

Final Design Review

Lockheed Martin #2
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Agenda

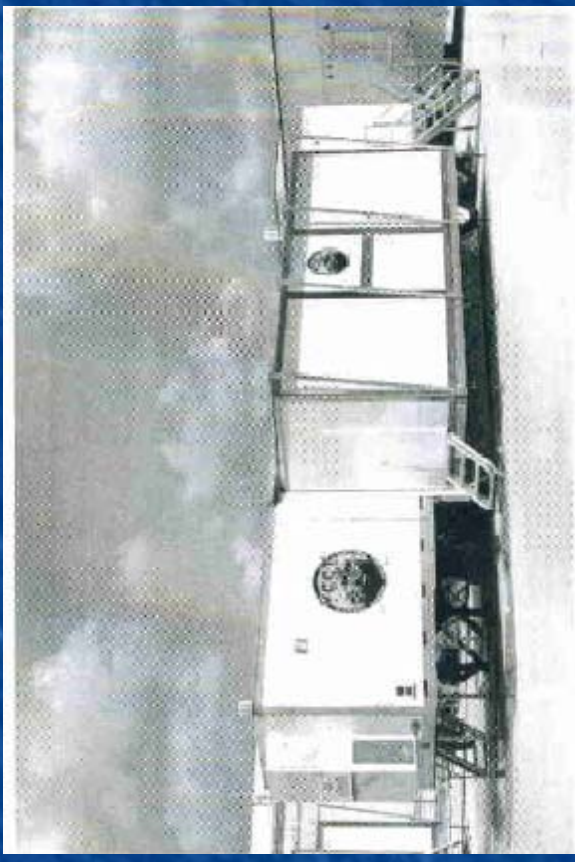
- Review Problem Definition
- Schematic/Positioning
- Parts
- Force Analysis
- Cost Analysis
- Animation
- What's Next
- Questions

Problem Definition

- A device needs to be designed that will raise the roof of the Virtual Combat Convoy Trainer.

Major Goals:

