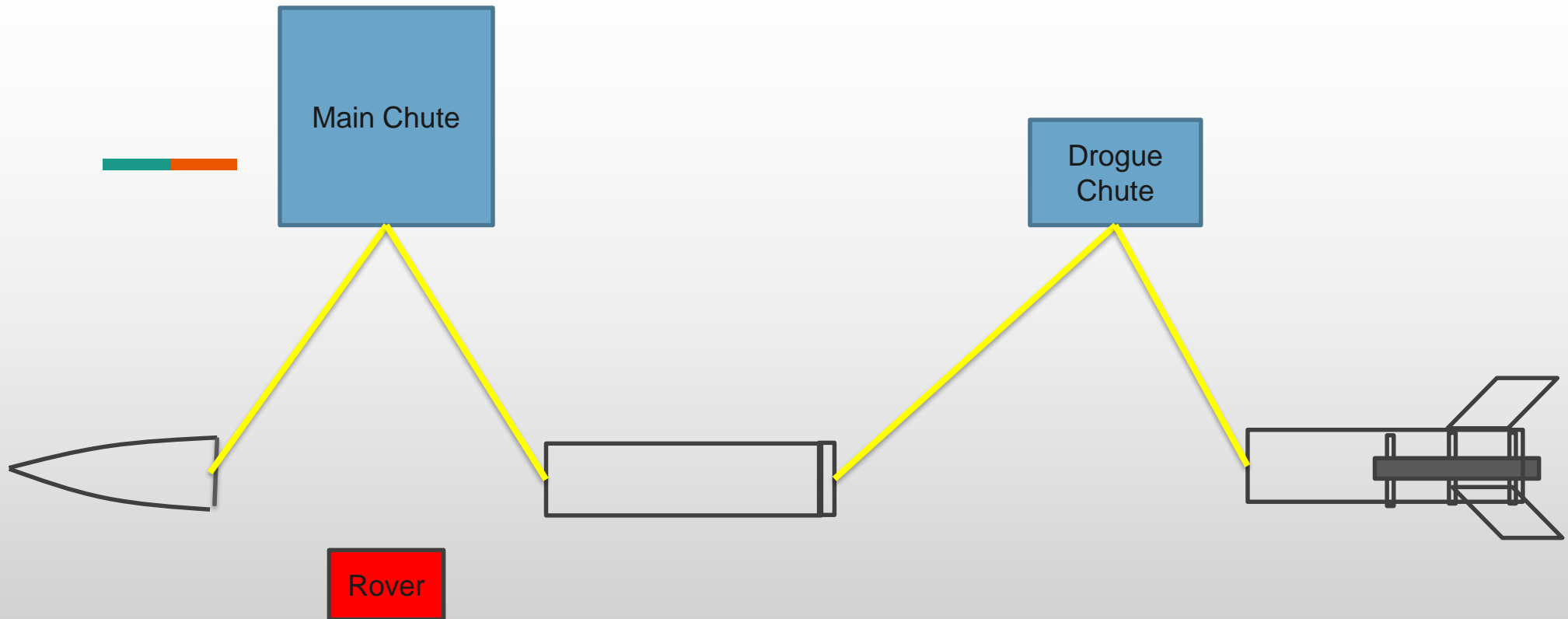
[K1440WT-None]	1265.36	273.53	620.48	9.36	2.80	1265.36
[2330-K2000-VM-P-I]	1209.94	278.69	620.26	9.02	0.17	1209.94

Recovery



- Document method of initiating recovery
 - Electronics Bay is used for ejection charge initiations.
- Parachute
 - 10 ft Iris Ultra parachute from Fruity Chutes for main parachute, and 72 inch elliptical for drogue parachute
 - The drogue is as large as it is to reduce the decent rate enough for the rover to be able to deploy safely.
 - For main, a safe decent is less than 20ft/s. We used RockSim to calculate the decent rate.
 - To protect the parachutes, Nomex deployment bags will be used.

Recovery



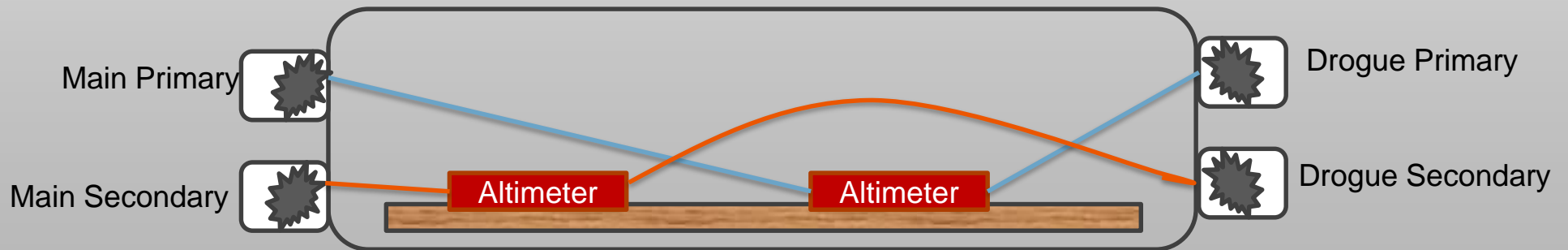
- 7/16 inch tubular Kevlar, 1200 lb. max
- Swivel and quick links. 880 lbs. max
- U-Bolts are mounted to the E-bay bulkheads with washers and lock nuts, and then epoxy overtop. This stops the nuts from coming loose, or anything un-attaching

Recovery Electronics



- Identify commercial altimeter(s) that will be used
 - Stratologger CF from PerfectFlite

- Show wiring diagram of altimeters with charges



Recovery Electronics



- Three ½ inch portholes were drilled
- The altimeter will be prepared by replacing batteries within an hour before launch, and testing continuity.
- Drogue – 13 grams of black powder was tested and was successful
- Main – 7 grams of black powder was tested and was successful
- Specify the volume of the section to be pressurized with calculated pressure level
- Drogue – 3607 in²
- Main – 1973 in²
- Specify how sections are secured before the ejection charges separate sections
 - shear pins – 0.075" (x3)
- Identify how charges are fired
 - e-matches