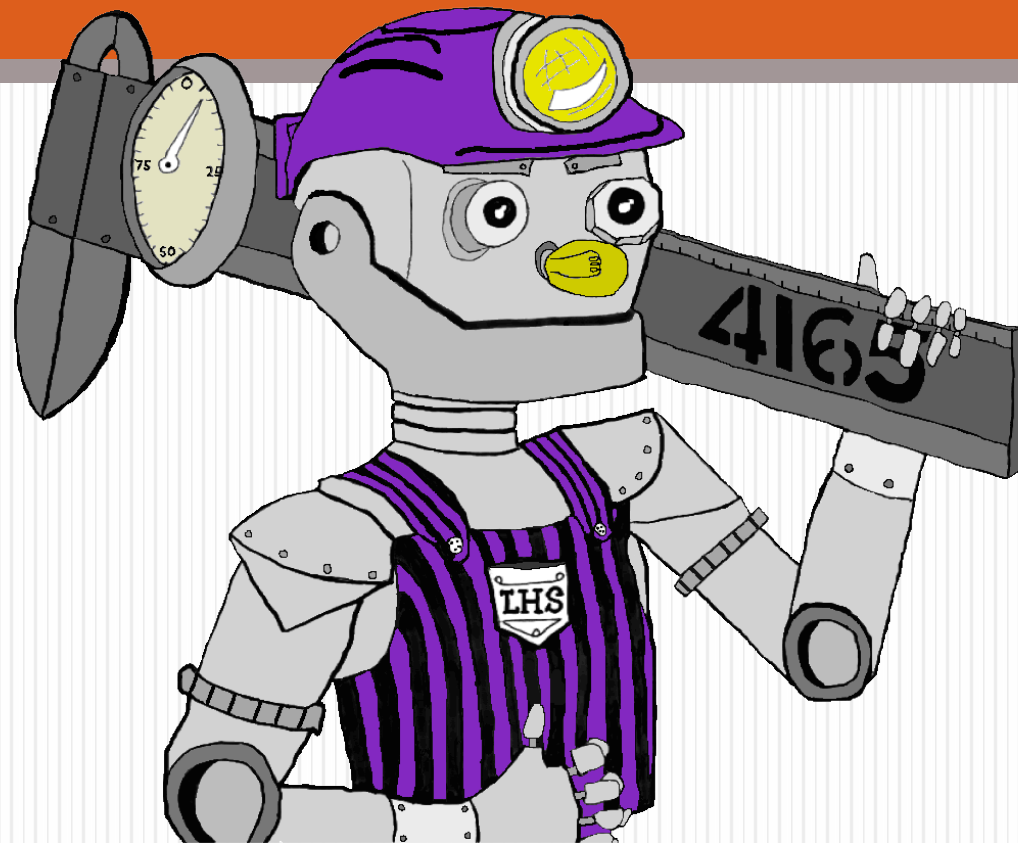
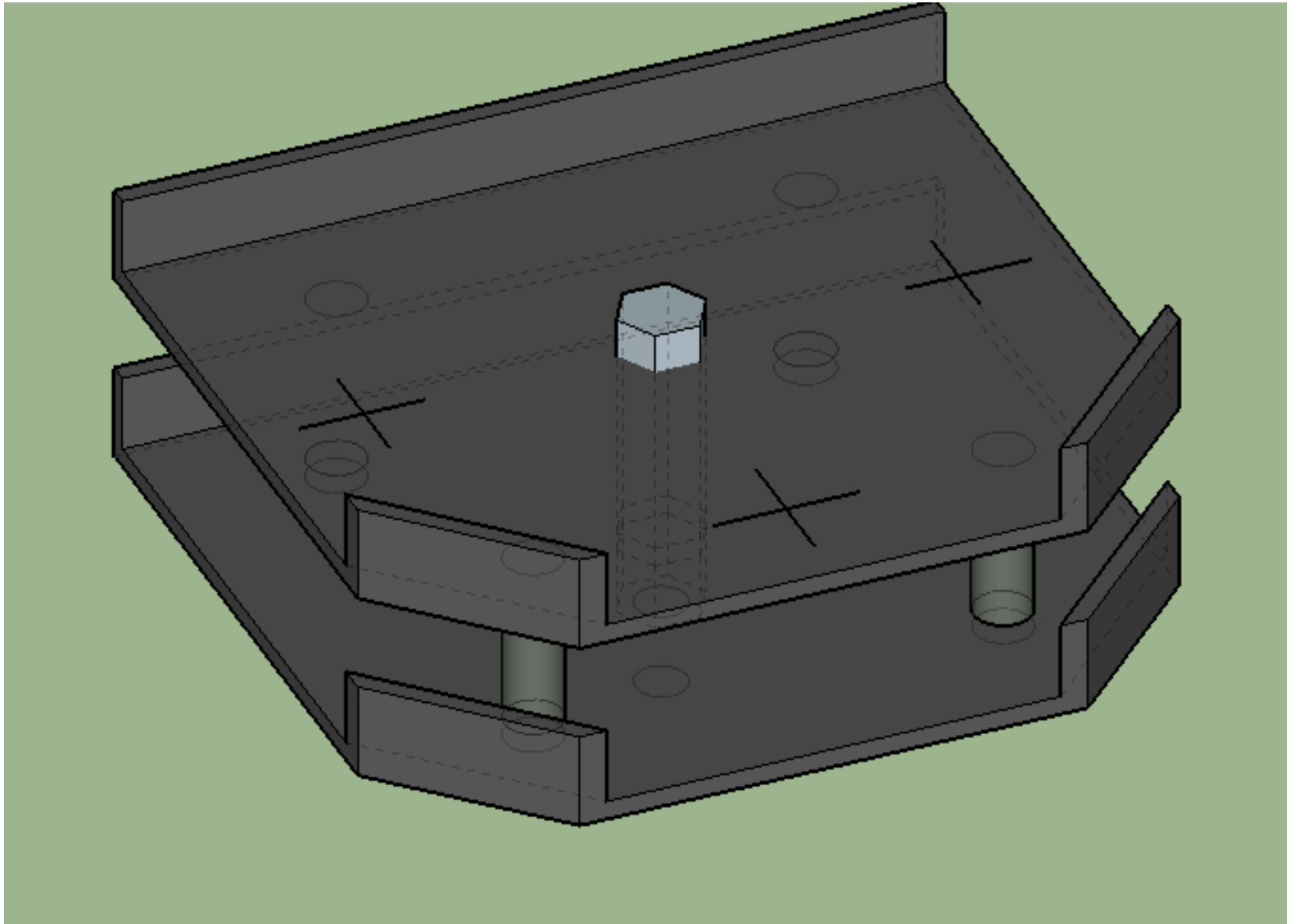


