



University of Idaho

College of Engineering

Debaling Agricultural Materials

UI-Debalers
Engineering Release Review

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Value Proposition

Agricultural feed stocks for bio-based products and biofuels:

- Biomass materials need to be baled for transport
- Bales need to be efficiently decompressed upon reaching destination
- Improvements needed over current designs
 - Dust or “Fines” generation
 - Detrimental damage of material
 - Steady outfeed
 - Reduced reliance on manual labor

Product Requirements

Specifications:

- Mechanical device to pull apart agricultural materials
- less unusable particles than a traditional hammer mill
- Consistent outfeed
- Easily transportable
- Prototype withstand 100 lb bales
- Full scale withstand 2,000 lb bales
- Conveyor like infeed system
- Conveyor outfeed

Progress to Date

4 Days of Testing:

- Initial test of concept with pitchfork
- Testing of teeth styles with hex head bolts and machine screws
- Prototype #1 test, validation of concept, design changes to be made for final design

Primary Proof of Concept:

- Plywood constructed frame
- Used to refine and adjust initial design

Primary Proof of Concept



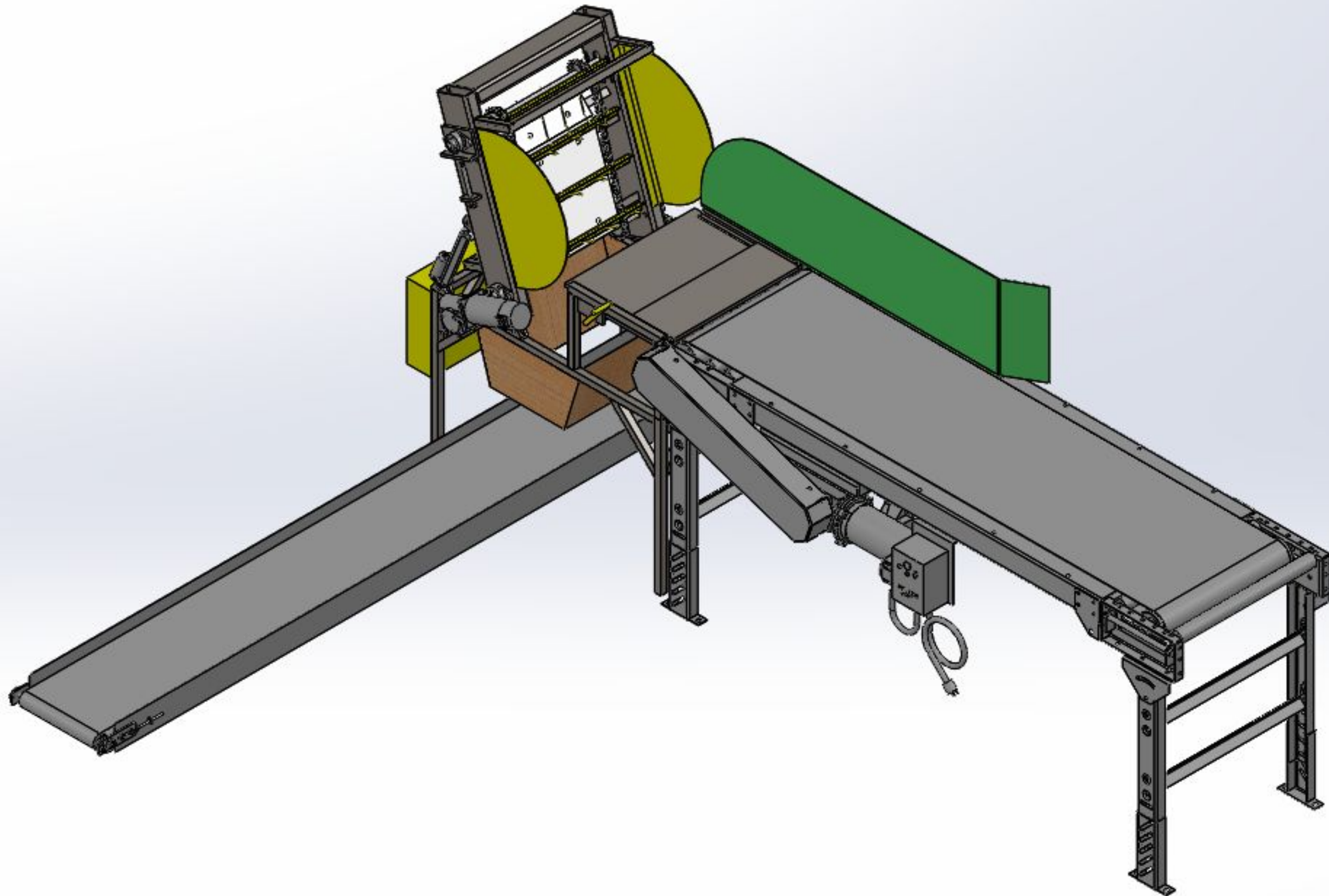
Primary Proof of Concept

Observations and Possible alterations

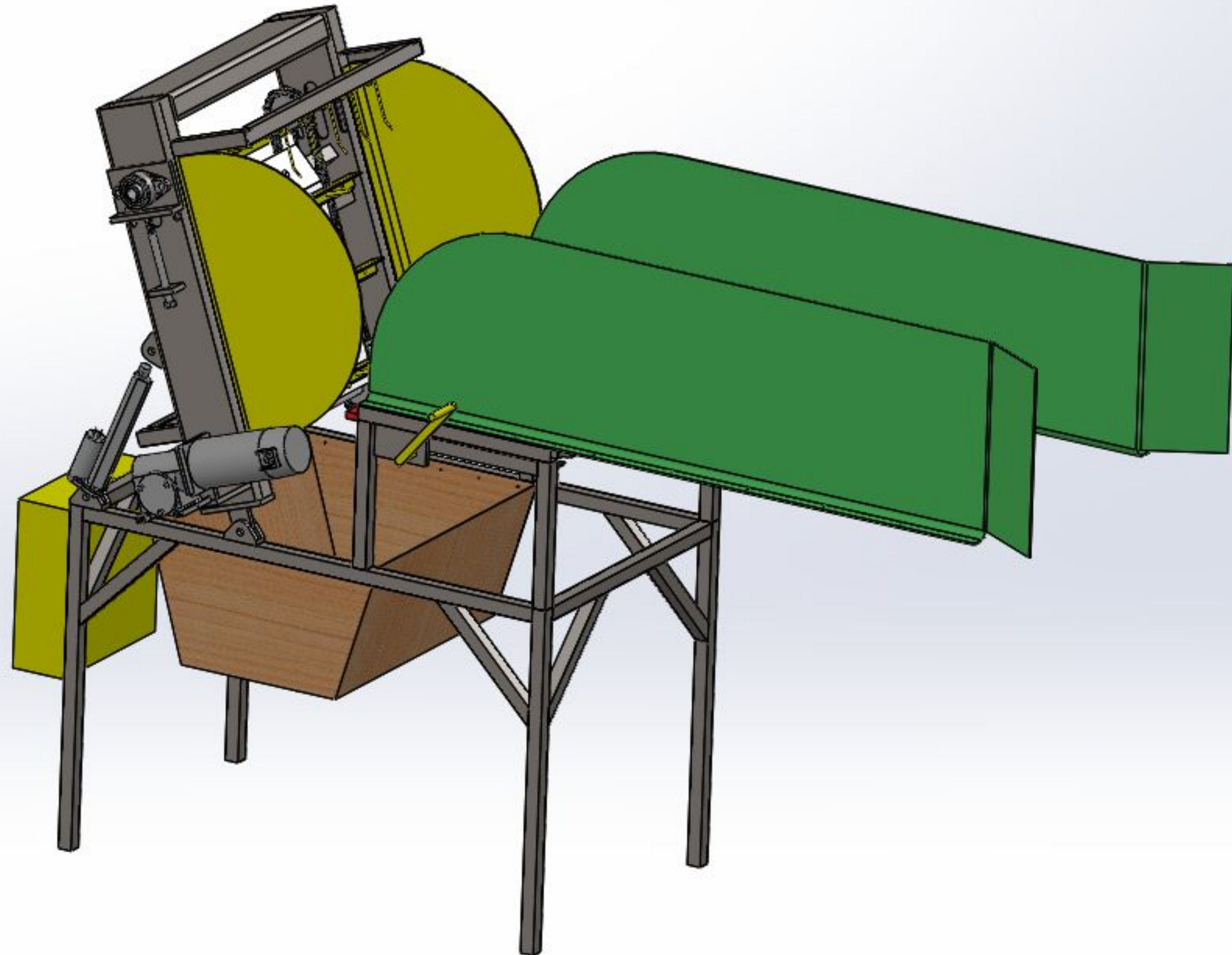
- Clearance gap is vital
 - 2" (will change based on material)
- RPM has a large effect
 - Test operation around 60 RPM
- Negative angle of attack
- Brush needed