- Make the current process safer
- Decrease Personnel



Process of Lifting the Roof

Step 1: Trailer



Step 2: Initial Roof Lift

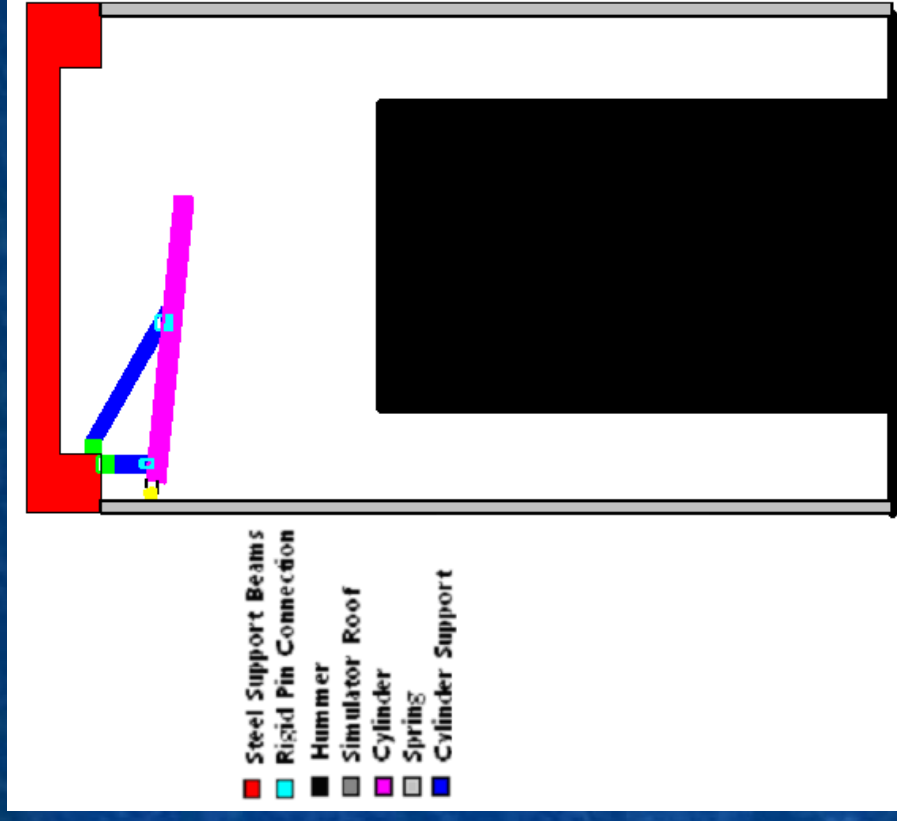


Step 3: Final Roof Height



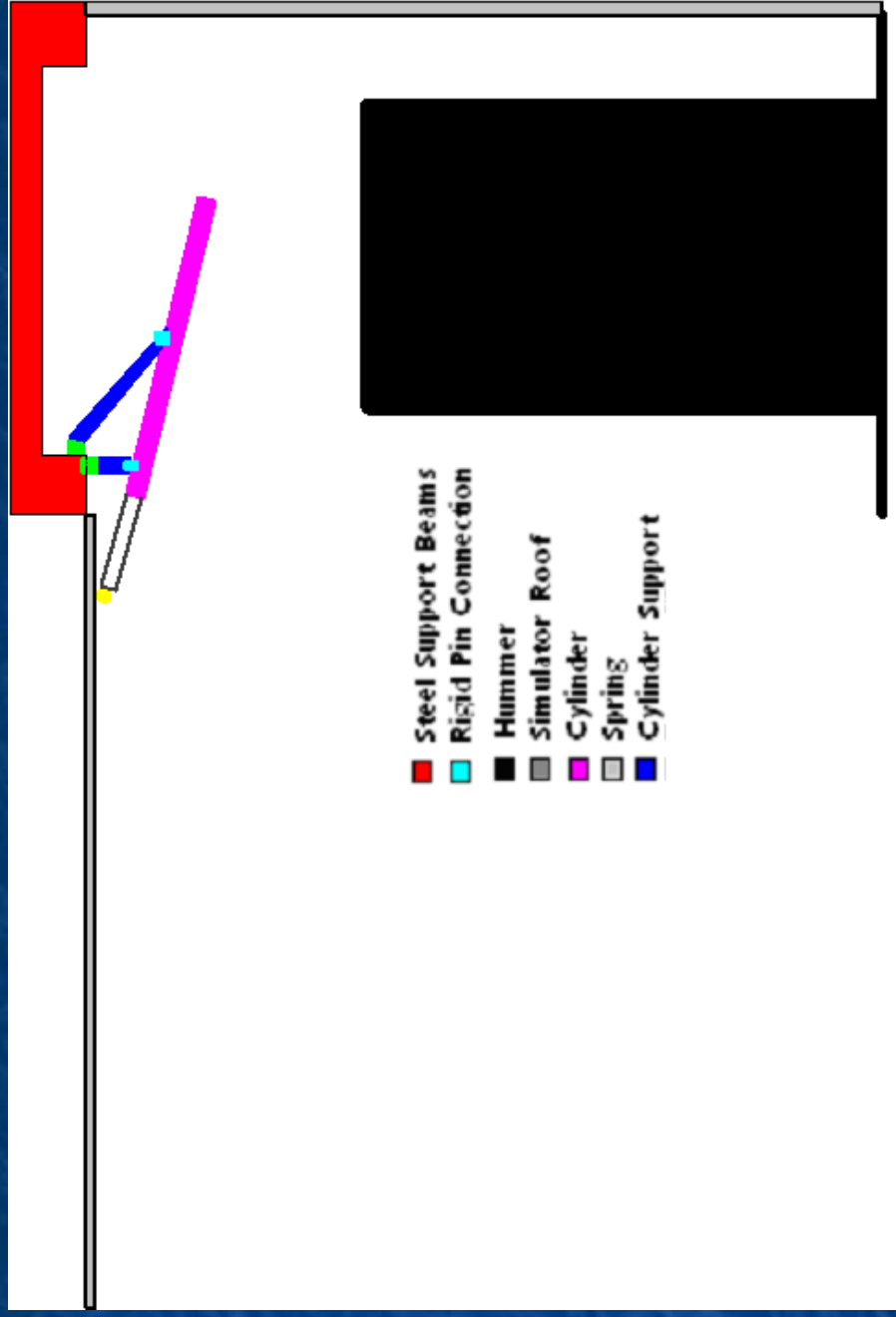
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System Schematic (Closed)



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System Schematic (Open)