# Team 4165 Swerve Concept



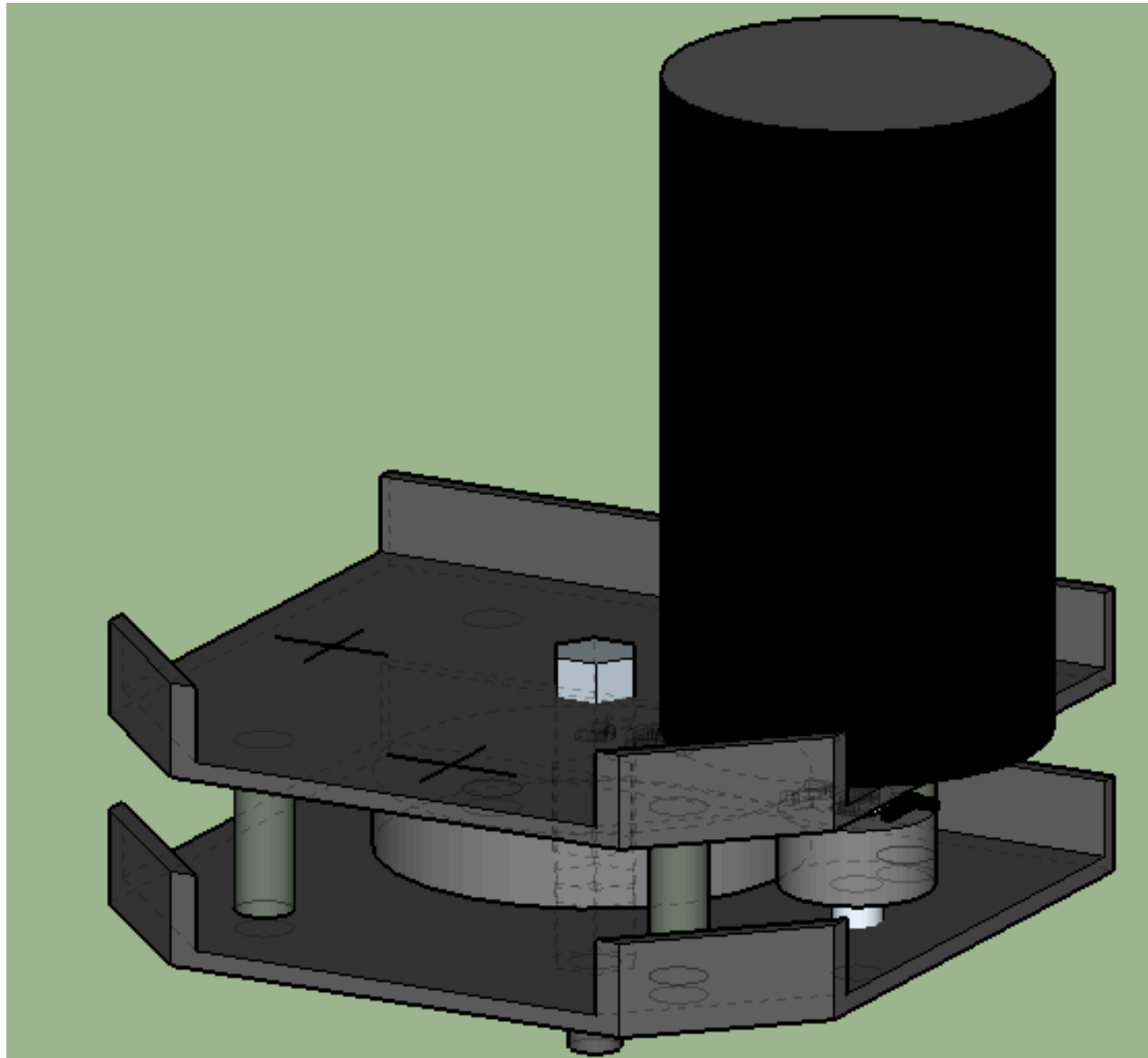
- Take a Single-Speed Single Reduction VEX Gearbox



# Change Gears on Gearbox

- Normally this version of the gearbox takes a 12T CIM motor and mates it to a 64T output gear.
- We replace the CIM gear with a 20T gear with shaft adapter.
- The output gear is then replaced with a 56T gear from Andymark.
- This maintains the gear spacing and no modification need made to the Gearbox.

