



University of Idaho

College of Engineering

QUALITY TUGS ENGINEERING RELEASE REVIEW

**JOSH FREI, NICK LOCKE, MAX JOHNSON,
CHASE ANDERSON**

PROBLEM DEFINITION



The goal is to create an airplane tug that can be used with a wide variety of tire sizes and types including those with wheel pants.



VALUE PROPOSITION



- Universal tugs are not commercially available for the wheel sizes needed
- Capture airplanes with wheel pants
- Minimal user input
- No modification needed for various types of wheels



PRODUCT REQUIREMENTS



- Minimal user input
- Different size wheels
 - 8.00x6
 - 7.00x6
 - 6.00x6 (wheel pants)
 - 5.00x6
 - 4.00x4
- 4,000 lb. aircraft
- 500 lb. static vertical load
- 5,000 cycles of operation
- Carry load up 2% grade
- Handle variety of surface conditions

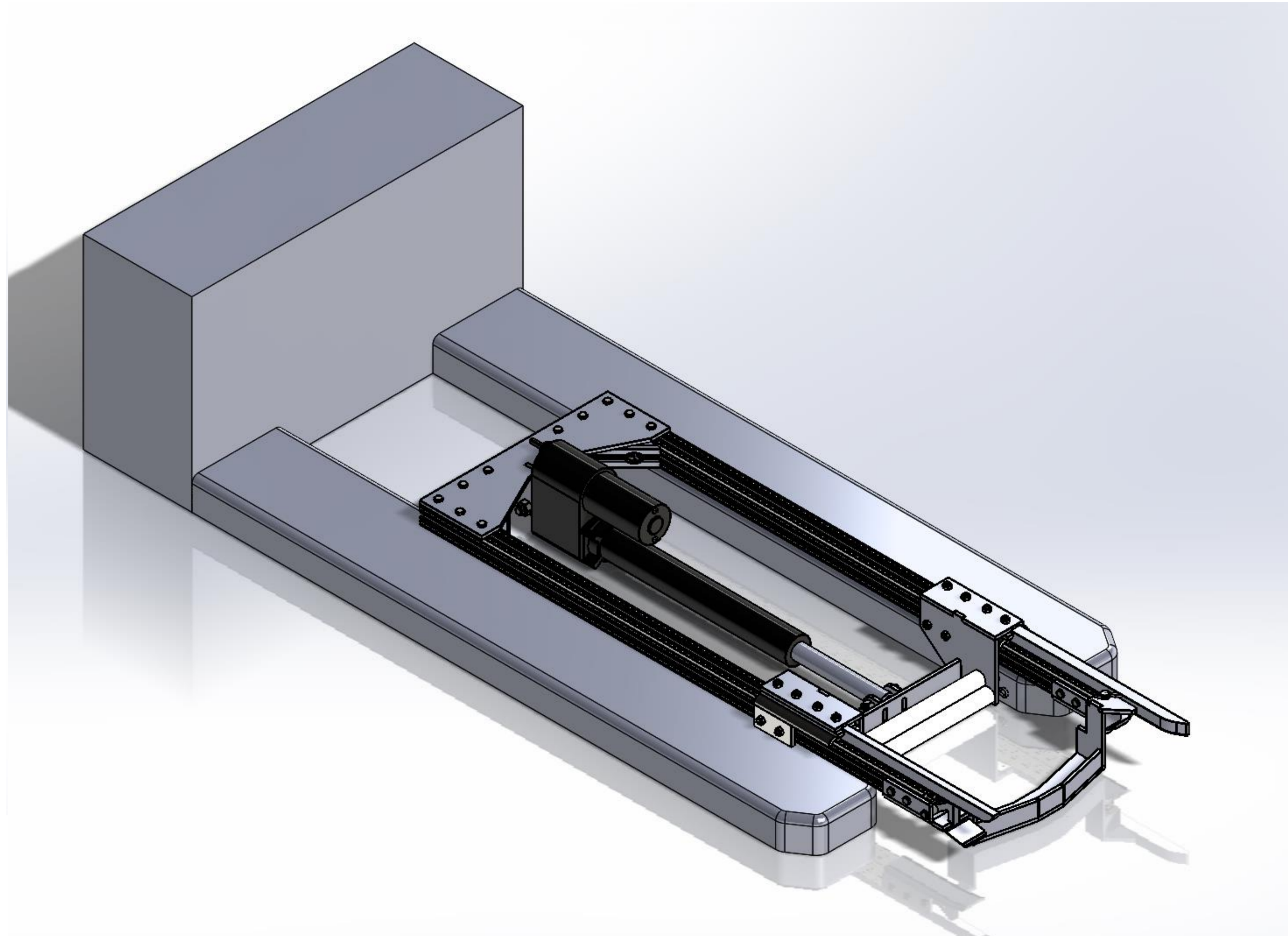


PALLET JACK

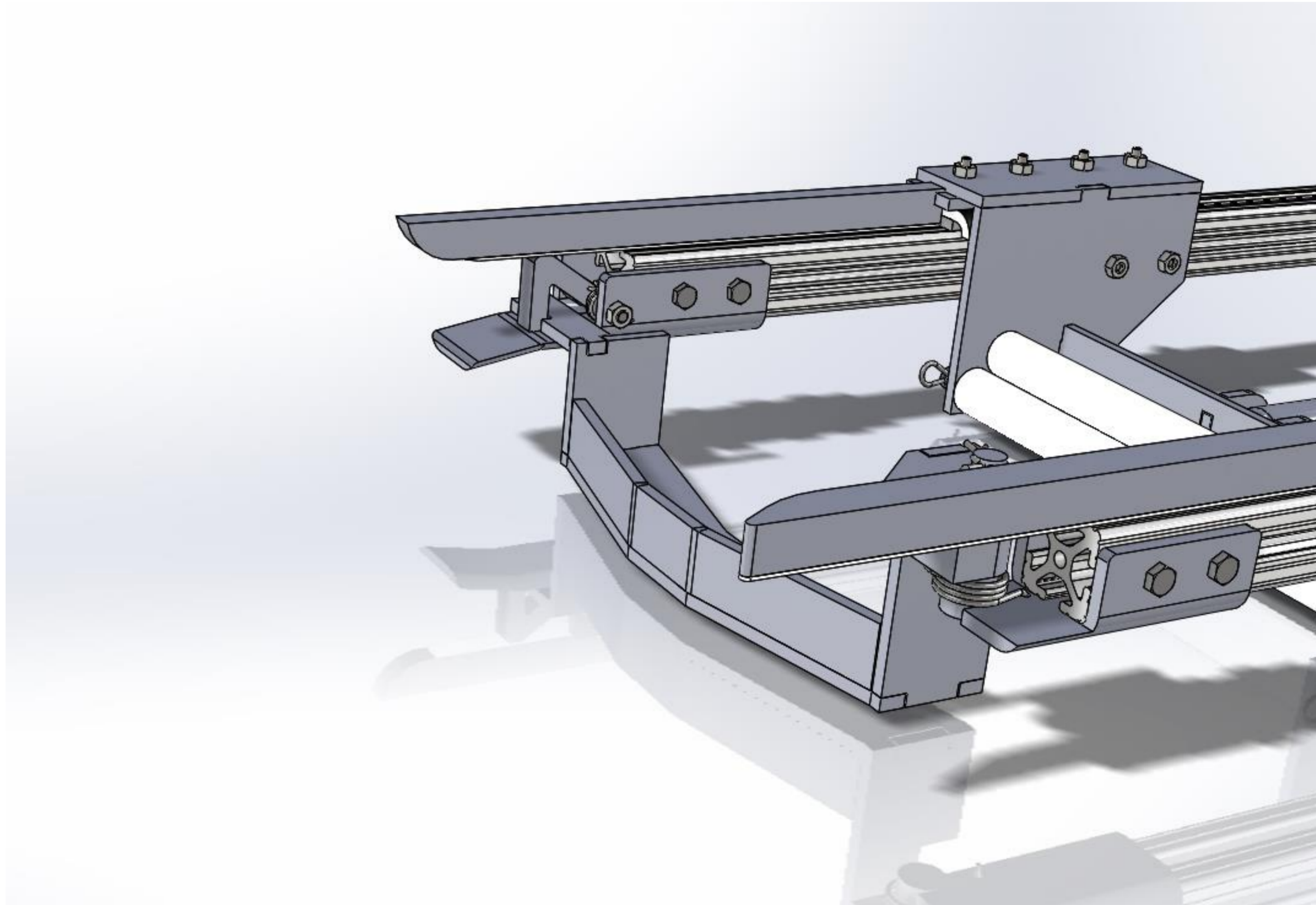
- Motorized drive and lift
- 840 lbs. empty weight
- Our device will be a prosthetic to the pallet jack to capture wheels
- Forks:
 - 47 ¼" in length
 - 7 ¼" wide
 - 3 ¼" off of ground
 - 12 ¼" between each fork