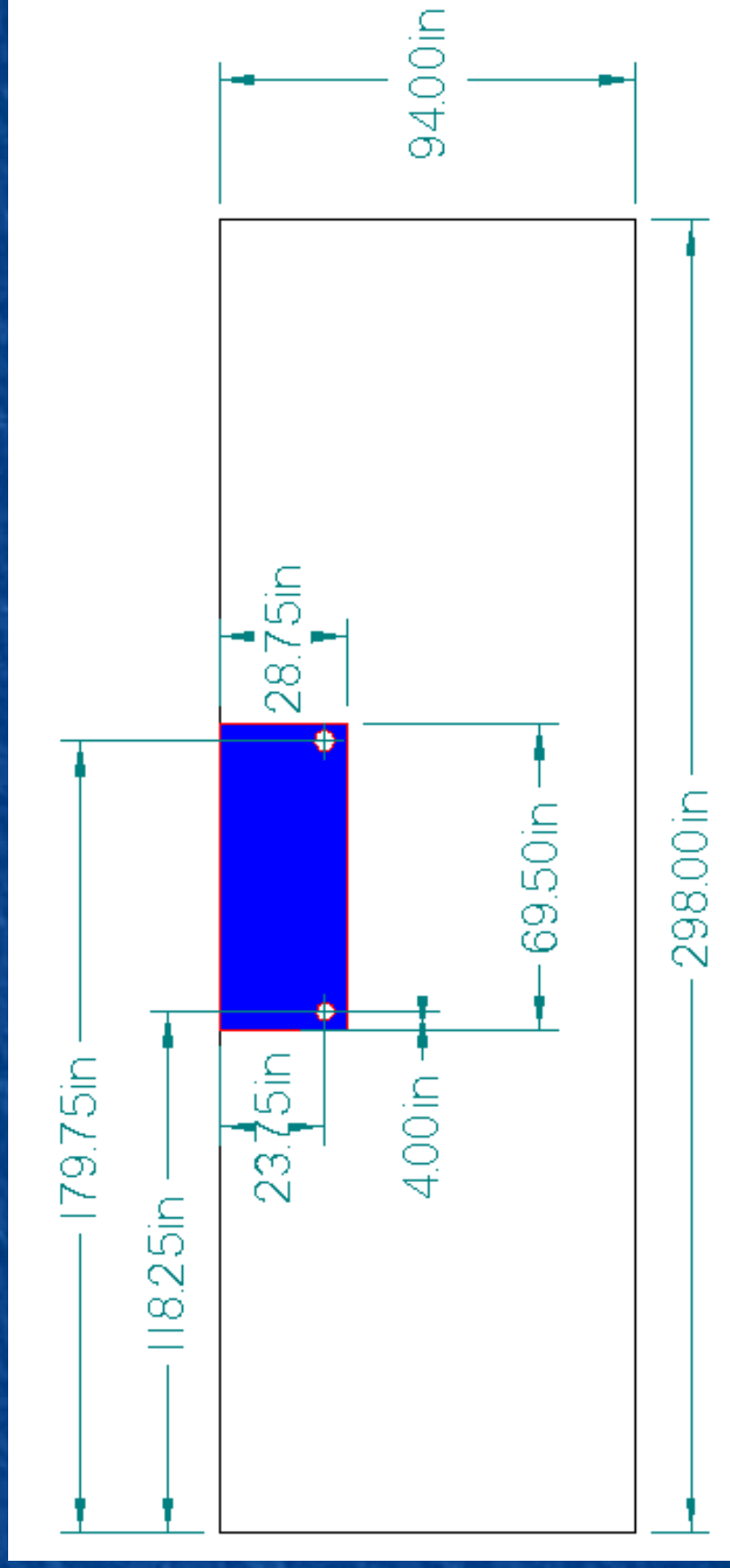


Positioning

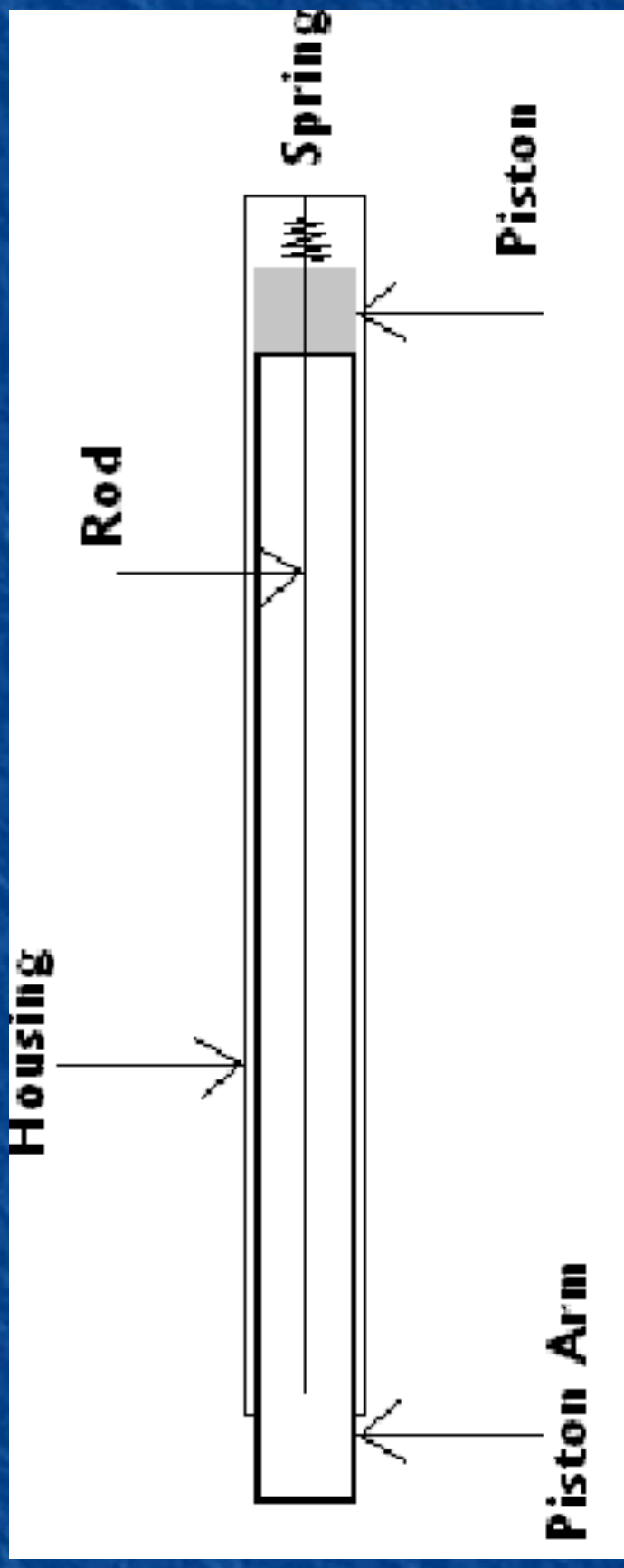


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Positioning

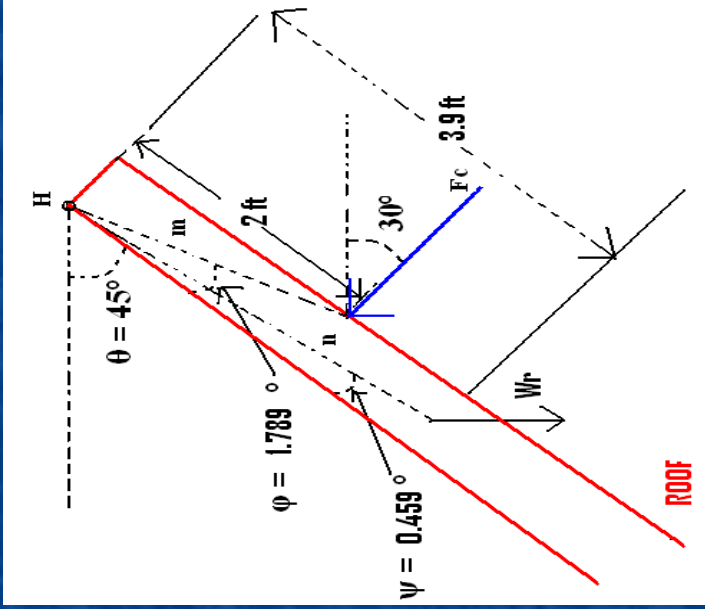
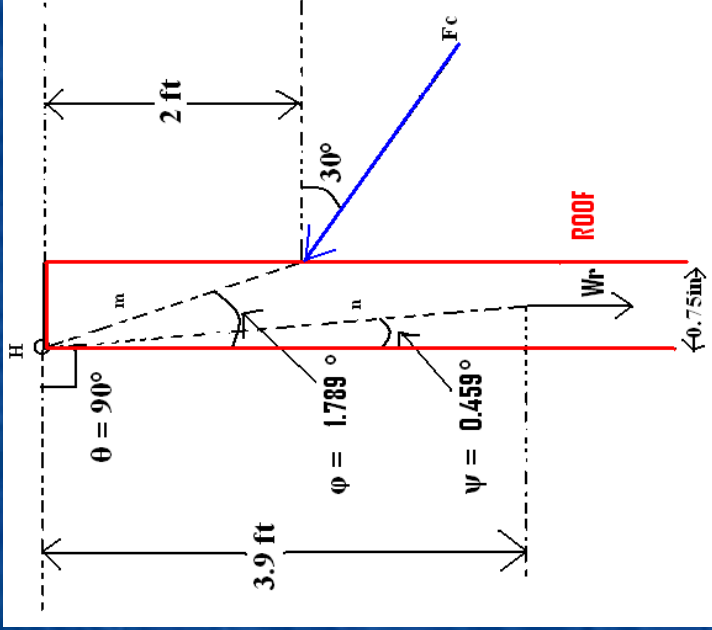


Cylinder Schematic



