Motor Assembly

Copper Face

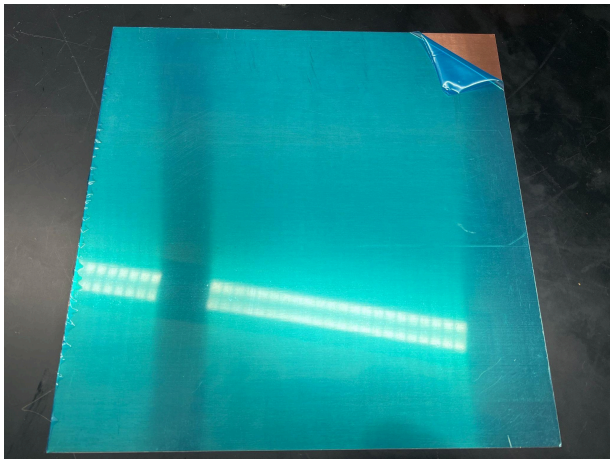

Figure 1: Uncut 1’ x 1’ copper sheet

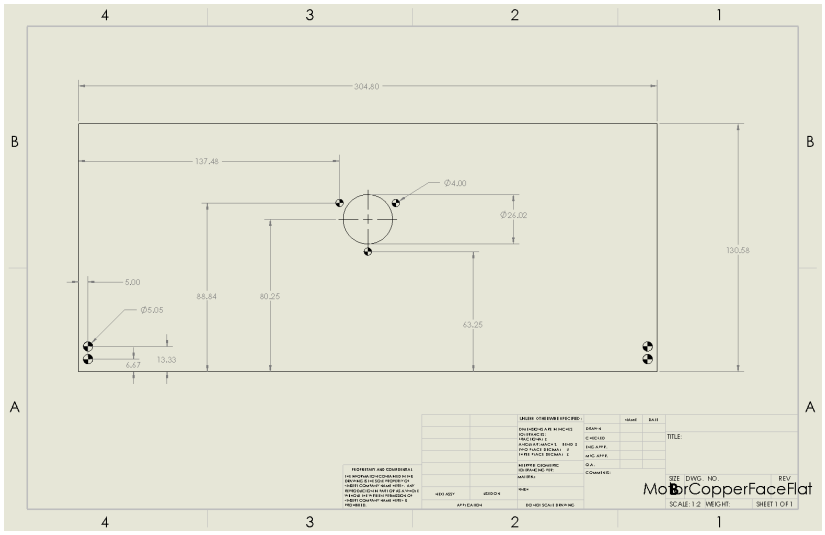

Figure 2: Copper face drawing

1. Starting from the 1’ x 1’ copper sheet illustrated in figure 1, on the metal shear in the. TEAM Lab, cut a piece to 130.58cm tall.
2. Drill a pilot hole in the cut copper sheet at 152.4mm in the x-dimension, and 88.84mm in the y-direction as illustrated in figure 2.
3. Using a 1” hole saw, drill a 1” hole centered at the previously drilled pilot hole.
4. Drill three 3mm holes 120 degrees apart around the previously drilled 1” hole as illustrated in figure 2.
5. Drill four 5mm holes at the locations illustrated in figure 2.

Motor Stand

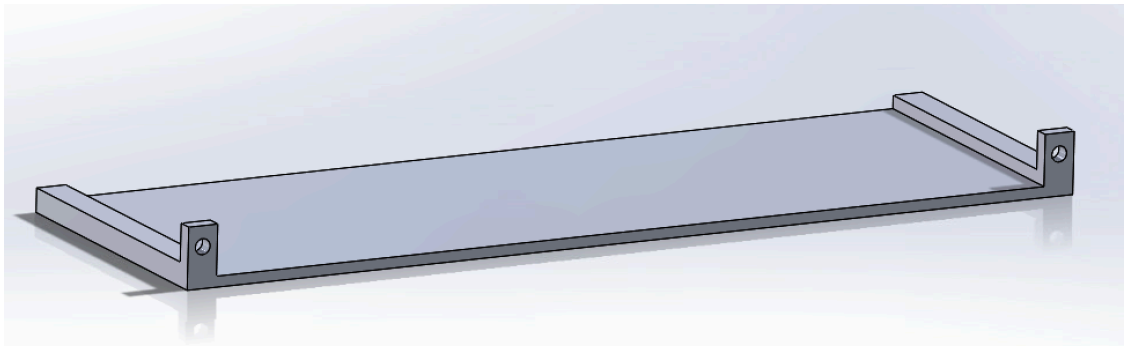

Figure 3: Motor stand SOLIDWORKS

1. 3D print attached motor stand .stl file at the Makerspace with 20% infill.