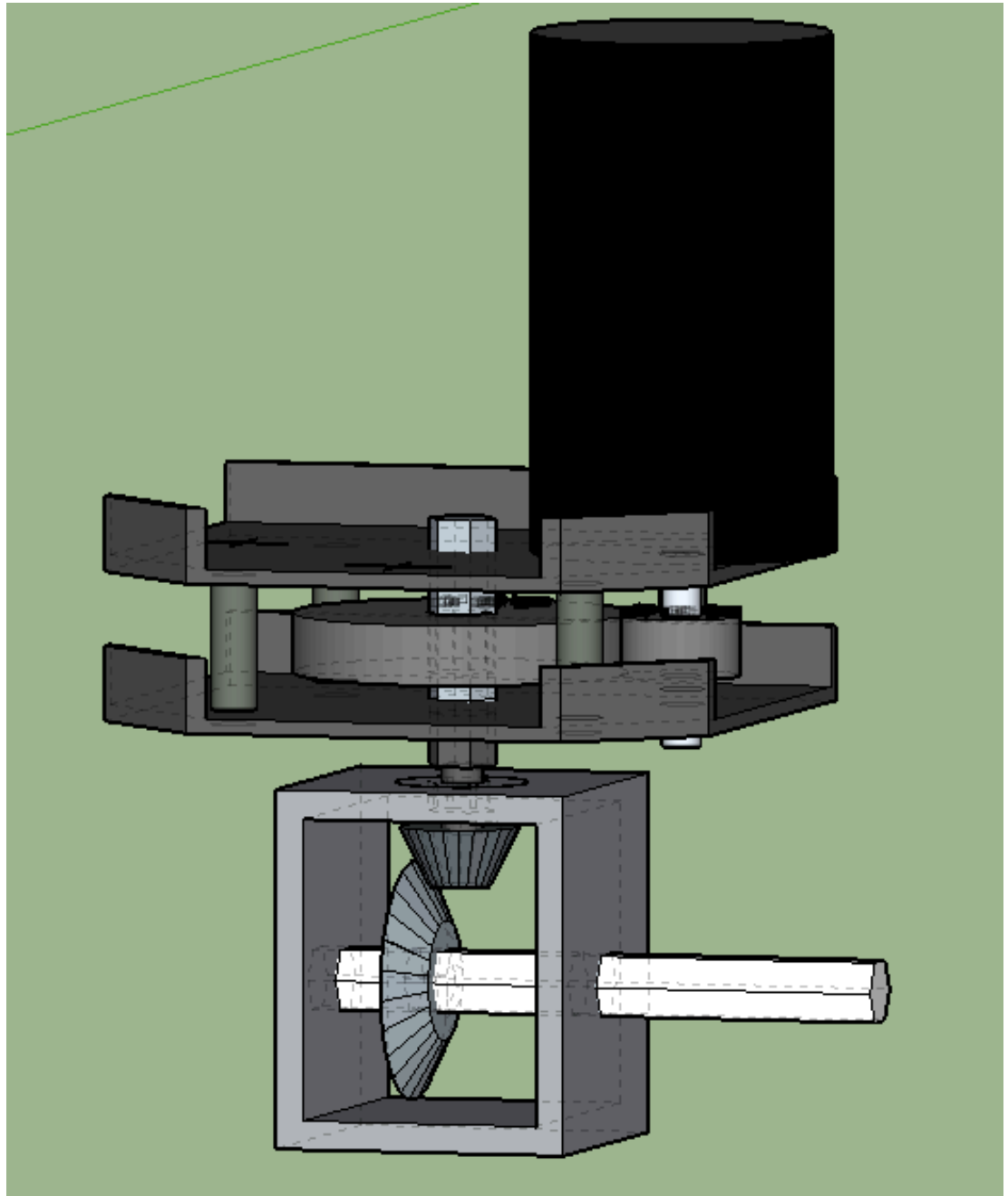
- Shown with CIM motor and 20T/56T Gears