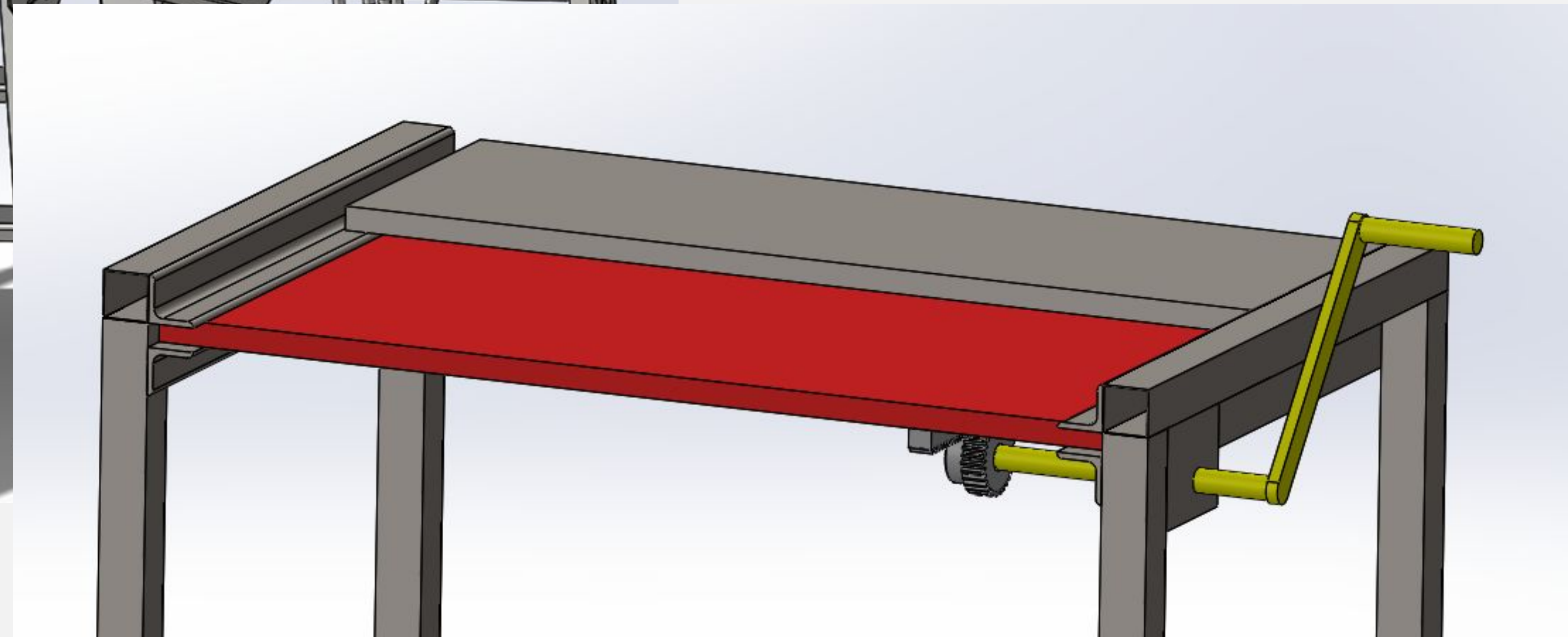