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Spring Force Analysis

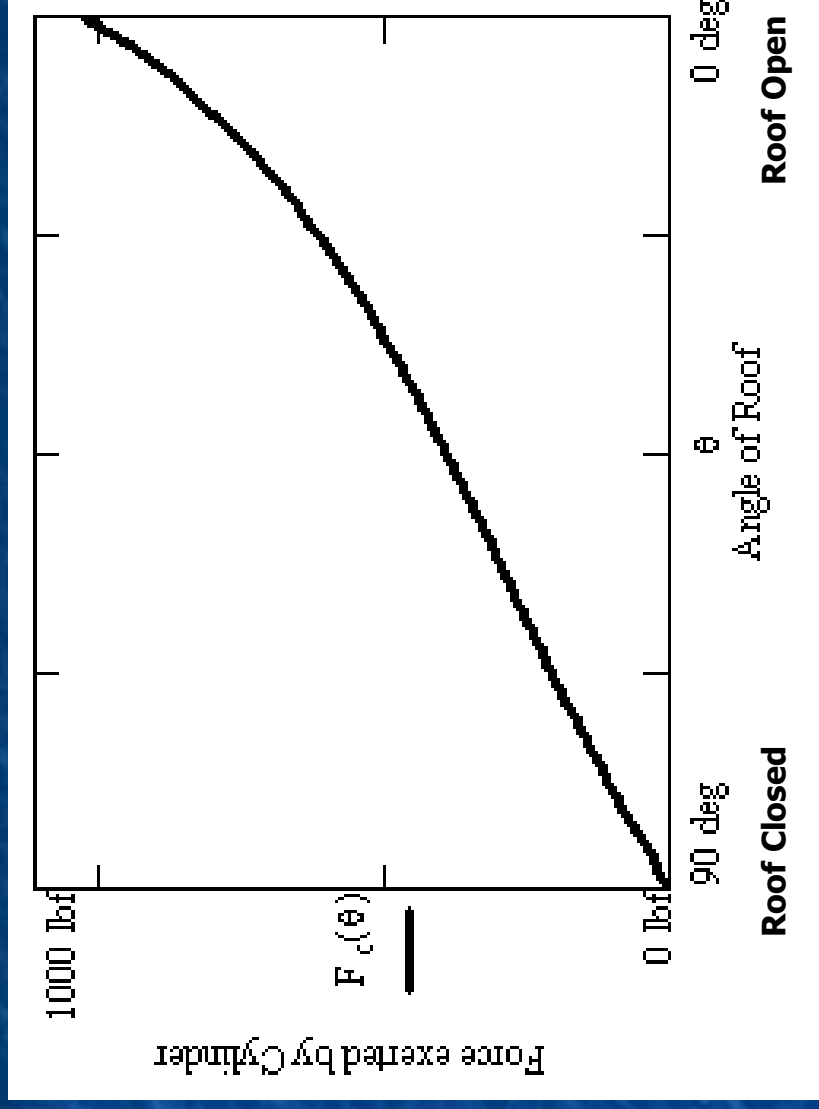


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Spring Force Analysis

Angle (deg)	Force (lbf)
0	925
10	719
20	581
30	477
40	390
50	313
60	240
70	167
80	87
90	5



