
# Structures - Deployment

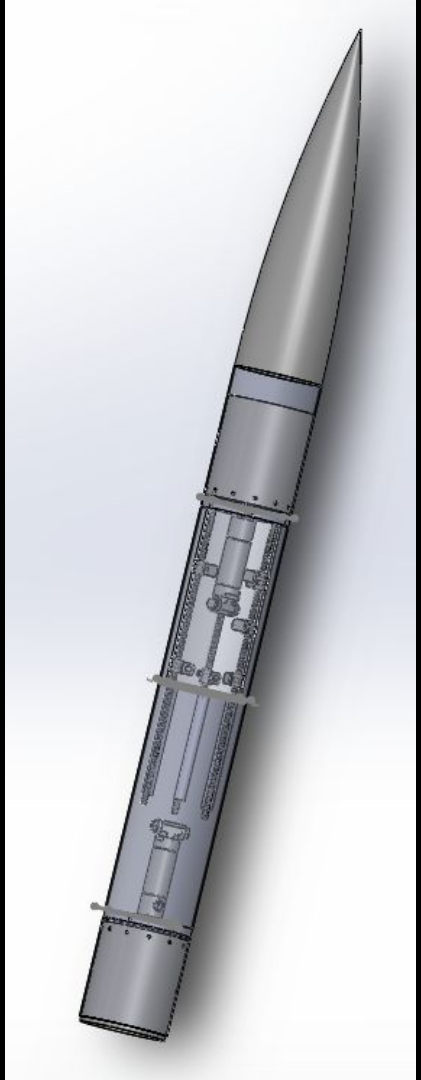
*11 March 2023*

# Medusa Deployment Mechanism Needs:

- Deploy all four parachutes successfully
- Limit cost/weight/complexity of system
- Be viable at high altitudes (low pressure, low temperature)
- Preventing early deployment
- Preventing parachute loss

# Concept 1: Black Powder Piston

- A small piston attaches to a diaphragm and cup that holds soft goods. E-matches ignite sealed black powder charges which extend the piston and break the shear-pins.
- Two pistons: One inside the AV Tower points upward toward main parachute, and second is under AV tower pointing downward.



# Black Powder Piston: Mass and Dimension

- Piston: 1 lb
- Aluminum diaphragms: 0.3 lb * 2 = 0.6 lb
- Brass fittings: 0.1 lb
- Fiberglass cup: 0.3 lb
- Anti-rotation rod: 0.05 lb
- Rope guide: 0.05 lb

Total: ~2.05 lb per mechanism

# Black Powder Piston: Cost Estimate

- Piston: $35.33
- Aluminum diaphragms: $22.89
- Brass fittings: $1.23 each
- Fiberglass cup: $11.44
- Anti-rotation rod: $6.93
- Rope guide: $10

Total: $87.82 per mechanism

# Black Powder Piston: Pros and Cons

Pros

- Familiar system
- Relatively cheap

Cons

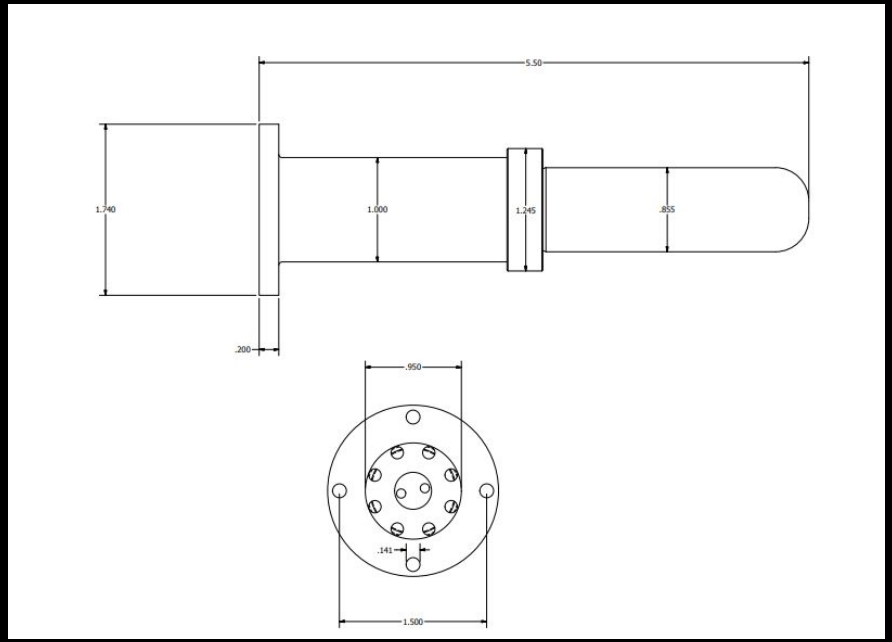
- More space required
- Necessity for more vacuum testing
- Heavier system
- Difficulties in high altitude deployment

# Concept 2: $CO_2$ Cartridge

- Cartridge releases CO2 into sealed parachute chamber, increasing the pressure within to break the shear pins and deploy the parachute
  - Chamber sealed by fiberglass bulkheads on top and bottom
- CO2 is released by a mechanism that punctures the cartridge such as premade CO2 ejection systems available for purchase online (Eagle)

# $CO_2$ Cartridge: Mass and Dimension

- RAPTOR & EAGLE: 4 oz without CO2
  - 16g canister: 0.7 oz



# $CO_2$ Cartridge: Cost Estimate

- Cartridges: $1.60
- RAPTOR COTS mechanism: $145
- EAGLE COTS mechanism: $135
- Solenoid: $40

# $CO_2$ Cartridge: Pros and Cons

Pros

- Lightweight and compact
- “Tested in vacuum”

Cons

- Unfamiliar system
- Expensive to buy, would take time to replicate correctly
- Need to make parachute bay somewhat airtight
- Potential for pressure-induced deployment