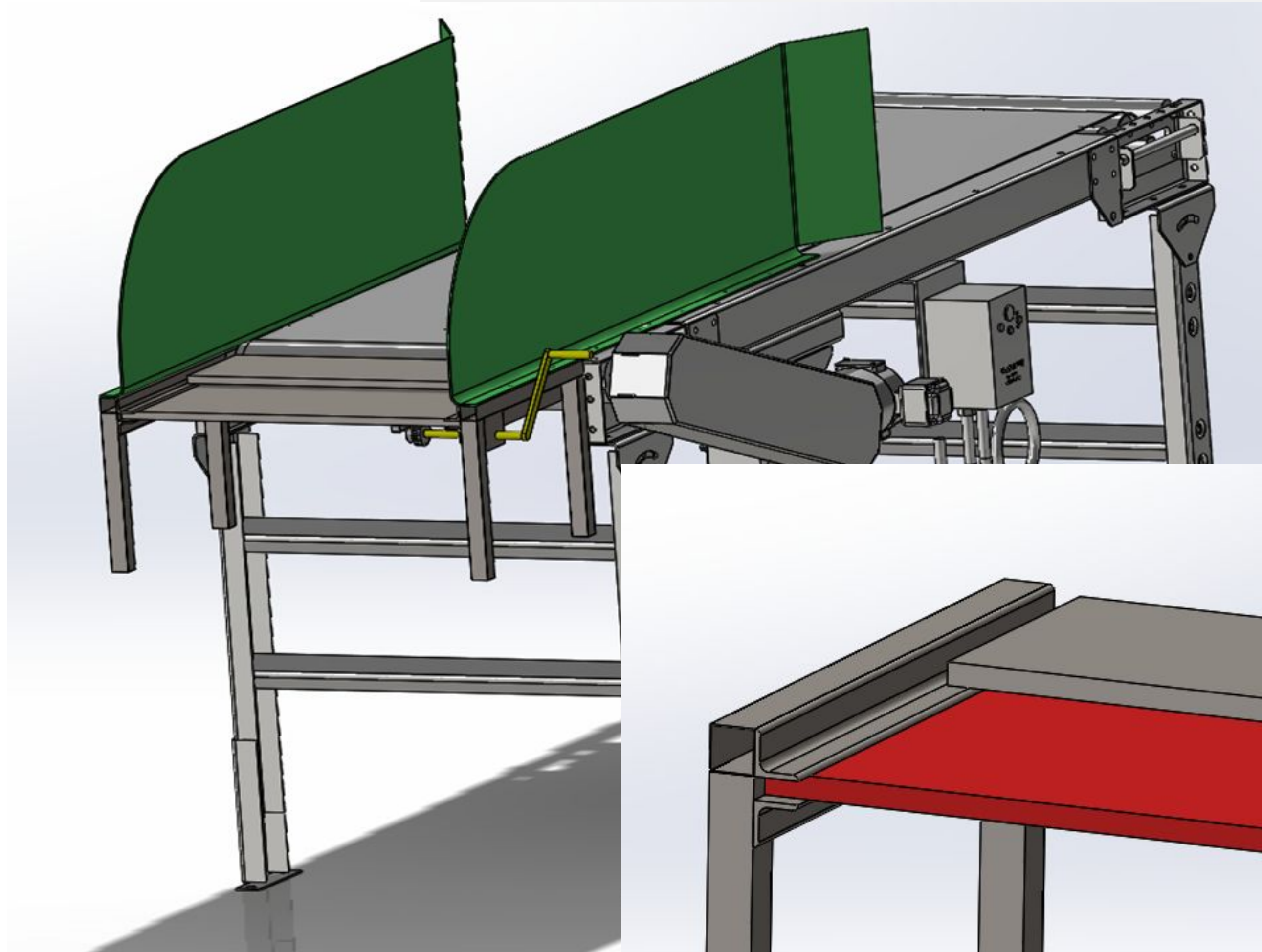
Final Design Concept