FINAL DESIGN OVERVIEW

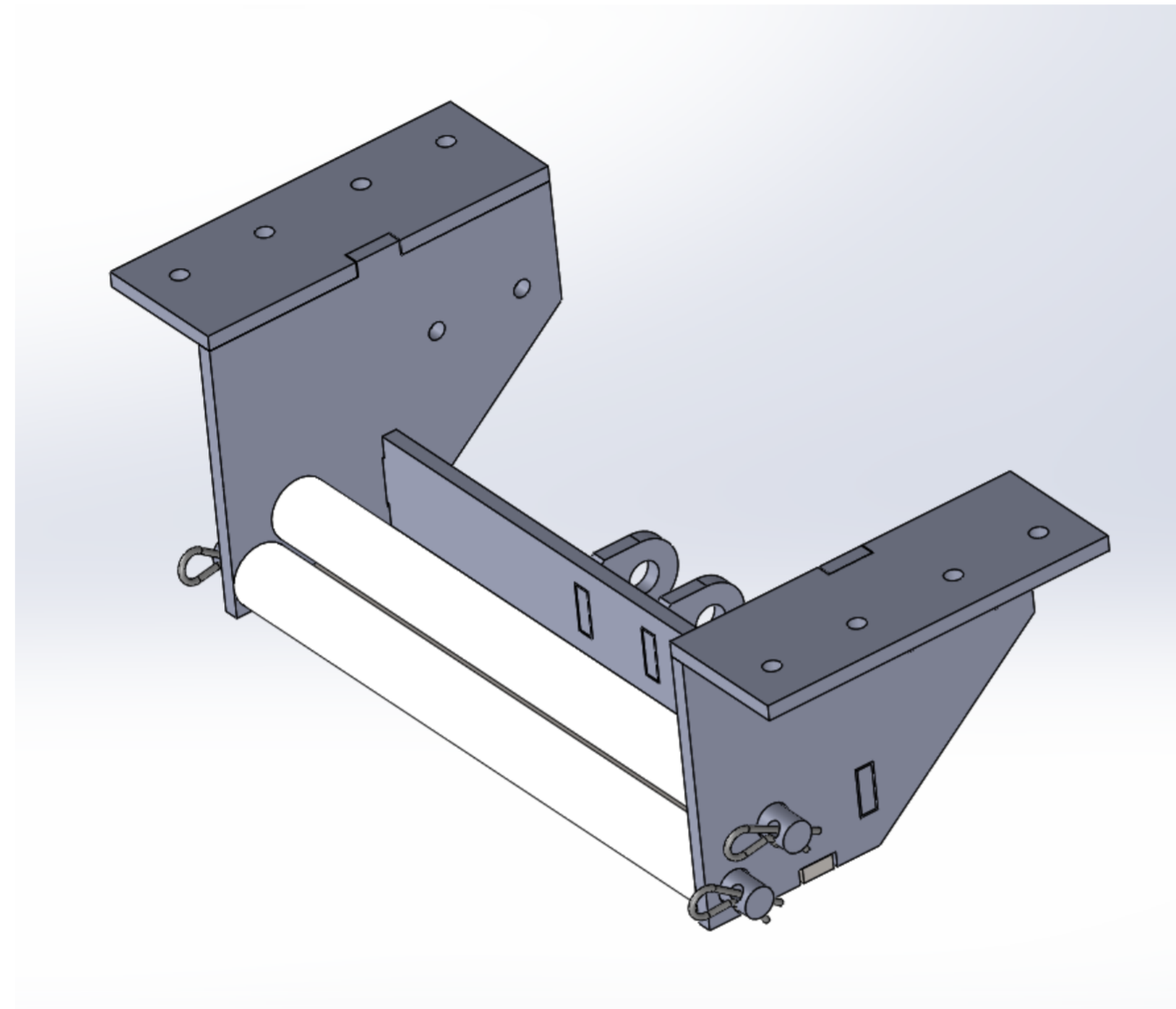


GATE DESIGN

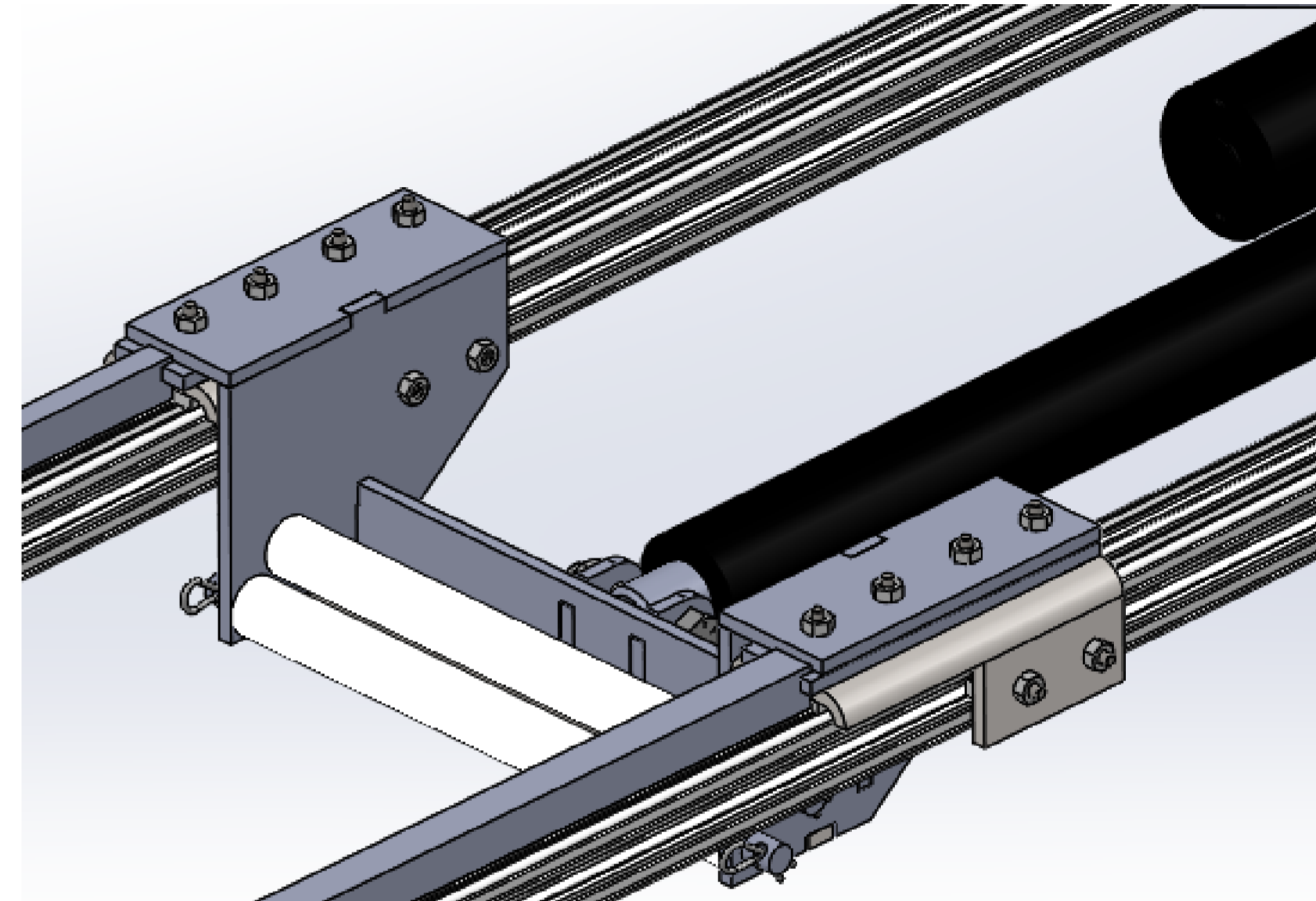


- Torsional springs keep gate and latch in open position.
- 1st actuator paddle hits gate cam closing gate.
- 2nd actuator paddle hits latch locking the gate.
- When actuator paddles are retracted, latch and gate swing open on their own.