Motor to Driveshaft Adapter

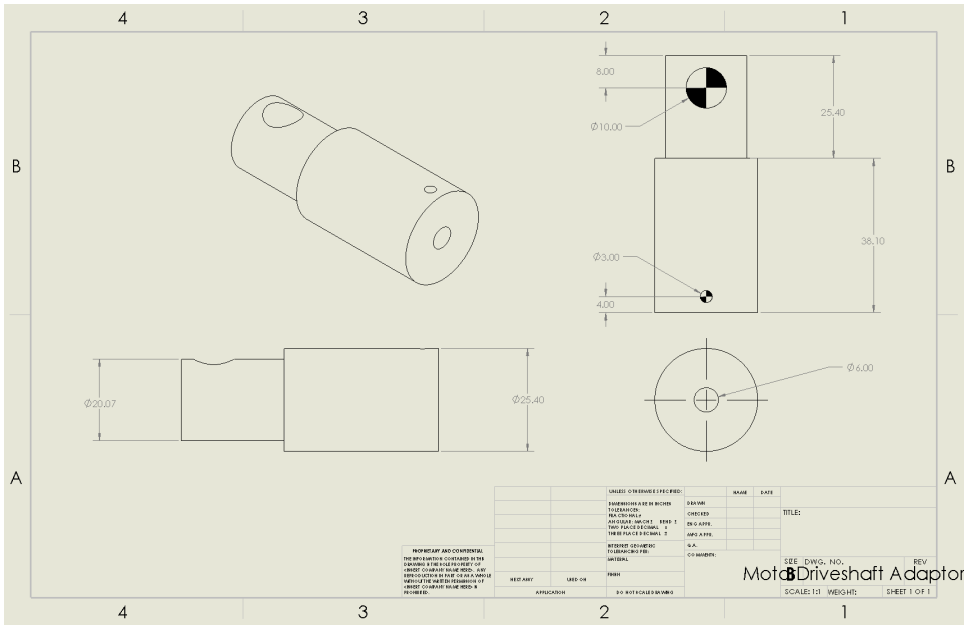

Figure 4: Driveshaft to Driveshaft Adapter drawing

1. Starting from 1” cylindrical aluminum stock, lathe one side down to a 20.07mm diameter 25.4mm in the TEAM Lab, as illustrated in figure 4.
2. Using a 6mm bit, drill a center hole 19mm deep on the side of the stock that is 25.4mm, as illustrated on figure 4.
3. Part the cylindrical aluminum stock off at 63.5mm, as illustrated in figure 4.
4. On the mill, drill a 3mm hole 4mm from the end of the 25.4mm end of the part. Drill down to the center hole drilled on the lathe, as illustrated on figure 4.
5. On the mill, drill a 10mm hole 8mm from the end of the 20.07mm end of the part. Drill all the way through the part, as illustrated on figure 4.