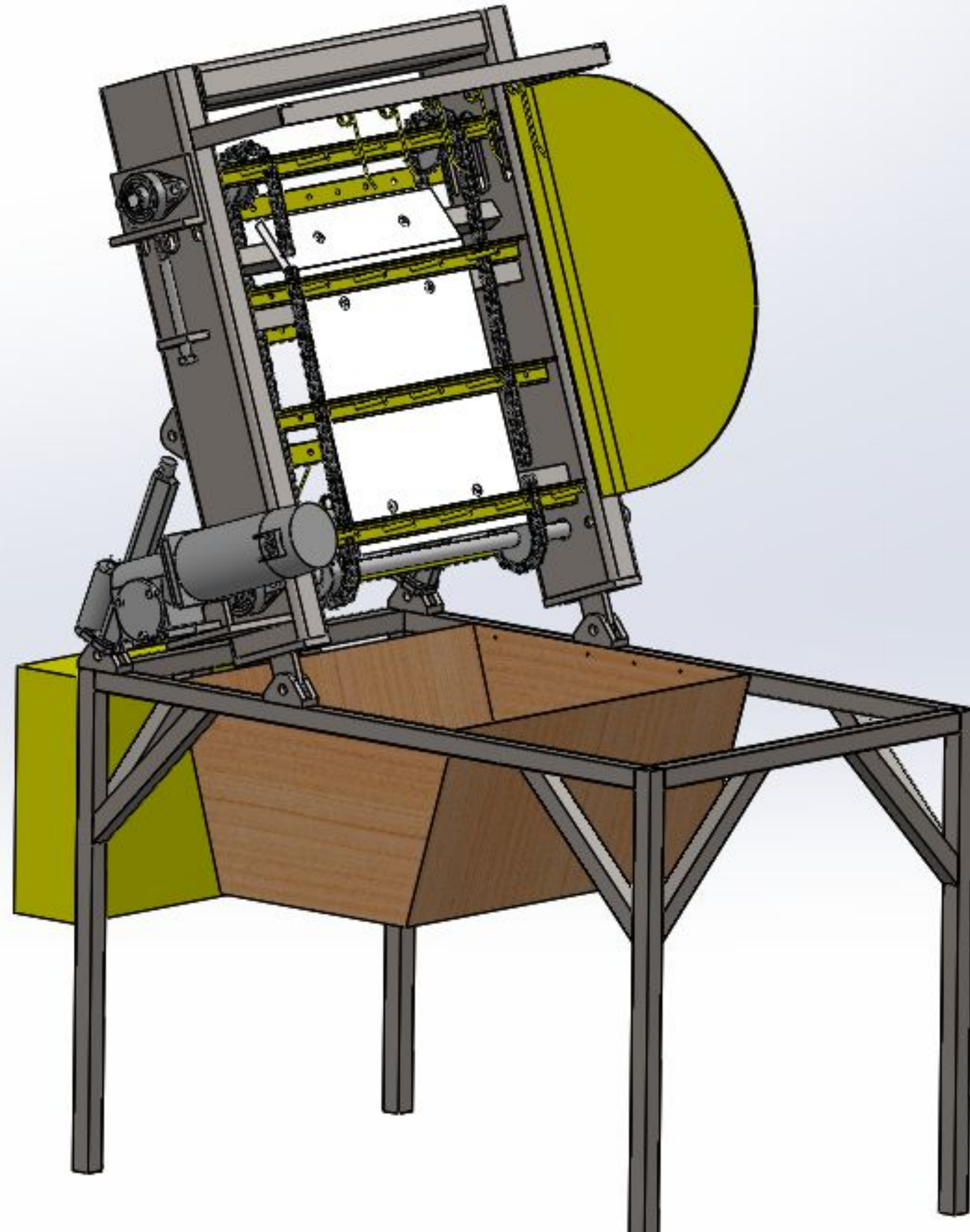
Final Design Prototype



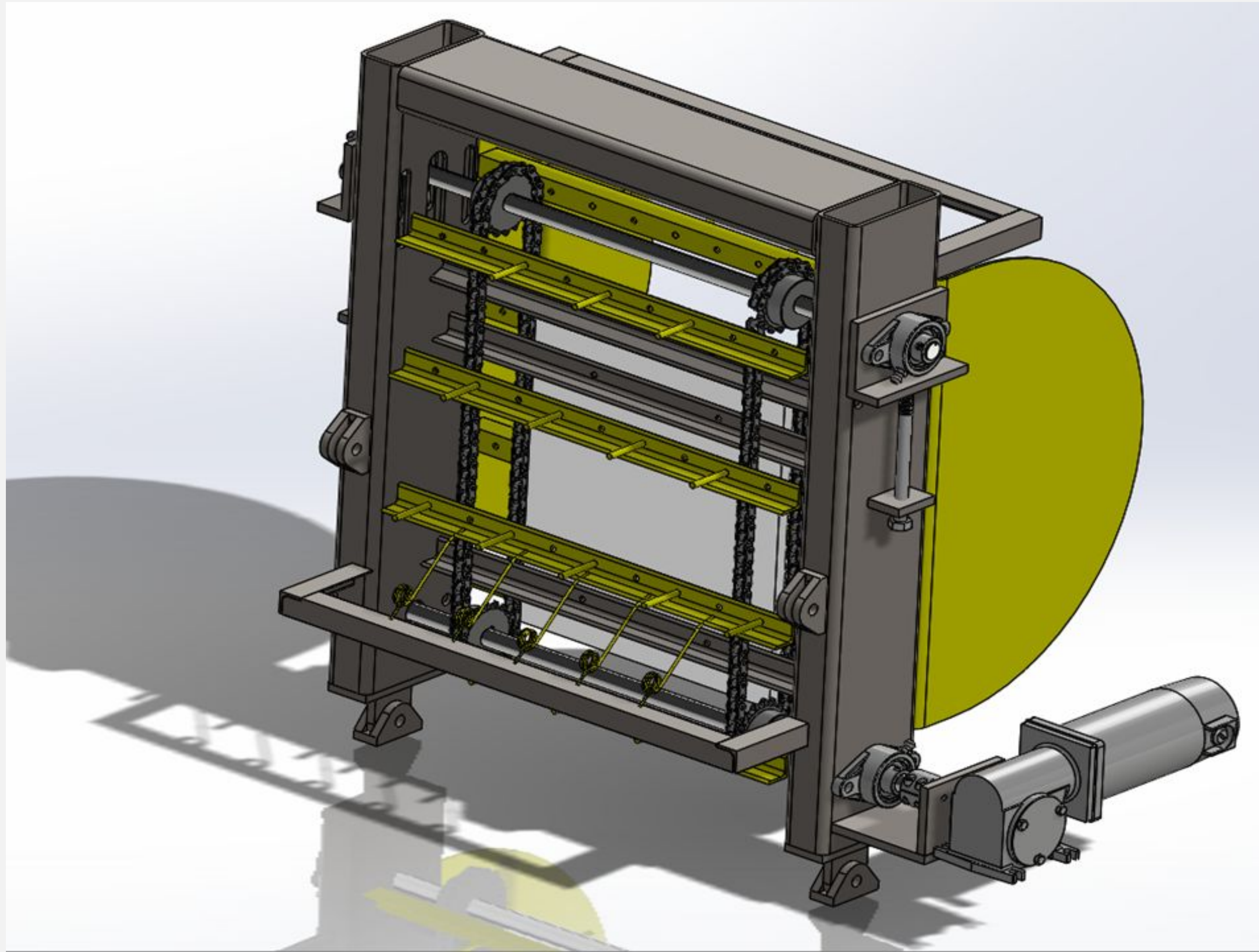
Infeed Design Concept



Debaling Head Design



Debaling Head Design



Material Cost

Cross Bars - Pacific Steel \$8

Linear Actuators - Amazon \$84

DC motor - Amazon \$165

6'- $\frac{3}{4}$ "-Shafts - Fastenal \$75

4- $\frac{3}{4}$ " Bearings - Amazon \$22

Electrical Box - Amazon \$32

UHMW Wear Plate - Amazon \$20

4 - Sprockets - Provided by client

Sub Total = \$700

Teeth - Fastenal \$20

Emergency Switch - Amazon \$13

2- 40 amp Relays - Amazon \$10

3 Rocker Switches - Amazon \$27

1200 watt DC Power Supply - Amazon \$86

DC Speed Controller - Amazon \$14

Chain - Provided by client

Metal - Pacific Steel \$140



Carolina Tarp Motor



- 50:1 gear reduction
- 1.5 HP
- 44 NM ~ 32.5 ft. lbs
- 80~100 RPM
- Reversible
- 3/4 inch Shaft for Direct Drive
- 40 Amp at max torque
- 12 volt
- 5/16 inch mounting holes