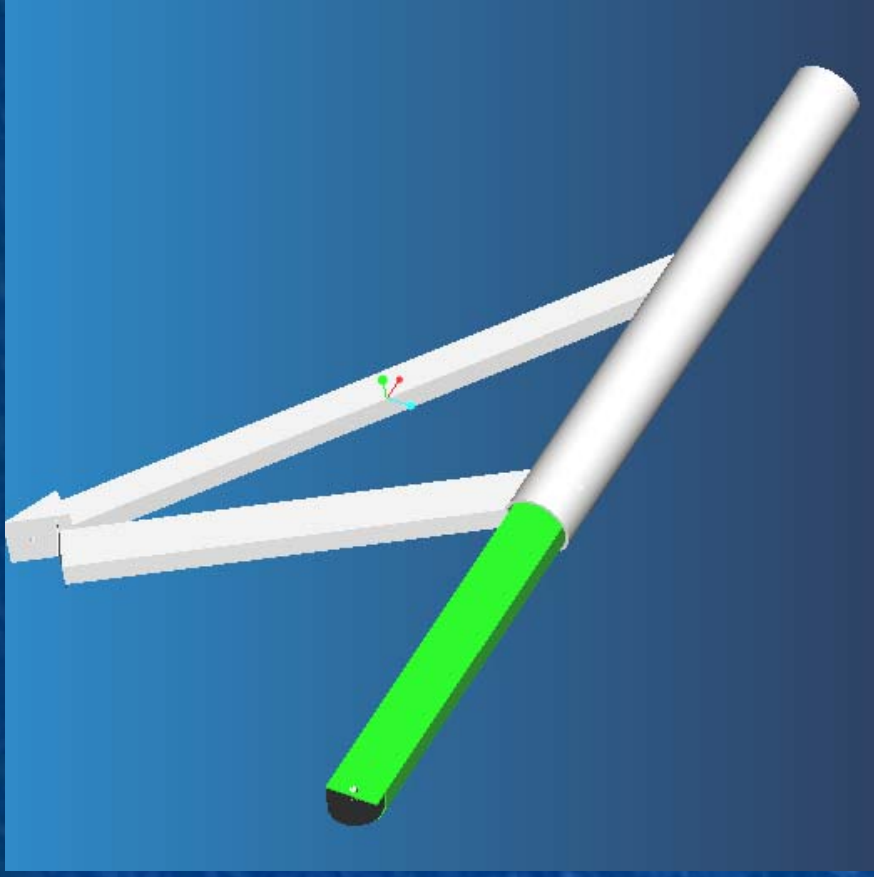
Piston Arm Bending

Material	Height (in)	Width (in)	Thickness (in)	Cost (\$)	Weight (lbf)	Factor of Safety (bending)	Deflection (in)
A36 steel	3	2	0.188	\$38.00	23.5	2.2	0.3
Al6061	3	2	0.25	\$102.00	10.5	2.7	0.7
Al6061	4	2	0.25	\$125.00	12.8	2.2	0.3
Al6063T52	3	1	0.125	\$43.10	4.4	1.0	1.8
Al6063T52	4	1.75	0.125	\$57.49	6.4	2.2	0.6

$$\sigma_{\text{bend}} := \frac{(M_{\text{pistonarm}} \cdot c)}{(I)}$$

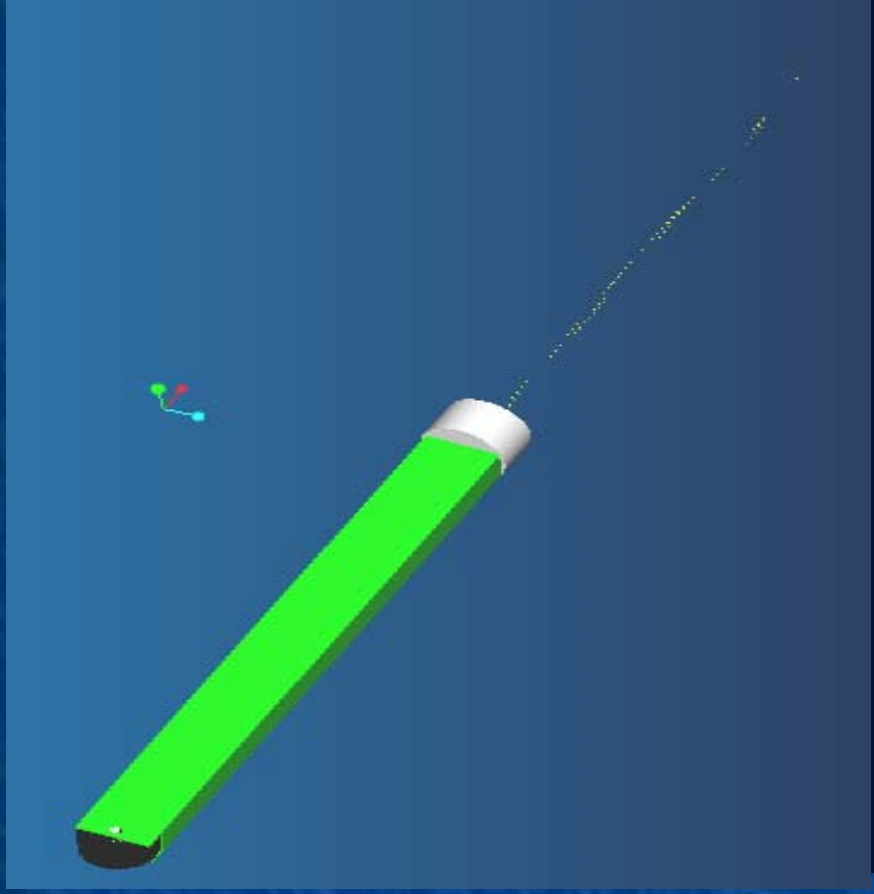
$$\text{piston_arm_deflection} := \frac{-\left(F_{\text{ry}} \cdot L^3\right)}{(3 \cdot E \cdot I)}$$