CLAMP DESIGN



- ½" Steel Rods
- UHMW Tube
 - ID: 9/16"
 - OD: 1 ¼"
- Toilet Paper Roll Design

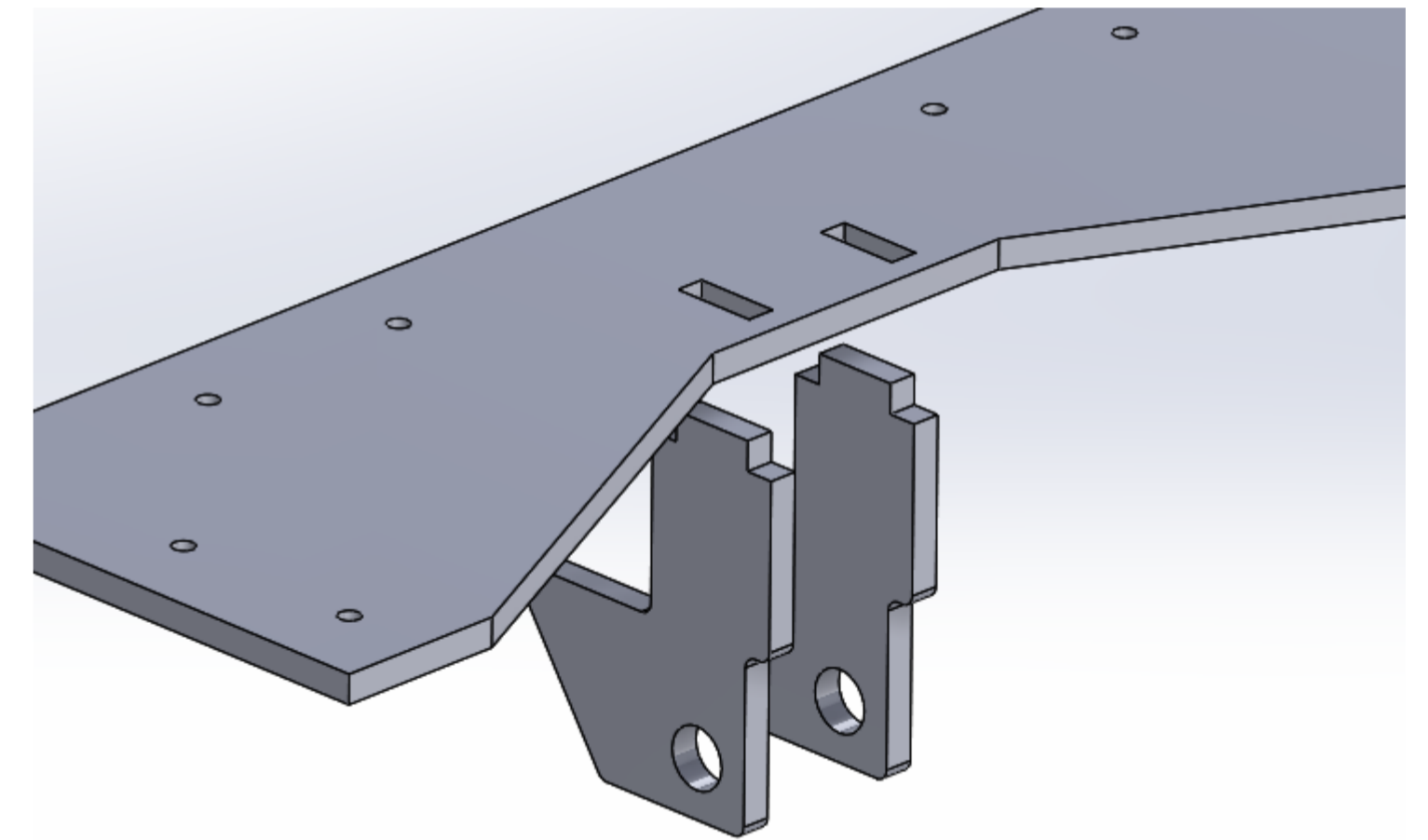
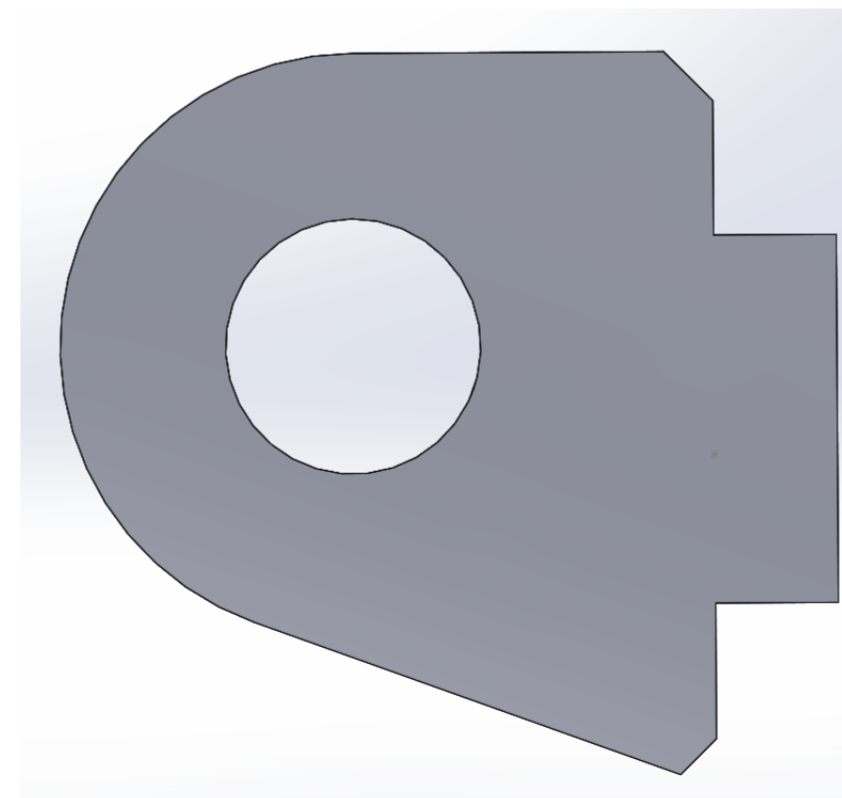
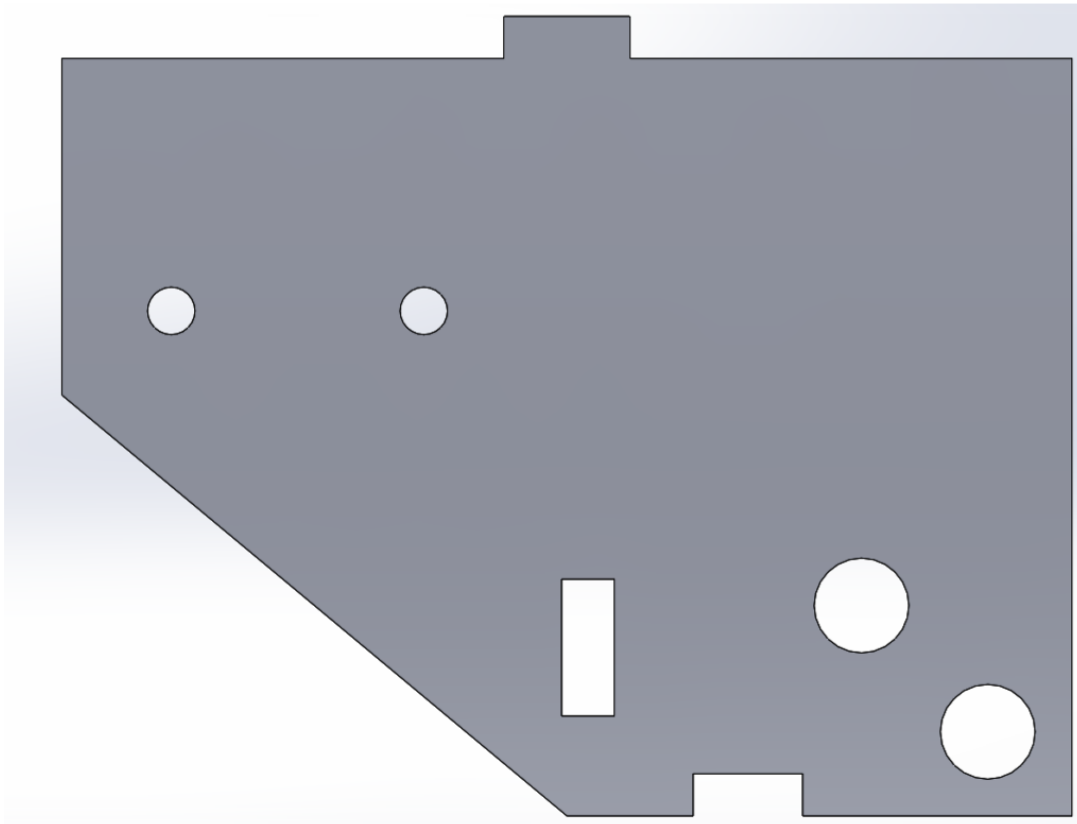
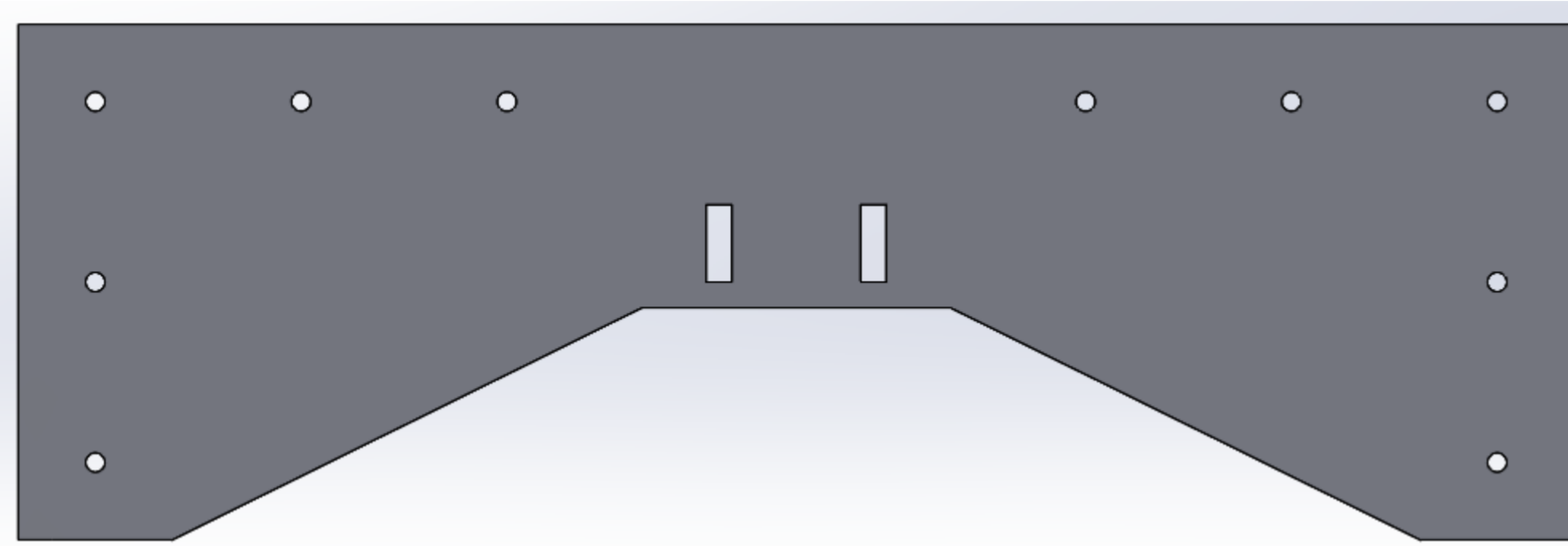