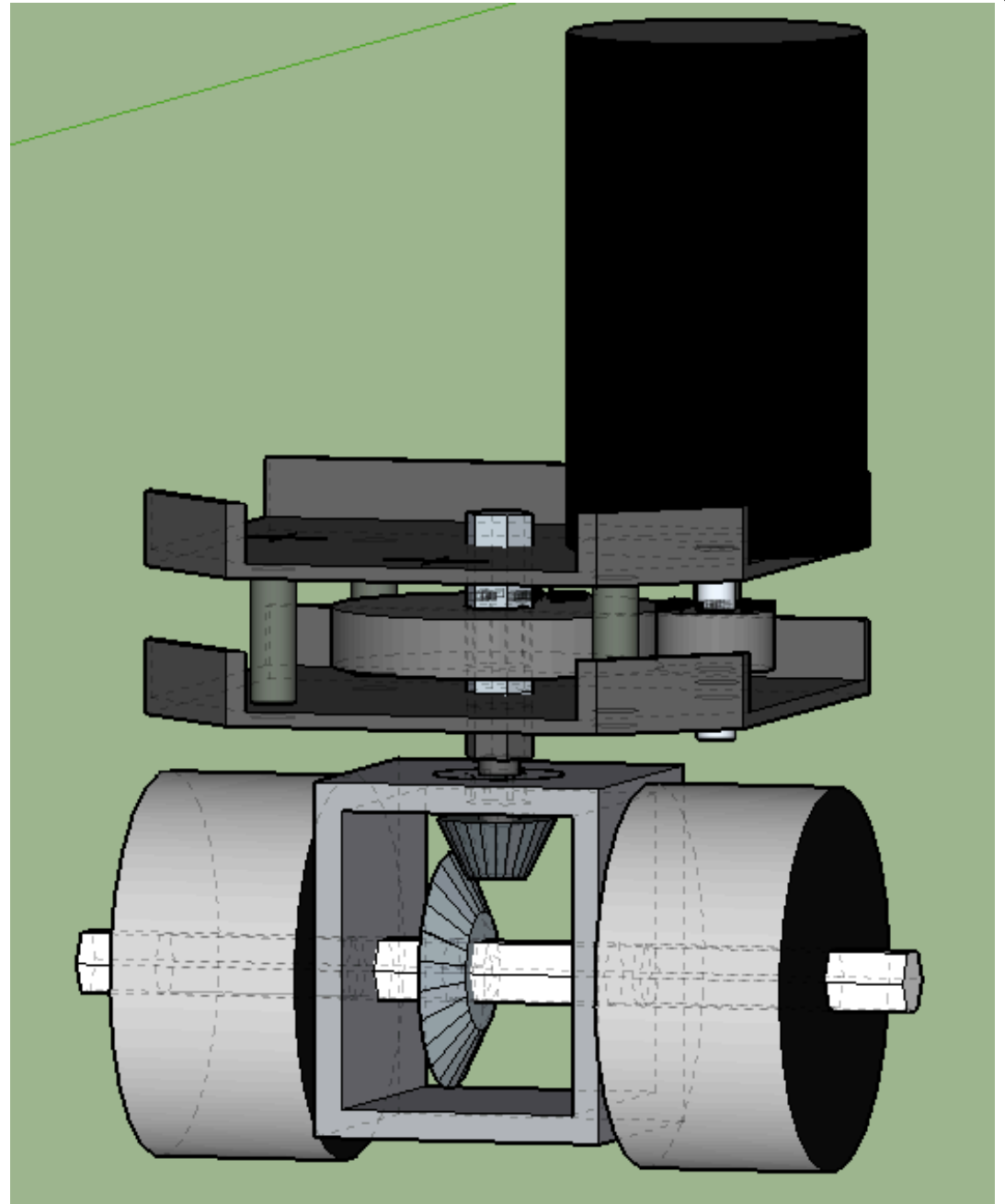
# Modify Output Shaft

- Currently we need to take the output shaft from the VEX gearbox and turn the end down from 1/2" hex to 8mm.
- We are working on finding a way to eliminate this step, by looking at alternate shaft options.
- This is the only step that required any precision machining.

- The Vex gearbox can now be mounted to a LJ Bevel gearbox from Andymark.



- With a simple change of bearings, the Bevel Gearbox output shaft can be replaced with hex shaft and two 3" or 3.25" wheels added.
- Shown with 3.25" Versa wheels



# Drive Advantages

- All gear transmission of torque (no belts to slip, chains to stretch, etc)
- Can change gears in VEX gearbox for different speeds/torques.
- COTS parts.



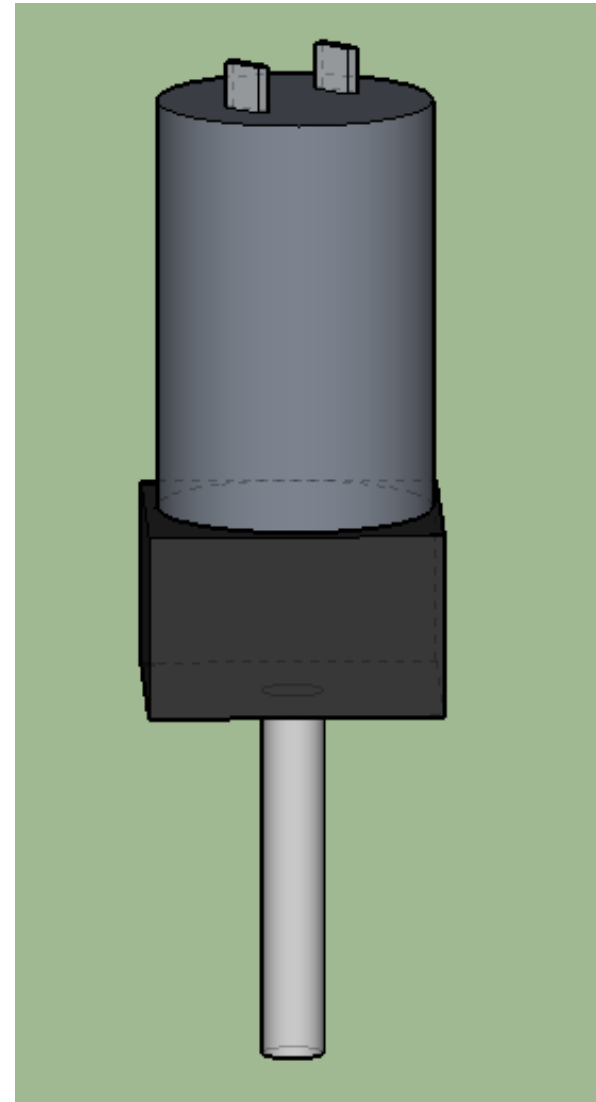
# Performance as Configured

1-Speed Drivetrain

		Free Speed (RPM)	Stall Torque (N*m)	Stall Current (Amp)	Free Current (Amp)		Speed Loss Constant	Drivetrain Efficiency
	CIM	5310	2.43	133	2.7		81%	90%
	# Gearboxes in Drivetrain	# Motors per Gearbox		Total Weight (lbs)	Weight on Driven Wheels		Wheel Dia. (in)	Wheel Coeff
	4	1		135	100%		3.25	1.3
	Driving Gear	Driven Gear		Drivetrain Free-Speed	Drivetrain Adjusted Speed		Pushing Match Current per Motor	
	20	56		13.45 ft/s	10.89 ft/s		88.40 Amps	
	20	40		5.60 : 1	<-- Overall Gear Ratio			
	1	1						
	1	1						

