# Target Altitude Safety Document

Spring Grove Area School District

Project Aether

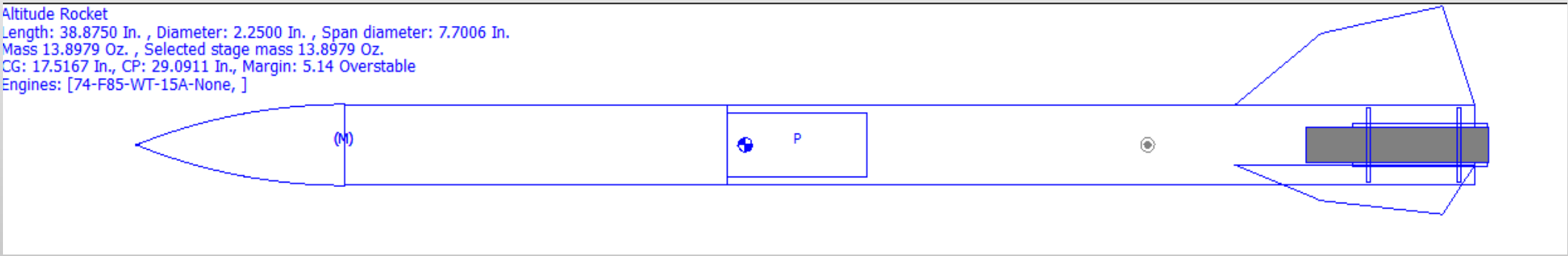
# Materials used

- 2 inch cardboard body tube – body tube
- 1/8 inch plywood-fins and altimeter mount
- 5 1/8 inch plywood centering rings – altimeter mount, bulk head motor casing
- linear rail lug- launch lugs
- Eye bolt and nut- bulk head
- 3mm Kevlar cord- shock cord
- Pop rivets- to secure noise cone
- Memory foam- nose cone filling
- Nomex fabric-heat shield
- 22 inch diameter parachute
- zap medium CA+- super glue
- two part five minute epoxy
- 29mm motor retainer
- 25grams of PLA plastic- nose cone
- 1 ¼ inch cardboard tubing-motor casing
- ½ inch cardboard tubing

# Other rocket design components

- Total weight with primary  motor -15.6 ounces
- Total weight with secondary motor- 15.7 ounces
- Primary motor-center of gravity from tip of nose cone- 22 inches, center of pressure from tip of noise cone- 29 inches.
- Secondary motor-center of gravity from tip of nose cone-17.5 inches, center of pressure from tip of noise cone-29in inches
- Rockets stability- primary motor-5.02 over stable.
- Rockets stability-  secondary motor-5.14 over stable

# Drawing of rocket and it's parts and dimensions



# Motor information

- The primary motor choice is a cesaroni f-30 with a thrust to weight ratio of 7.01:1.
- The secondary motor choice is a cesaroni f-85 with a thrust to weight ratio of 18.57:1.
- Our method of motor retention is to use a motor casing and a retaining cap.

# Motor simulation

- Primary motor simulation:

| Engines loaded | Max. altitude Feet | Max. velocity Feet / Sec | Max. acceleration Feet/sec/sec | Time to apogee | Velocity at deploym Feet / Sec | Altitude at deploym Feet |
|---|---|---|---|---|---|---|
| [73-F30-WH_LB-6A- | 2032.86 | 439.02 | 4882.41 | 10.37 | 214.91 | 599.76 |

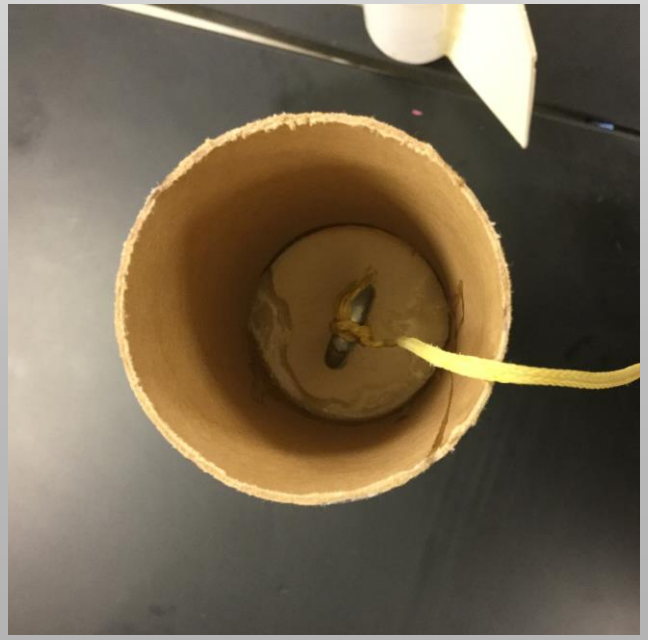
- Secondary motor simulation:

| Engines loaded | Max. altitude Feet | Max. velocity Feet / Sec | Max. acceleration Feet/sec/sec | Time to apogee | Velocity at deploym Feet / Sec | Altitude at deploym Feet |
|---|---|---|---|---|---|---|
| [74-F85-WT-15A-No | 1984.09 | 559.52 | 5014.63 | 9.65 | 211.42 | 599.93 |

# Recovery systems

●What we are using strong eye bolts connected to a ¼ inch plywood bulk head and an eye bold connected to the motor mount.

● The Kevlar shock cord is very strong and is securely knotted and epoxied to the eye bolts and the parachute is knotted and securely glued to the shock cord..



# Recovery methods

- We will be using the motor ejection from the motor and drilling into the charge so that both the primary and secondary motor delays will be set at nine seconds.
- Our parachute is a 16" CATO Shute which will carry our .97 lb rocket at a descent no faster than 20 fps.
- The parachute will be protected by a Nomex heat shield which is 6" by 6" to properly create a barrier for heat in a 2" diameter rocket

# Recovery electronics

- We will be using a perfect flight P-nut altimeter to document the altitude that we reach.
- We will have four pressure ports at approximately 0.025 inches in size.
- The only preparation for the altimeter is to charge it and then turn it on and it is ready to go.
- The sections of the rocket are secured by a friction fit.
- The charges are fired when the delay burns out that is inside the motor.