- Linear actuator connects to clamp with bolt.
- Connects to linear sliders via bolts.

MANUFACTURING PROCESS



Laser Cut Parts make up about 65% of the model

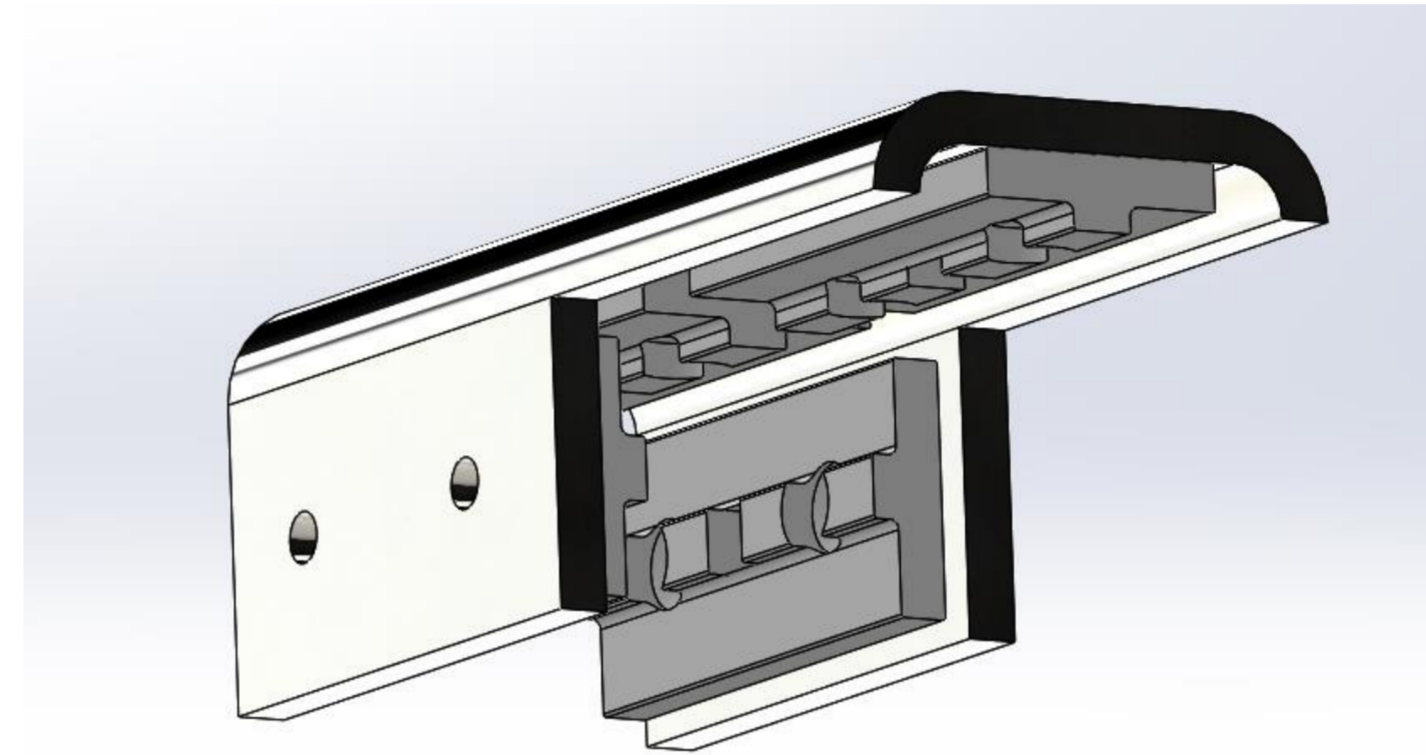