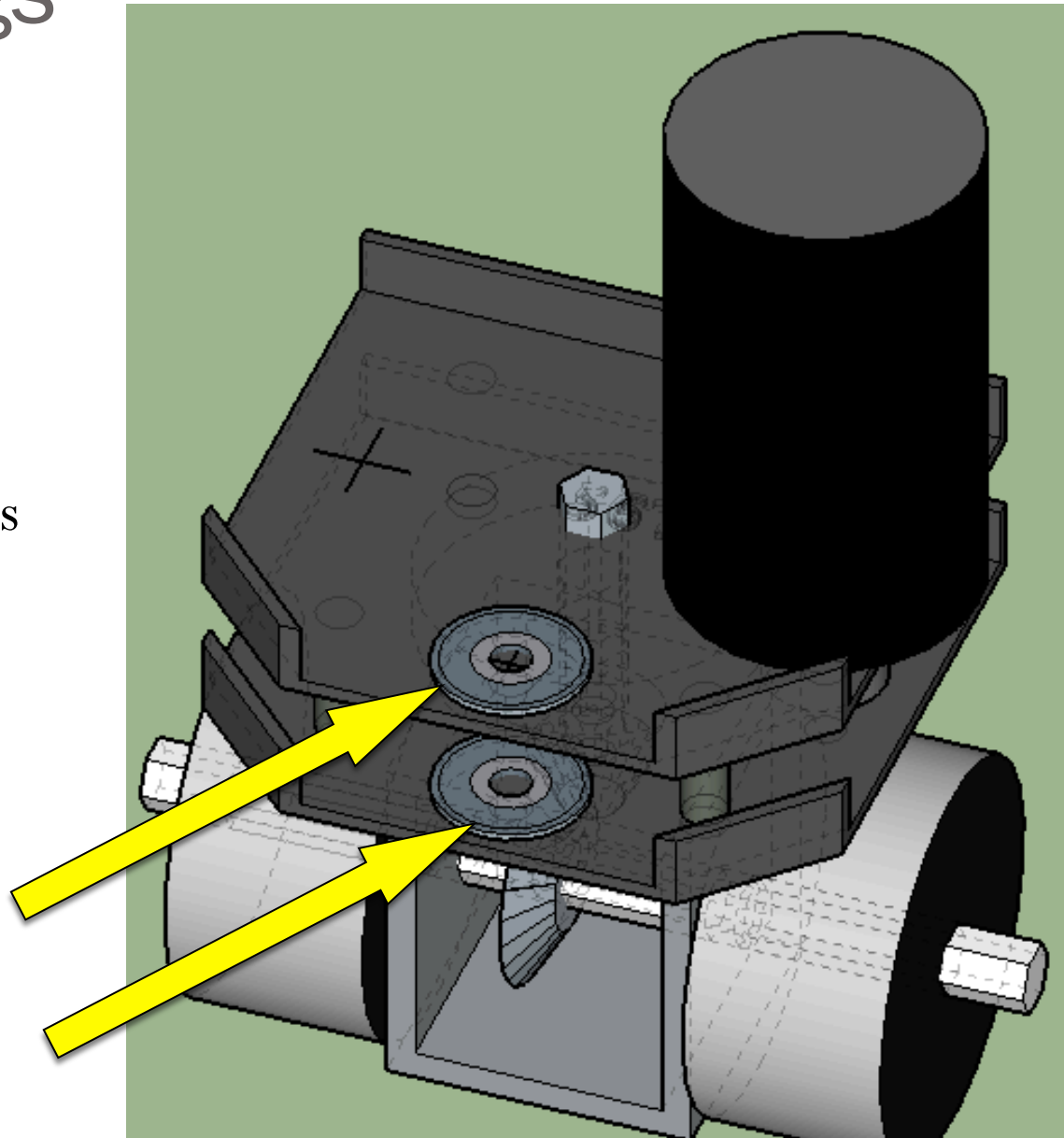
# Steering Assembly

- Banebots RS-775 18V motor
- 9:1 VEX Versaplanetary



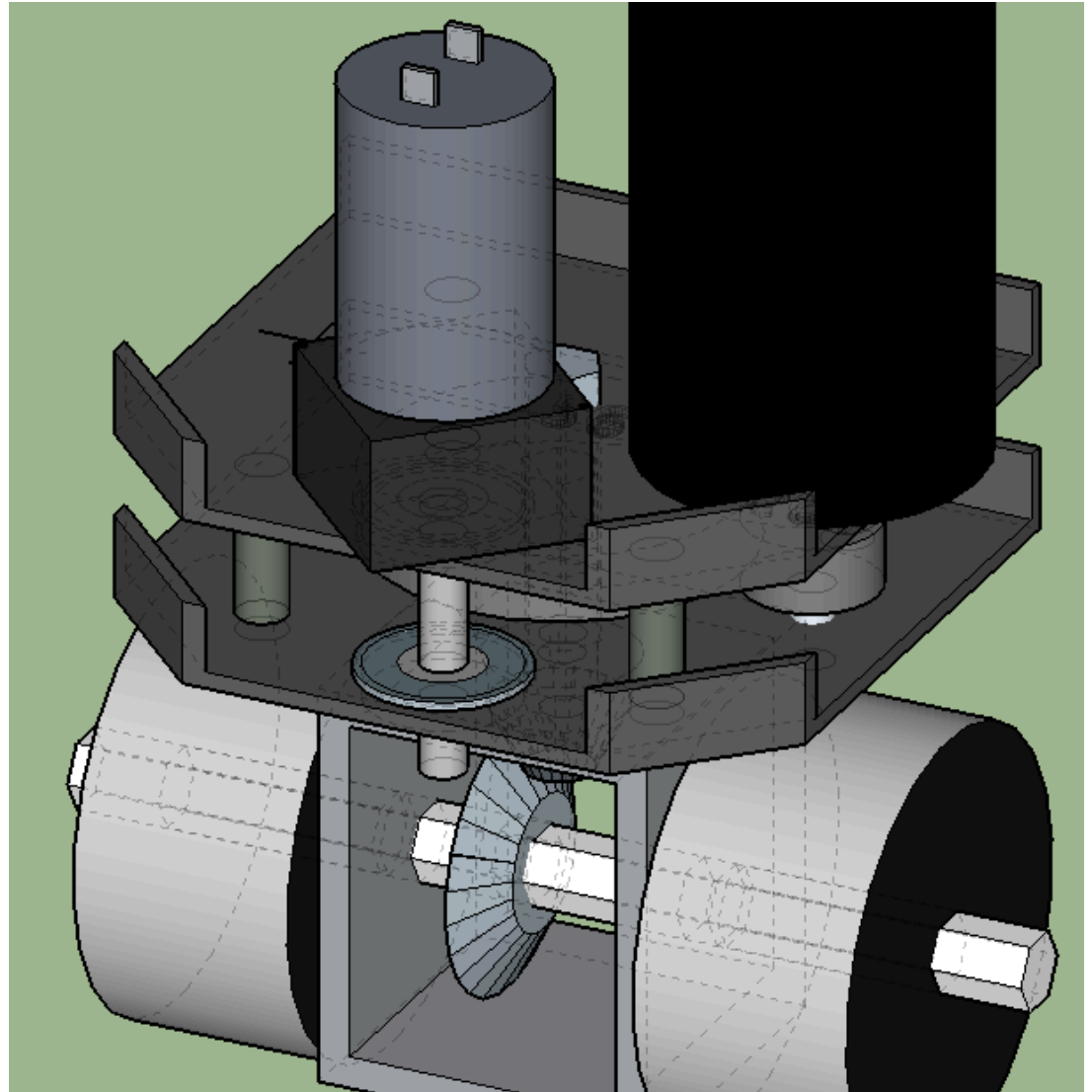
# Mount Bearings

- Drill out the other CIM mounting hole to 1 1/8" Diameter with a step drill bit and press in bearings