Assembly



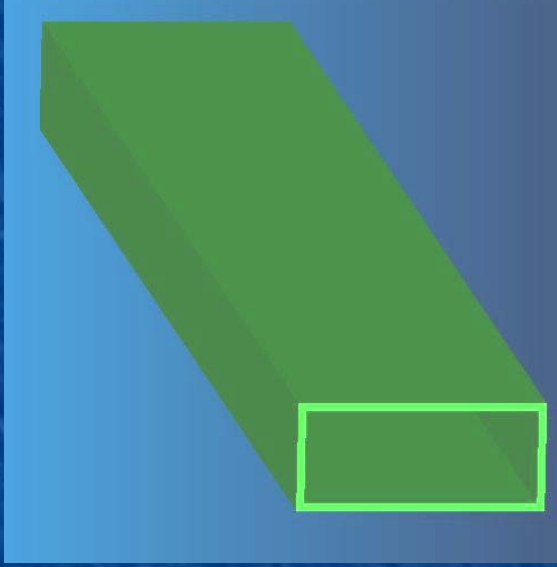
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Assembly



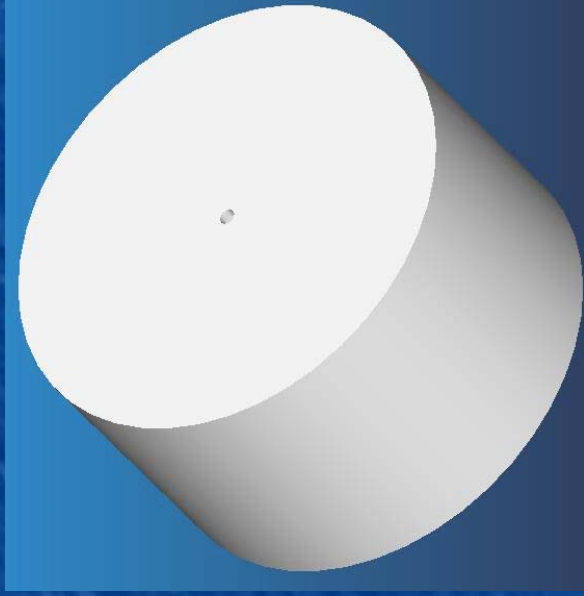
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Parts: Piston Arm



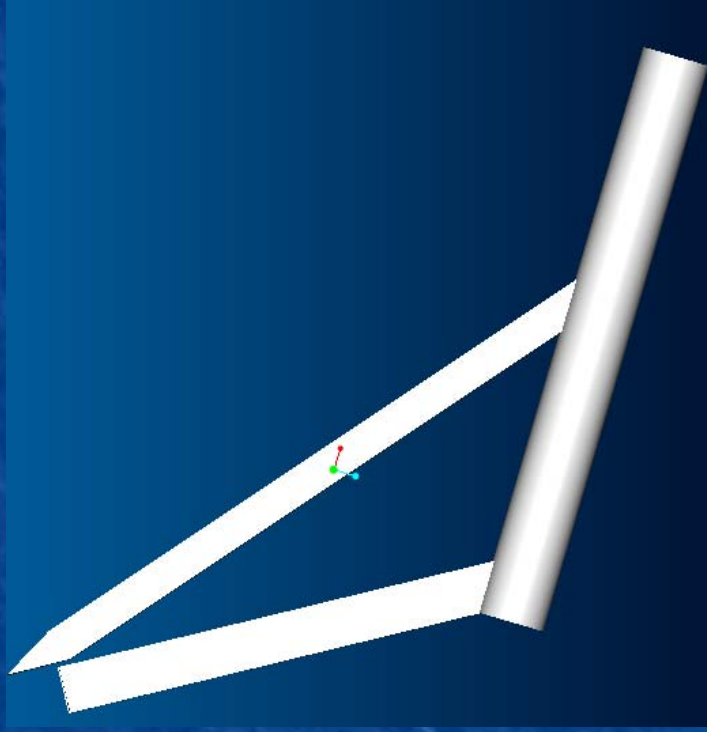
- 4 in x 1.75 in x 36 in
- Thickness: 0.125 in
- Aluminum (Al6063T52)
- \$57.49
- Deflection: Max 0.6 in
- Factor of Safety (Bending): 2.2

Parts: Piston



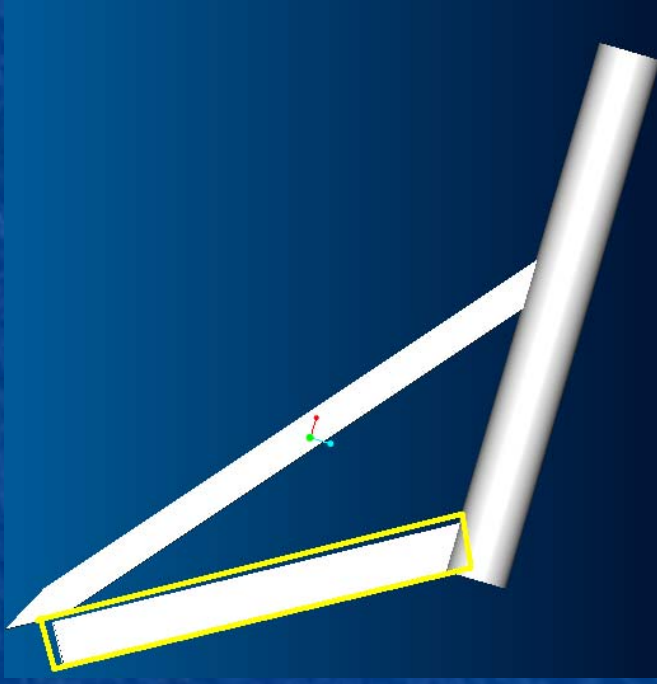
- Radius: 2.25 in
- Height: 2.6 in
- Aluminum
- \$101