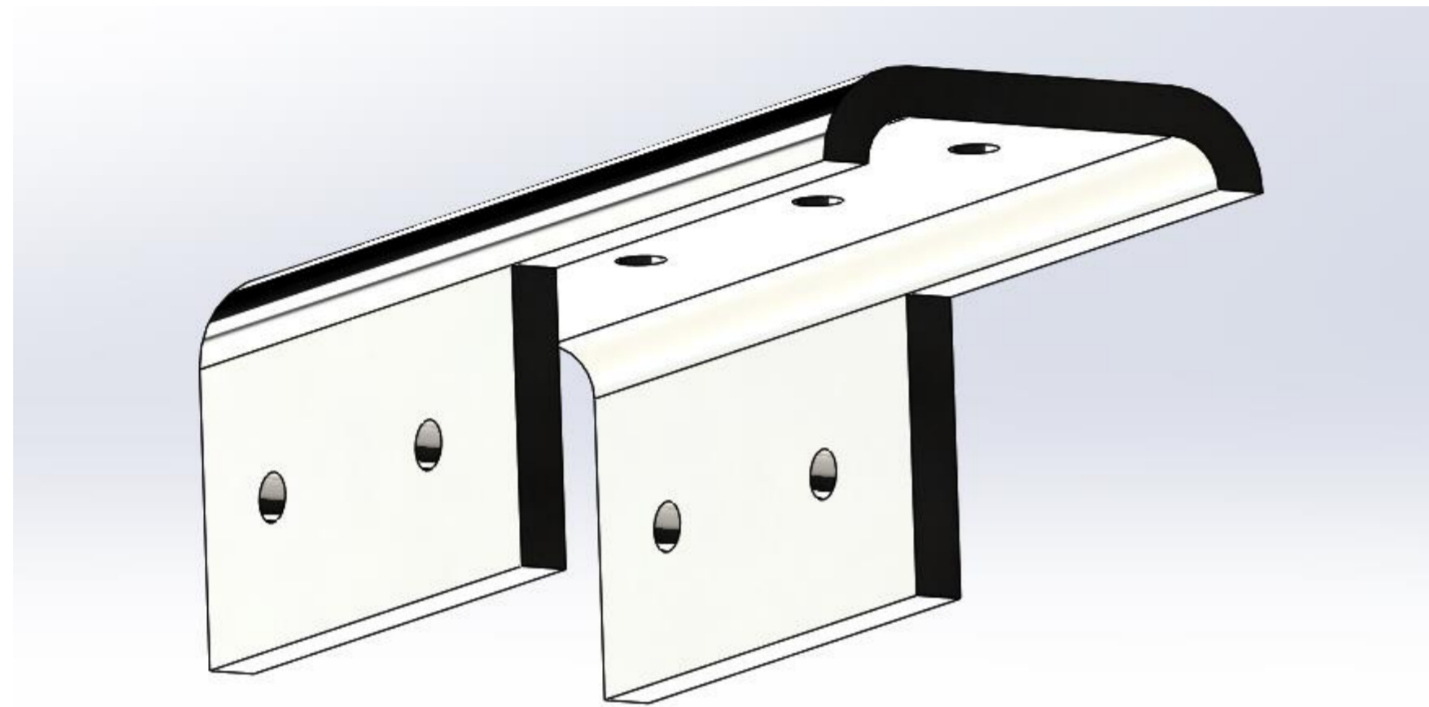


Slot and key design
makes assembly
fool proof

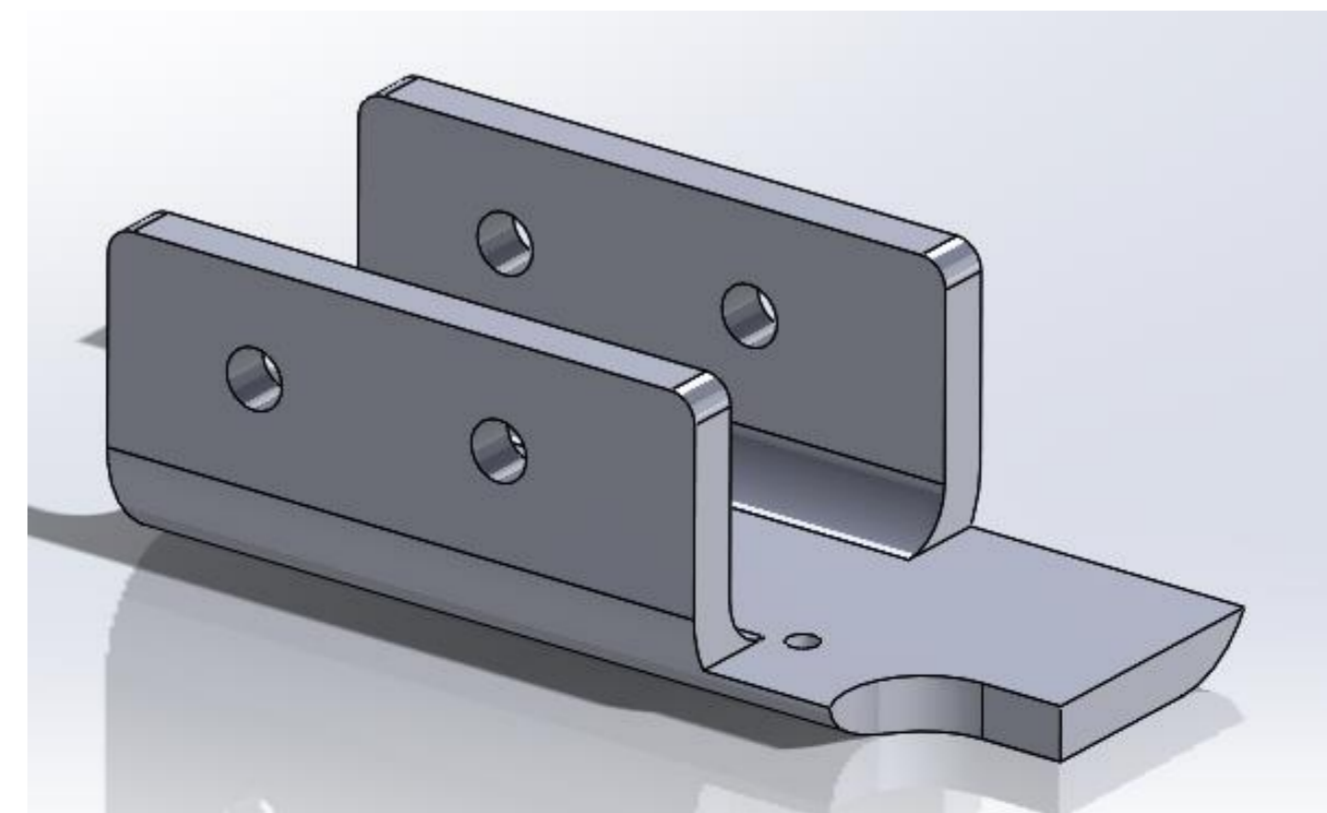
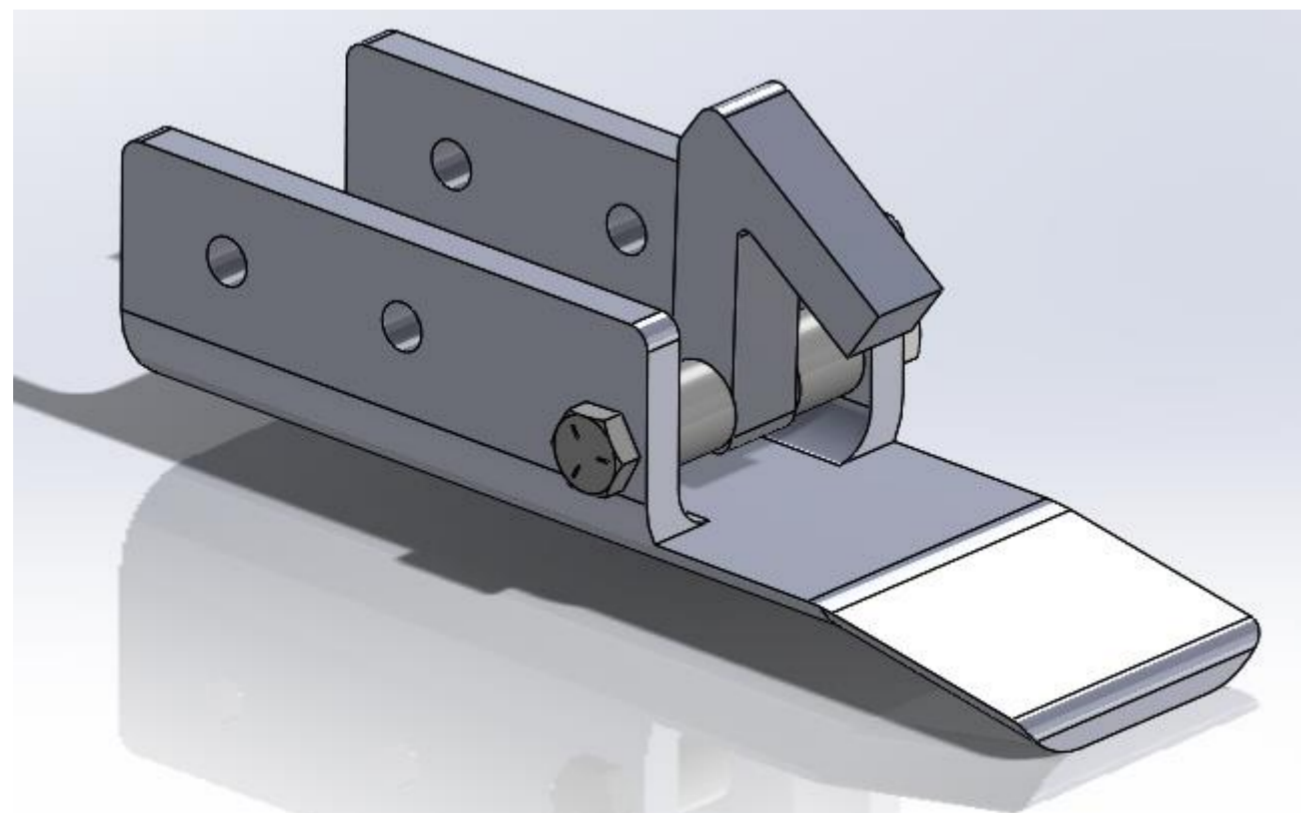
MANUFACTURING PROCESS