# Steering Assembly

- Take the Steering Assembly and mount it to the gearbox passing its shaft through the support bearings.



# Steering Gear Assembly

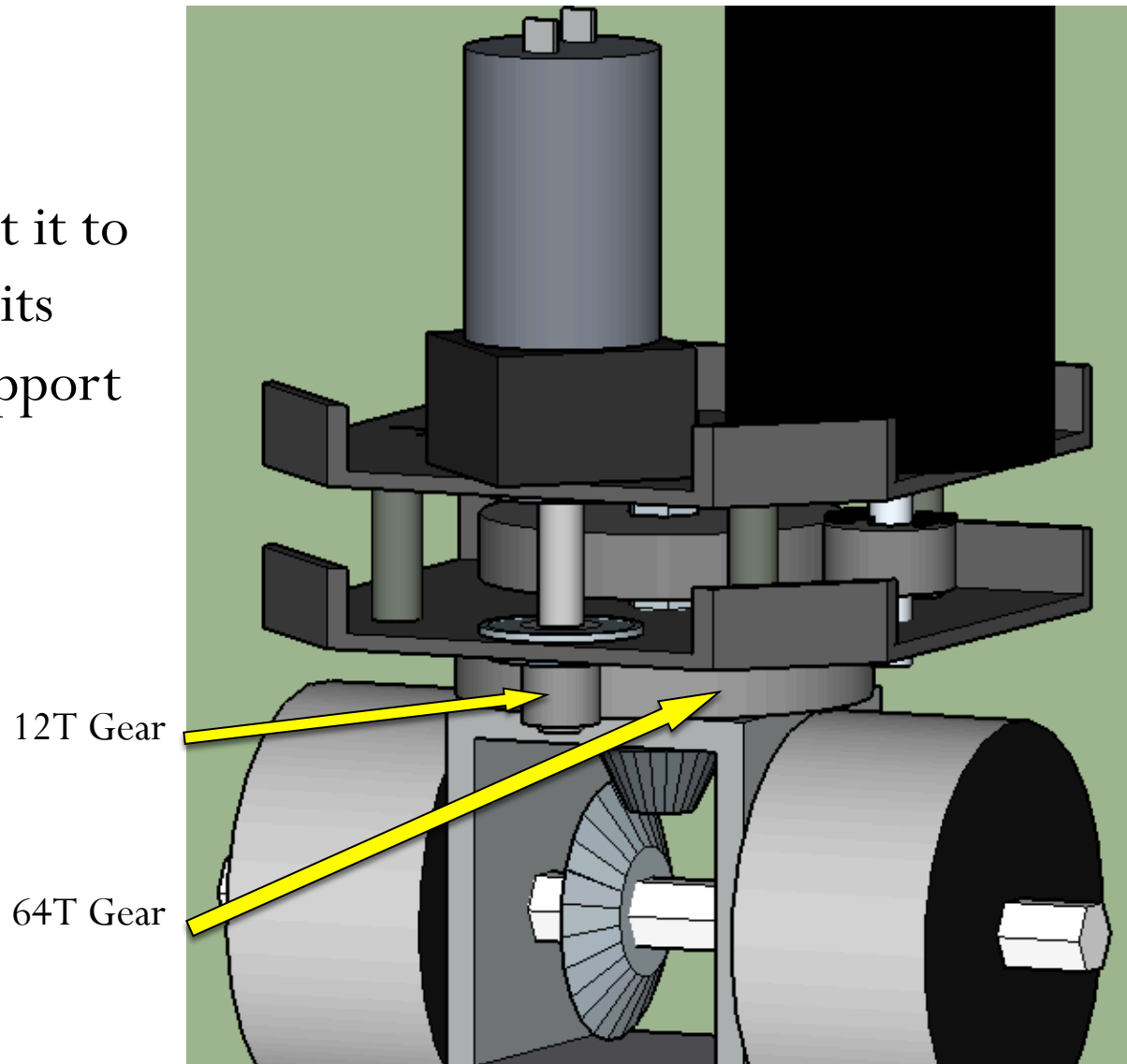
- For the next part we are going to use the original 12T and 64T gears that came with the Single Speed Vex Gearbox, avoiding the expense of purchasing additional gears.