Parts: Housing



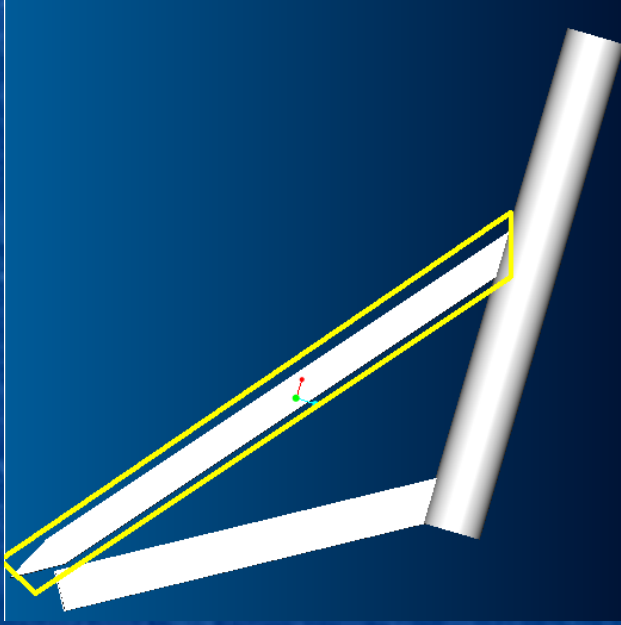
- Vertical Support Beam
- Angular Support Beam
- Cylinder Housing

Parts: Vertical Support



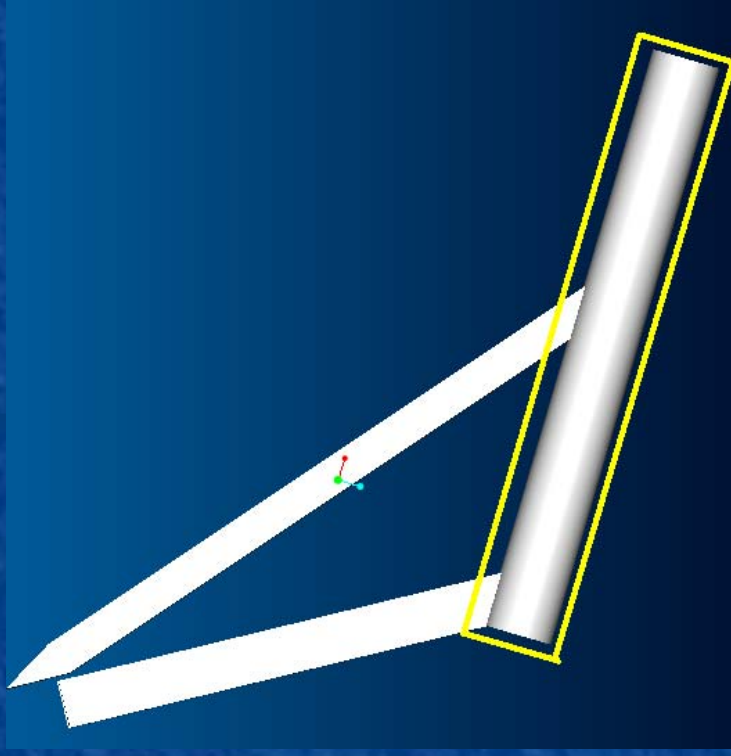
- 1 in x 2 in x 17.75 in
- Thickness: 0.125 in
- Aluminum (6063)
- \$58.73
- Factor of Safety (Buckling): 15

Parts: Angular Support



- 1 in x 2 in x 24.6 in
- Thickness: 0.125 in
- Aluminum (6063)
- \$58.73
- Factor of Safety (Bending): 30