The linear sliders will be custom made out of square tube and purchased UHMW sliders



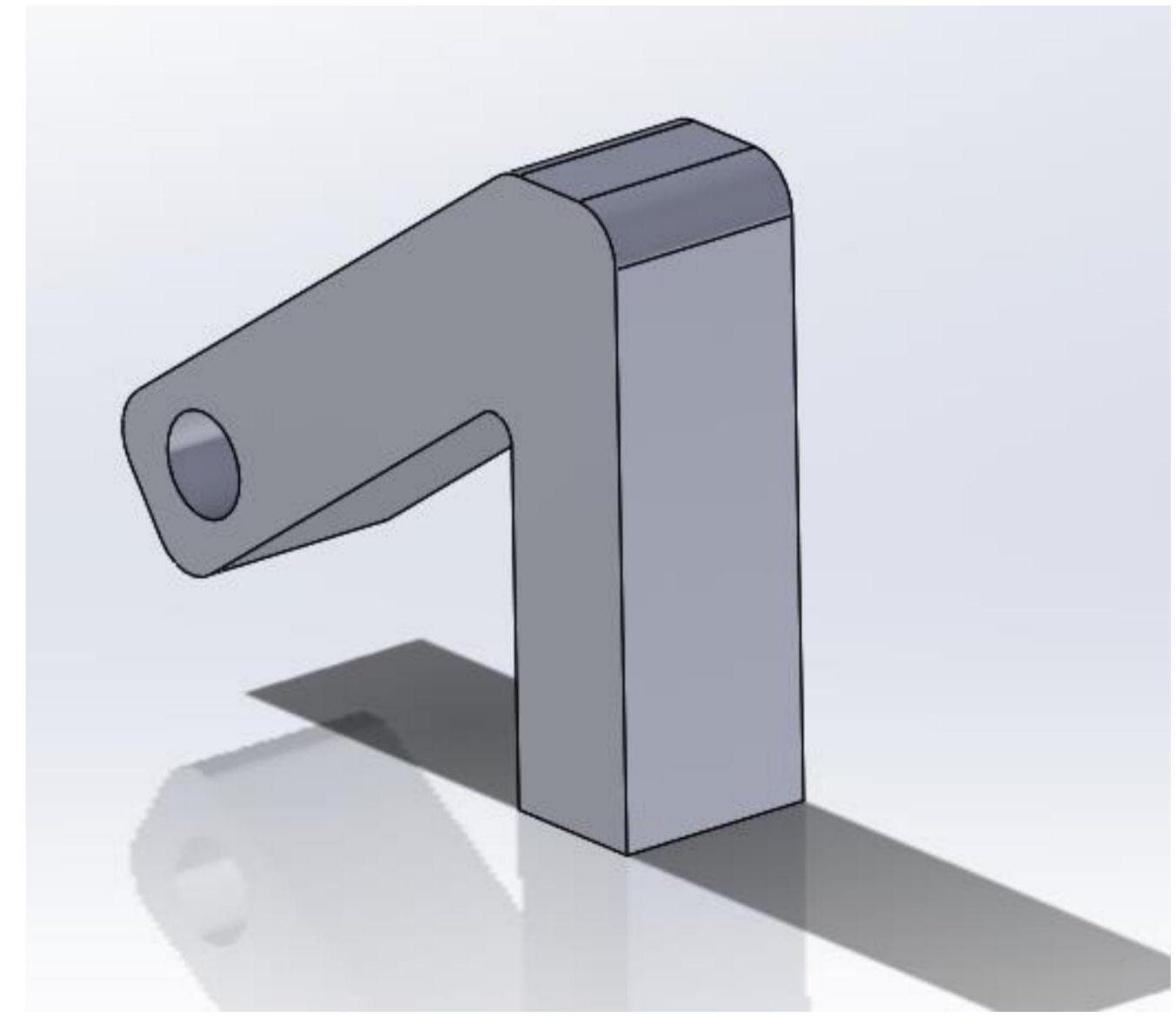
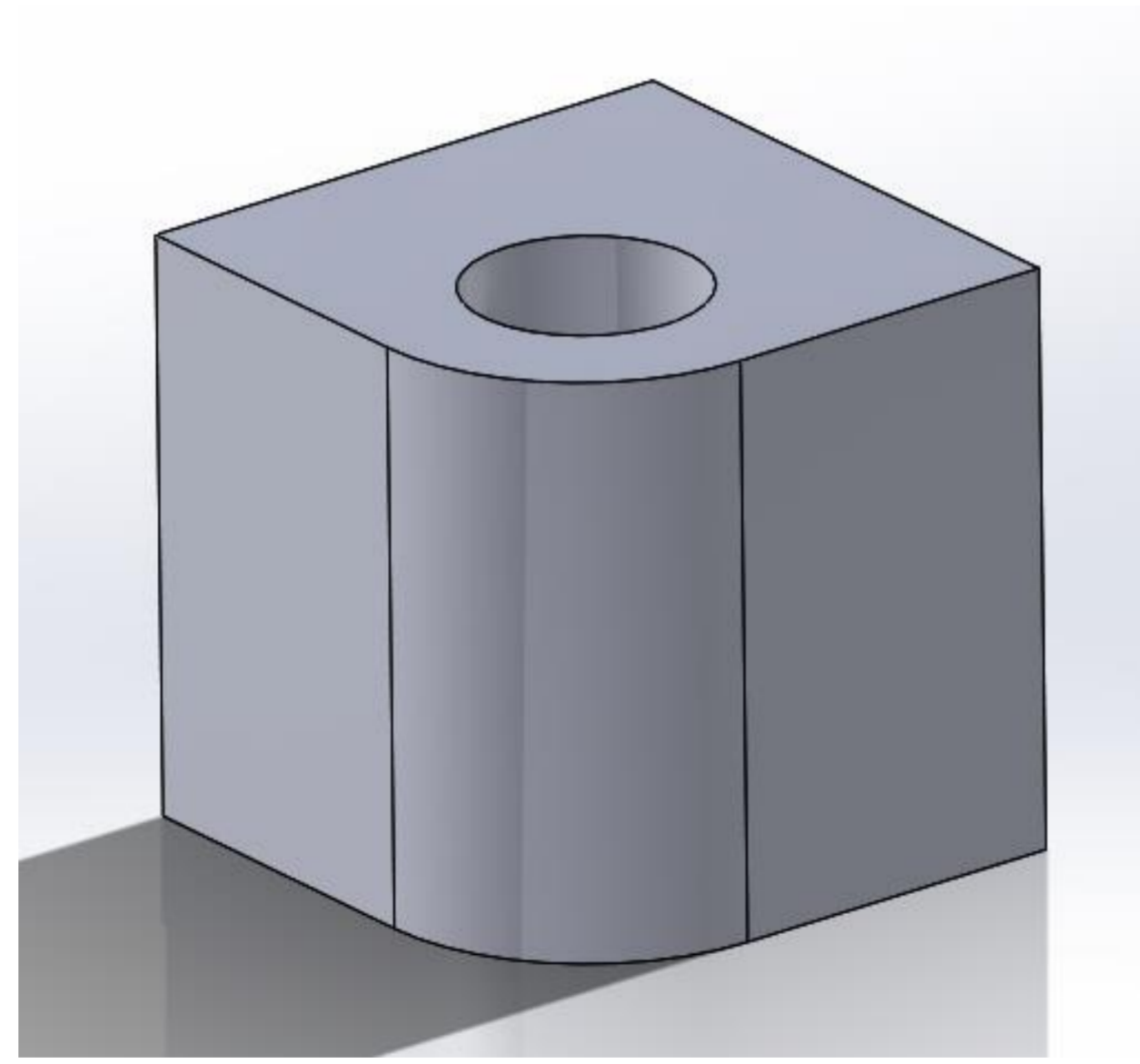
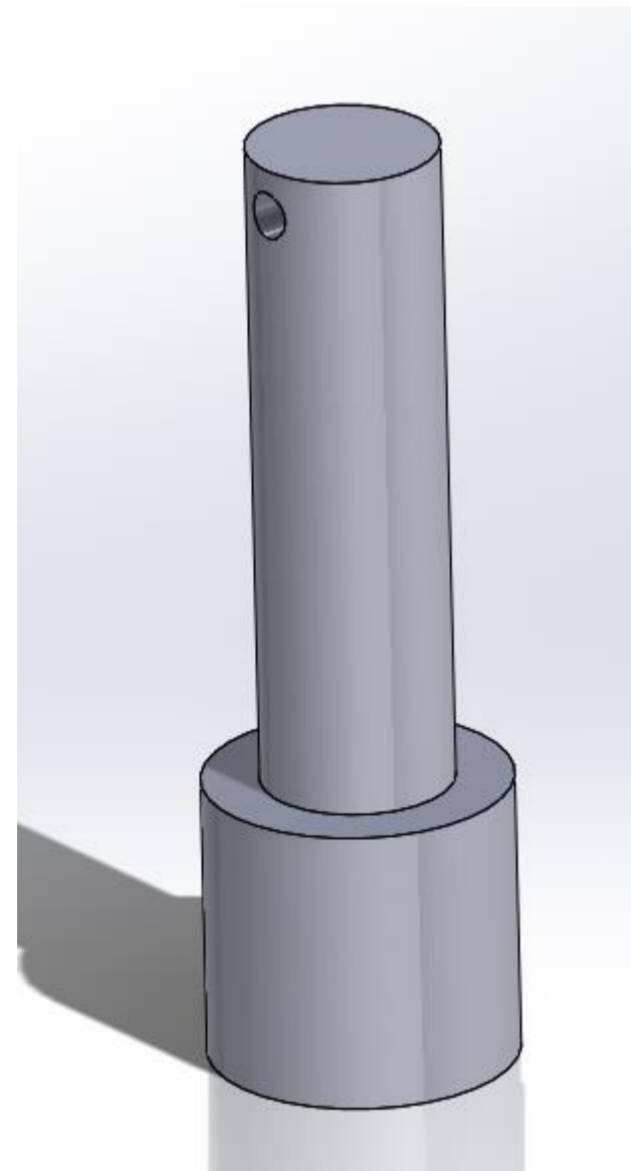
Hinge and latch components with square tube also