Project Management

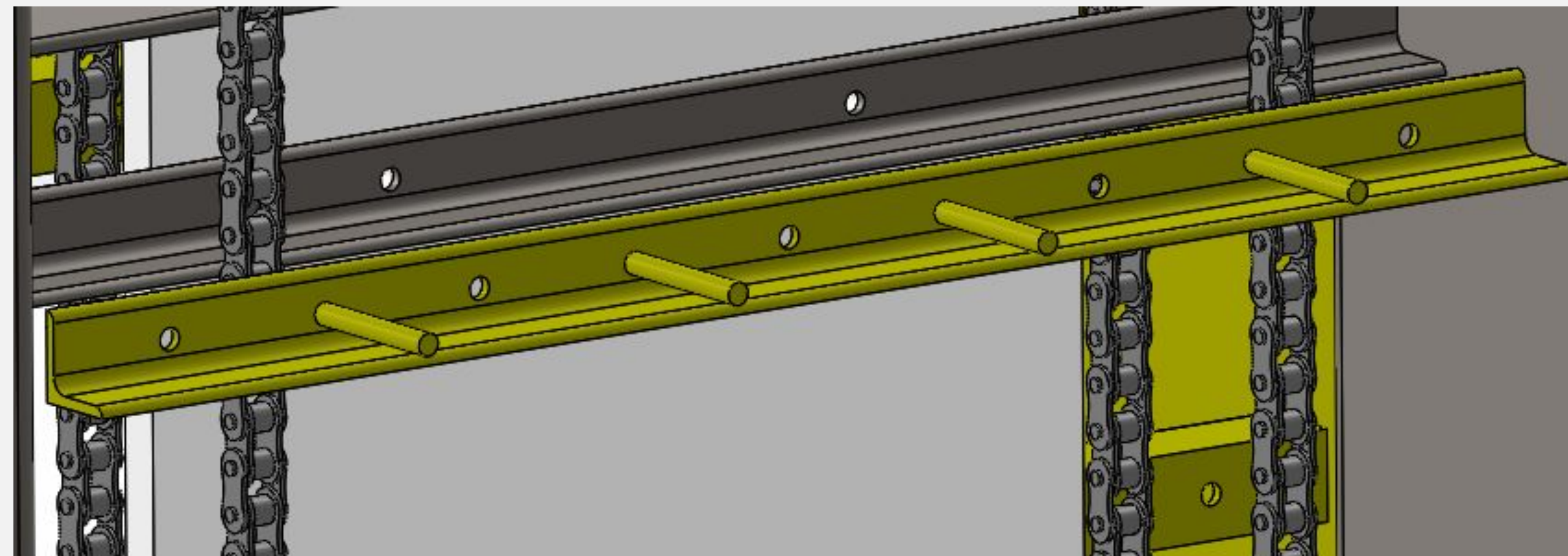
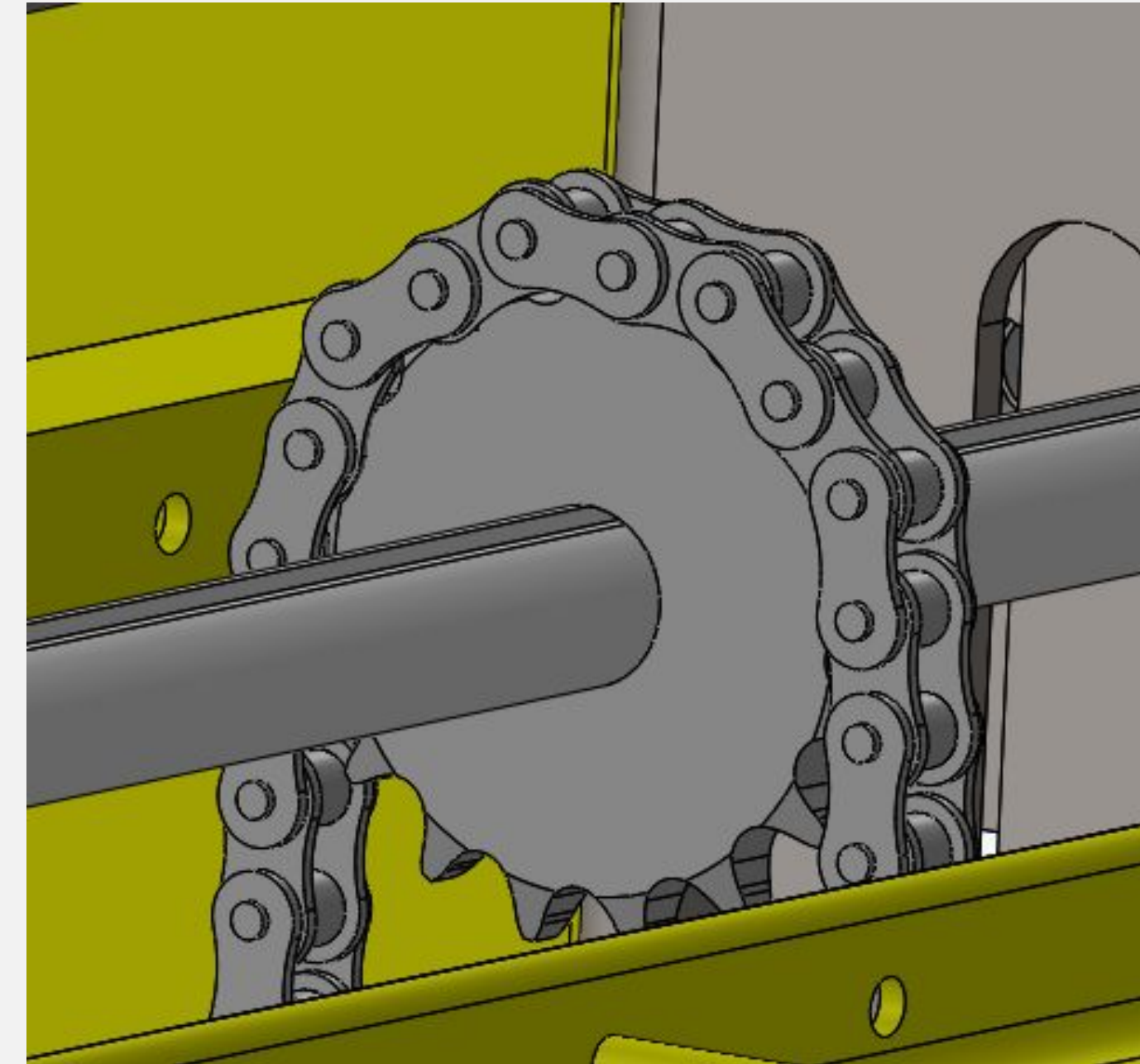
- Current Budget: \$1200.00
 - \$90.00 spent, \$1110.00 remaining
- Projected expenses:
 - Second prototype \$700.00
 - Machine shop time \$200.00
- Going forward-second prototype
 - End of March
 - Final drawings end of April

	Test prototype and note design changes	2/17/2020	2/17/2020
Feb 10 - Feb 14			
Feb 17 - Feb 21	Engineering Release Review		
	Logbook Review		
Feb 24 - Feb 28	Engineering Release Review		
	Design Prototype #2 (Scale for Expo)	2/18/2020	
Mar 2 - Mar 6	Prep Material for Snapshot 3		
	Snapshot #3		
Mar 9 - Mar 13	Engineering Release Review	3/9/2020	
	Team member citizen ship form		
	Purchase all material for final prototype		
Mar 16 - Mar 20			
Mar 23 - Mar 27	Build Final Design		
Mar 30 - Apr 3	Test Final Design		
Apr 6 - Apr 10	Design Full Size model		
	Analysis on full size motor		
	Analysis on full size mechanical components		
Apr 13 - Apr 17	Logbook Review		
	Second Engineering Release of Full Scale		
Apr 20 - Apr 24	Wrap up paperwork and portfolio		
Apr 27 - May 1	Expo		

DFMEA

Highest Probability of Failure

- 22 entries
- Drive chain skipping or snapping
 - (RPN score of 16)
- Cross bar failure
 - (RPN score of 12)
- Electrical controls
 - (RPN score of 12)





Questions?

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