# Simulation Information

## Masses (lb)

$W_R$ { Drogue & Main: 6.21
Anchor: 0.28
ARRD: 0.08

$W_P$ Payload: 8
$W_A$ Avionics: 3.04
$W_N$ NOS assembly: 21.56
$W_S$ Swagelok assembly: 8.35
$W_C$ Combustion chamber assembly: 9.49

From Nosecone shape: $C_{d_N} = 0.15$
From cylinder: must find this

} For drag force calculation
$F_d = F_{d_{nose}} + F_{d_{body}}$

## Givens:

$\rho = 0.0765\ lb/ft^3$
$V = 1000\ ft/s$
$A = \pi r^2 = \pi (0.615/2)^2 = 0.2971\ ft^2$

From sims { $C_d = \sim 0.01$
$F_d = \sim 114\ lb_f$
Thrust = $200\ lb_f$

## Calcs to be done

$F_d = \frac{2C_d}{\rho V^2 A} \rightarrow C_d = \frac{2F_d}{\rho V^2 A}$ Drag Force

axial (y-directional stress) and von-mises stresses (Maybe also deflection & strain)

$\sigma_{cr} = \frac{\pi^2 E}{(k\frac{L}{r})^2}$

**Aluminum 6061 T6:**
$E = 10007604\ Psi$

**PVC:**
$E = 400000\ Psi$

| Buckled shape of column is shown by dashed line | (a) | (b) | (c) | (d) | (e) | (f) |
|---|---|---|---|---|---|---|
| Theoretical $K$ value | 0.5 | 0.7 | 1.0 | 1.0 | 2.0 | 2.0 |
| Recommended design value when ideal conditions are approximated | 0.65 | 0.80 | 1.0 | 1.2 | 2.0 | 2.0 |
| End condition code | Rotation fixed, Translation fixed | Rotation free, Translation fixed | Rotation fixed, Translation free | Rotation free, Translation free | | |

A = Area ($in^2$, $mm^2$)
I = Moment of Inertia ($in^4$, $mm^4$)
$G_r$ = Radius of Gyration = (in, mm)
y = Distance of Axis to Extreme Fiber (in, mm)

| Section | Open Section Properties Case 17 Calculator | Open Section Properties Case 18 Calculator | Open Section Properties Case 19 Calculator |
|---|---|---|---|
| Moment of Inertia | $\frac{\pi d^4}{64}$ | $\frac{(9\pi^2-64)d^4}{1152\pi}$ | $\frac{\pi(D^4-d^4)}{64}$ |
| Radius of Gyration | $\frac{d}{4}$ | $\frac{\sqrt{(9\pi^2-64)d^2}}{12\pi}$ | $\frac{\sqrt{D^2+d^2}}{4}$ |
| Area | $\frac{\pi d^2}{4}$ | $\frac{\pi d^2}{8}$ | $\frac{\pi(D^2-d^2)}{4}$ |
| y | $\frac{d}{2}$ | $\frac{(3\pi-4)d}{6\pi}$ | $\frac{D}{2}$ |

K = 0.65
L = length
r = radius of guration