MANUFACTURING PROCESS



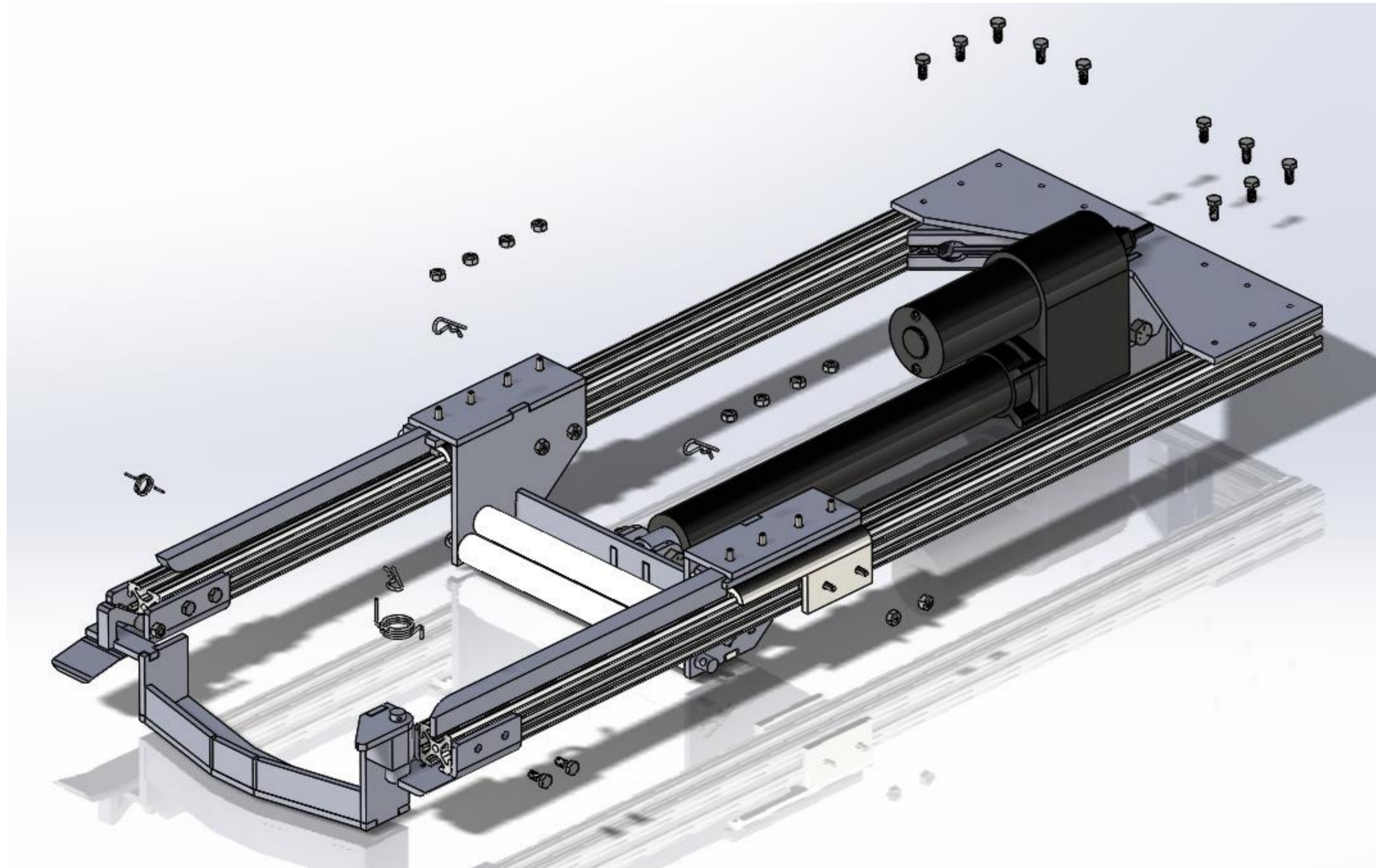
Machined parts make up only 3 parts of the assembly.