# Steering Gear Assembly

- The 64T gear will be mounted directly to the top of the LJ Bevel box. It can be centered using a Hex hub. It will be secured using 6 small bolts.
- The 12T gear will be mounted to the end of the Versaplanetary output shaft.
- By keeping the same center points and gears as originally came with the gearbox we know that they will align properly.

# Steering Gear Assembly

- Take the Steering Assembly and mount it to the gearbox passing its shaft through the support bearings.



# Steering Advantages

- All gear transmission of torque (no belts to slip, chains to stretch, etc)
- Reuses original Vex gears, saving \$\$
- Flexible: could change gear ratios for added \$\$
- Compact
- All COTS parts



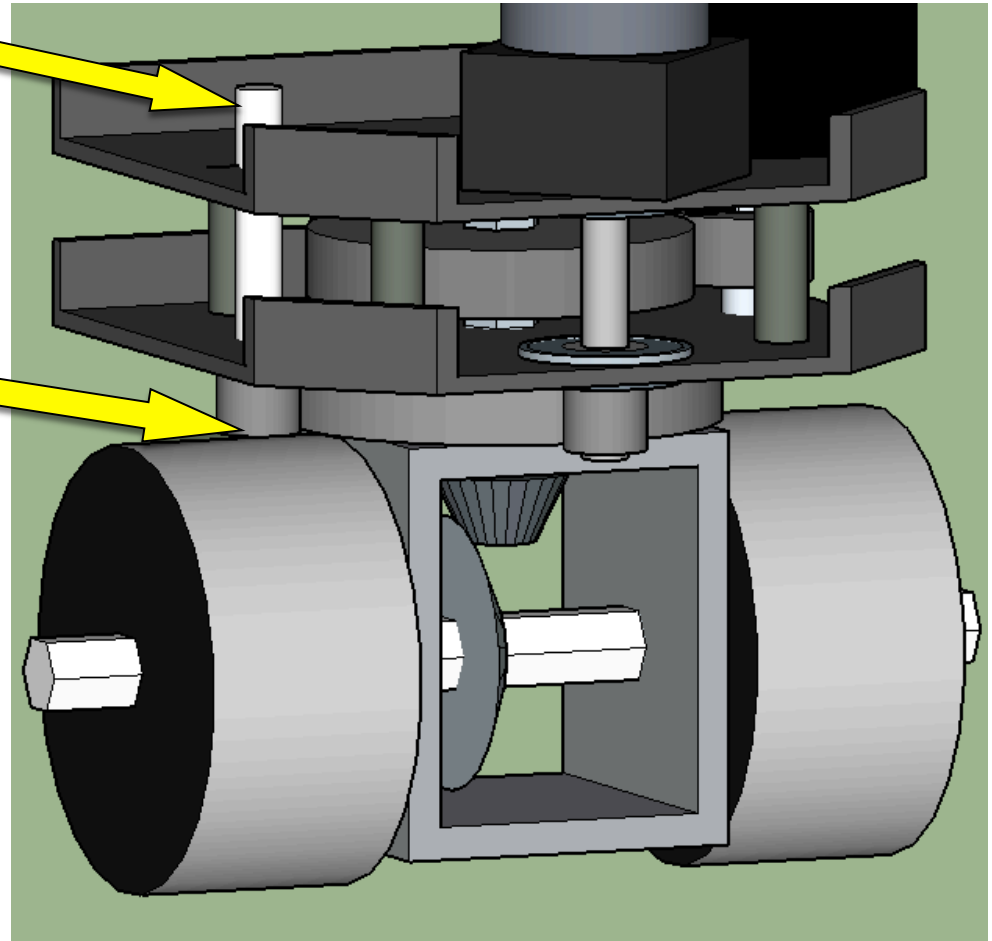
# Steering Performance

Rotary Mechanism					
	Free Speed (RPM)	Stall Torque (N*m)	Stall Current (Amp)	Free Current (Amp)	
RS-775-18 (@12V)	13000	0.78	86.67	1.80	##
# Motors per Gearbox	Gearbox Efficiency		Arm Load (lbs)	Arm Length (in)	
1	70%		40	2.125	
Driving Gear	Driven Gear		Arm Rotational Speed	Arm Time to move 90- degrees	
1	9	No Load:	1625.0 deg/s	0.06 sec	
12	64	Loaded:	1032.0 deg/s	0.09 sec	
1	1				
1	1				
48.00 : 1	<-- Overall Ratio		Current Draw per Motor (loaded)	Stall Load	
			23.48 amps	109.62 lbs	