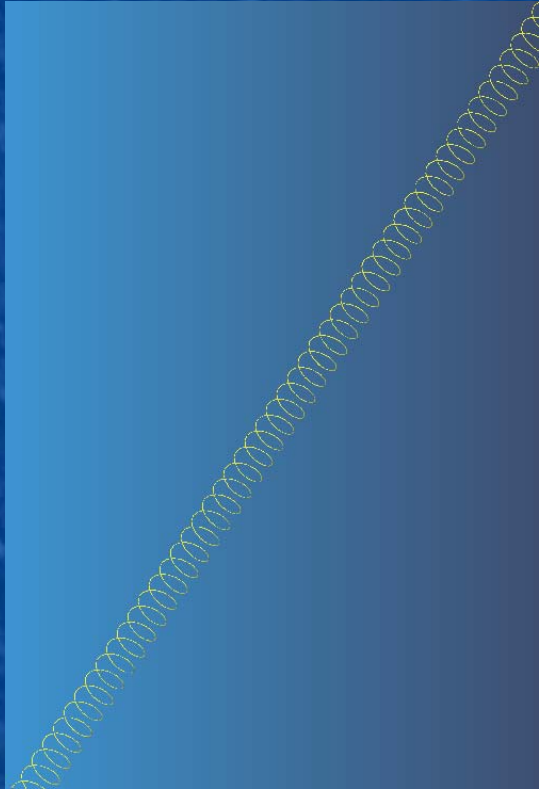
Parts: Cylinder Housing



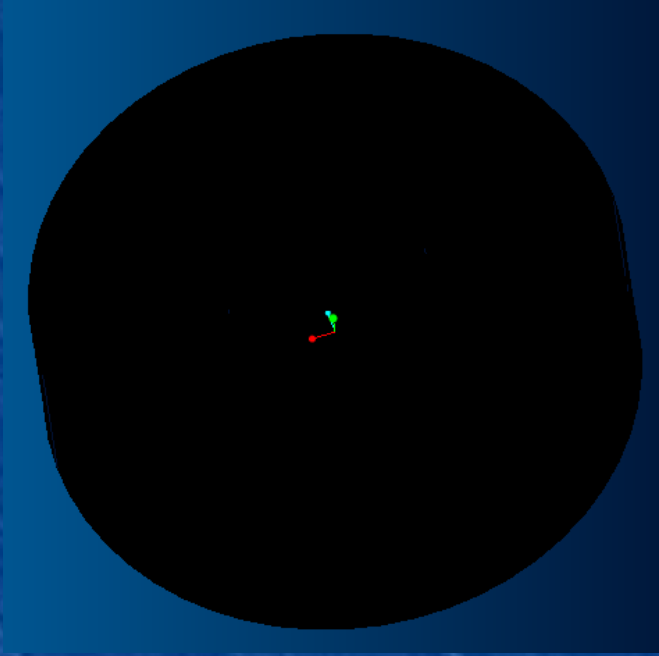
- Diameter: 5 in
- Length: 43 in
- Aluminum (Al6063T52)
- \$57.49

Parts: Compression Spring

- Length: 36 in
- Compressed Length: 2.32 in
- Diameter: 0.187 in
- Constant: 31.8 lbf/in
- Steel
- \$12.24



Parts: Wheel

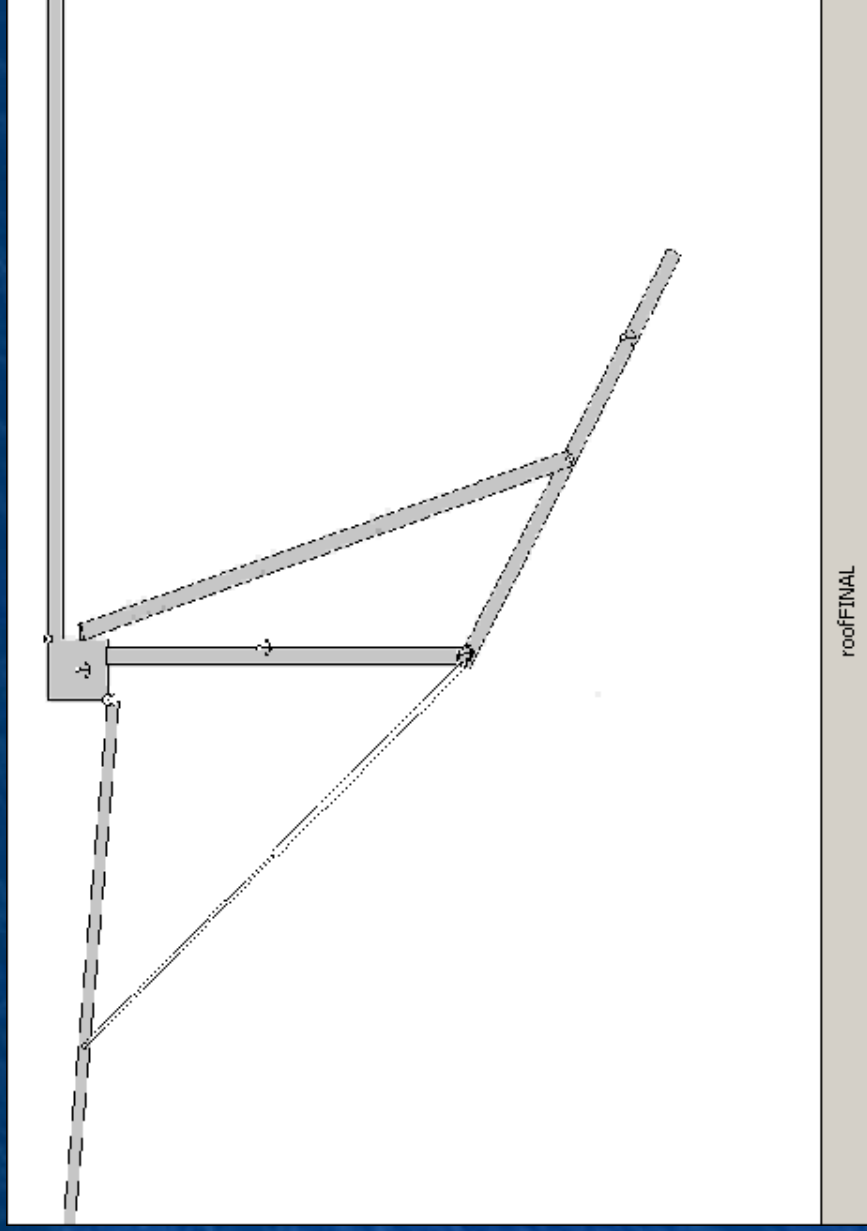


- Outer Diameter: 4 in
- Inner Diameter: 1.4 in
- Plastic
- \$6.57

Cost Analysis

Part	Company	Part Number	Cost(\$)
Piston Arm	McMaster Carr	88935K84	\$57.49
Piston	ThumperStuff	NA	\$101.00
Spring	McMaster Carr	9662K15	\$12.50
Vertical Support Beam	McMaster Carr	88935K66	\$58.73
Angular Support Beam	McMaster Carr	88935K66	\$58.73
Cylinder Housing	Online Metals	6566K563	\$47.10
Wheel	McMaster Carr	2315T527	\$6.57
Pin	McMaster Carr	92735A510	\$4.20
Rod	McMaster Carr	9061K123	\$23.10
			\$369

Animation



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Spring

- Before Break: Order Parts
- Jan 9: Start Website
- Jan 21: Build Prototype (1/5 Scale)
- Late Jan: Visit Orlando
- Early Feb: Test Prototype
- Early March: Complete Full Size Cylinder

Questions?



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