MANUFACTURING PROCESS



Standard purchased parts make up the rest of our assembly.



BILL OF MATERIALS



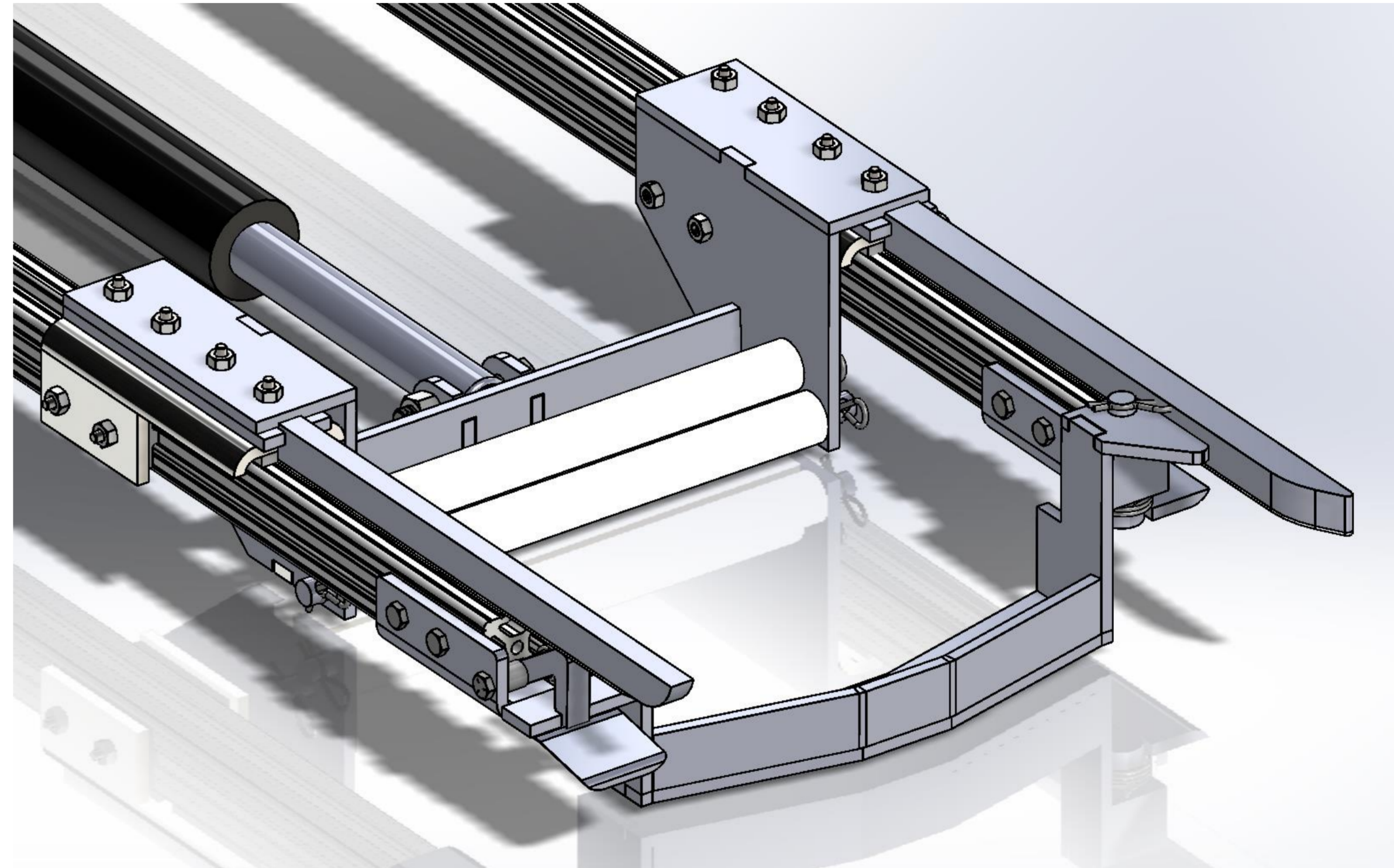
Quality Tugs Bill of Materials

Item Number	Vendor	Part Number	Part	Description	Quantity	Cost Per Unit	Length (in.)	Price
1	Amazon	PA-17-12-2000	Linear Actuator	Progressive Automations 12" Stroke, 2000 lbs Force	1	\$ 309.00		\$ 309.00
2	Amazon	MPC 0462	Linear Actuator	Wiring, Switch, and Relay for Actuator	1	\$ 34.95		\$ 34.95
3	8020/Bill	1515-S	Frame	1.5" x 1.5"x42" Smooth Surface T-Slotted Profile	2	\$ 0.53	42	\$ 44.52
4	8020/Bill	1515-S	Frame	1.5" x 1.5"x13" Smooth Surface T-Slotted Profile	1	\$ 0.53	13	\$ 6.89
5	8020/Bill	3202	Frame	1/4-20 Slide-in T-Nut	18	\$ 0.79		\$ 14.22
6	8020/Bill	3703	Frame	5/16-18 Slide-in T-Nut	10	\$ 0.84		\$ 8.40
7	8020	6814	Linear Bearing	Bearing Pad	8	\$ 2.95		\$ 23.60
8	8020	2539	Frame	45 Degree Frame Support	2	\$ 13.50		\$ 27.00
9	Ace	92240A105	1/4-20 Hex Bolt	Hex Bolt For Mounts	18	\$ 0.28		\$ 5.04
10	Ace	91247A018	1/4-20 Par Thr Bolt	Bolt for Latch	1	\$ 1.23		\$ 1.23
11	Ace	95479A113	1/4-20 Nut	Hex Nut	1	\$ 0.12		\$ 0.12
12	McMaster	9271K586	Torsional Spring	Latch Torsional Spring	1	\$ 5.19		\$ 5.19
13	McMaster	9271K594	Torsional Spring	Gate Torsional Spring	1	\$ 1.59		\$ 1.59
14	Ace	90176A159	Nylon Spacer	Nylon Spacer for Latch	2	\$ 0.13		\$ 0.26
15	CDA Metals		.75 X .75 Bar Stock	Gate Actuator Bar Stock	1	\$ 11.05	24	\$ 11.05
16	CDA Metals		.5 X .75	Latch Actuator Bar Stock	1	\$ 9.52	24	\$ 9.52
17	CDA Metals		Laser Cut Parts	Laser Cut Parts	1	\$ 250.00		\$ 250.00
18	CDA Metals		Square Tubing	2x2x1/4 Tubing for Mount	1	\$ 12.38	12	\$ 12.38
19	CDA Metals		Square Tubing	2.5x2.5x1/4 Tubing For Slides	1	\$ 32.00	24	\$ 32.00
20	CDA Metals		Rod	12.25"x.5" Steel Rod	1	\$ 9.14	36	\$ 9.14
21	Amazon	8.88519E+11	UHMW Sheet	UHMW Tape for Actuators	1	\$ 7.55		\$ 7.55
22	Ace		Cotter Pins	Cotter Pins	5	\$ 1.00		\$ 5.00
23	Grainger/Amazon	1UWP2	UHMW Tube	5/8"x 1-1/4" Tube Stock UHMW-PE	1	\$ 22.35	24	\$ 22.35
24				Shipping				\$ 150.00
25				Cut Charge for 8020	3	\$ 2.00		\$ 6.00
							Total:	\$ 997.00

RISK MANAGEMENT



- Latch and Gate
- Actuator Paddle Length
- Torsional Springs
- Bearing Pads



QUESTIONS?