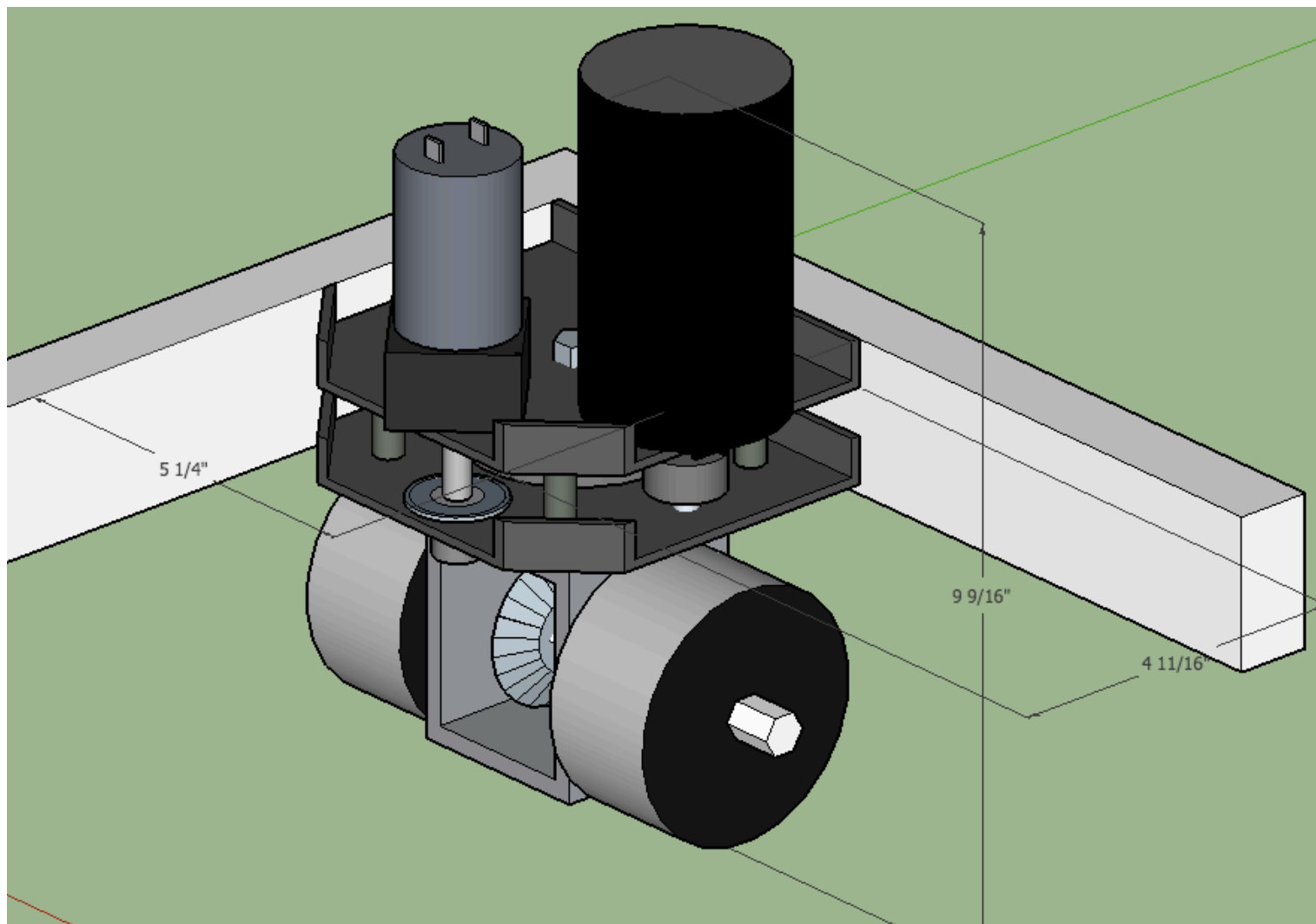
Arm load based on 160 lb robot

# Steering Control

- A unpowered **Jackshaft** can be mounted in the third CIM mounting position with an **12T gear** to give a good encoder mounting position.



Easy to Mount (Shown w 1x2 frame)



# Overview

- Total Weight  $\sim$  7.4lb
- Total Cost  $\sim$  \$ 380
- Only one piece needs to be slightly machined
- Flexible Gear ratios
- Compact ( $\sim$ 5"x5"x10")

	<b>7.37</b>	<b>380</b>
	Weight	Cost
56T Al gear	0.18	23
20 T .5hex	0.03	7
8mm to .5 hex adapter	0.03	11
LJ gear box	0.95	129
SS SR gearbox	0.665	65
CIM Motor	2.82	28
Versa wheels (2)	0.48	12
Steel Shaft 1/2 hex	0.4	1
RS 775	0.75	17
Wheel Shaft Collars(2)	0.06	12
Thrust Bearing	0.11	15
Versa Planetary 1:9	0.56	60
12 T CIM from SSSR	0.05	0
64 T from SSSR	0.285	0

# Overview

- We think this design will bring the possibility of swerve to many teams with out high level manufacturing abilities.
- It is a system they can build and modify on their own with only basic tools. Rather than a premade one-size-fits-all solution.