Full Motor Assembly

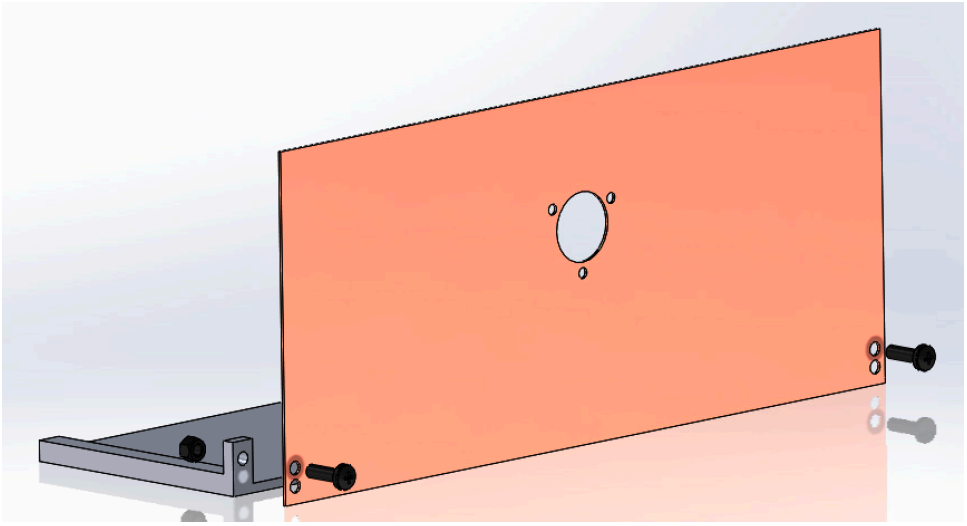

Figure 5: Motor stand and Face connected via two M5 screws

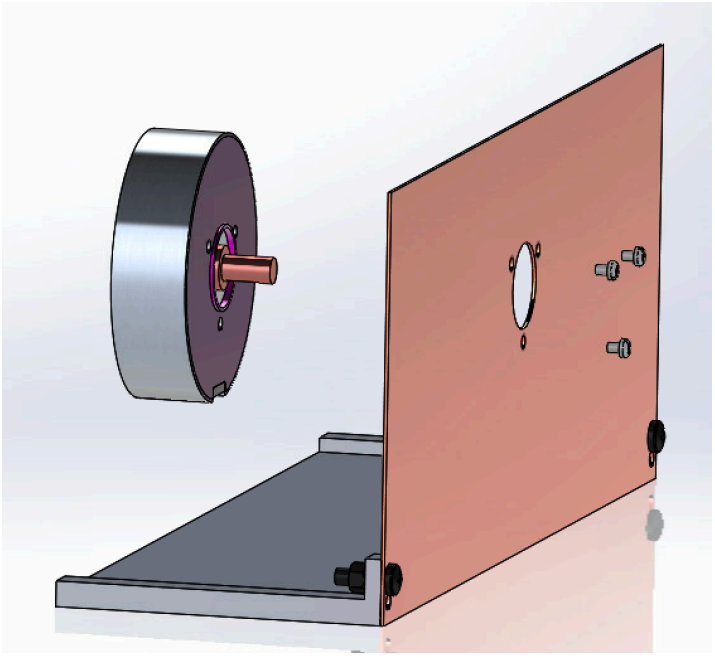

Figure 6: Motor connected to Motor stand via three M4 screws

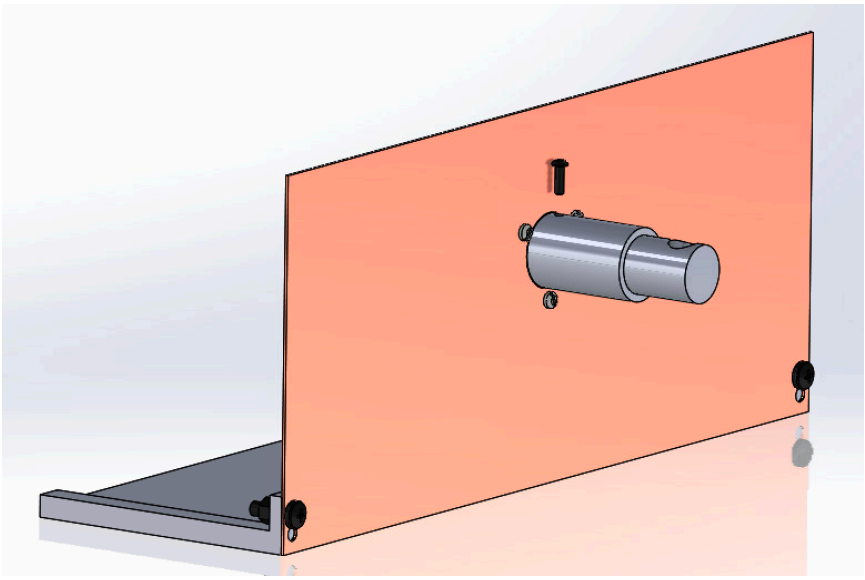

Figure 7: Motor to Driveshaft Adapter connected to motor via a M3 set screw

1. Using two M5 screws, attach copper face to copper stand. One screw on each side staggered, as illustrated in figure 5.
2. Using three M4 and three M4 washers, connect the piezoelectric motor to the copper face. Motor cable connection should point down, as illustrated in figure 6.
3. Slide the Motor to Driveshaft Adapter over the motor stud. Using a M3 screw, screw down onto one of the two flat sides of the motor stud to secure the adapter to the motor, as illustrated in figure 7.

Gearbox Assembly

3D Print Components

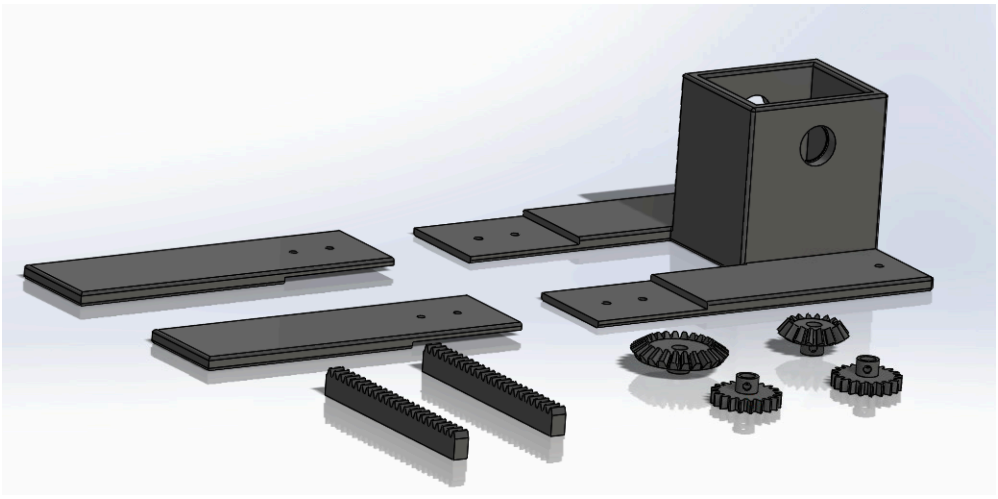

Figure 8: Gearbox 3D printed components

At the Makerspace, 3D print the Gearbox, Gearbox Extensions, Bevel Gears, Pinion Gears, and Rack Gears at 20% infill, as illustrated in figure 8.

Crosspin

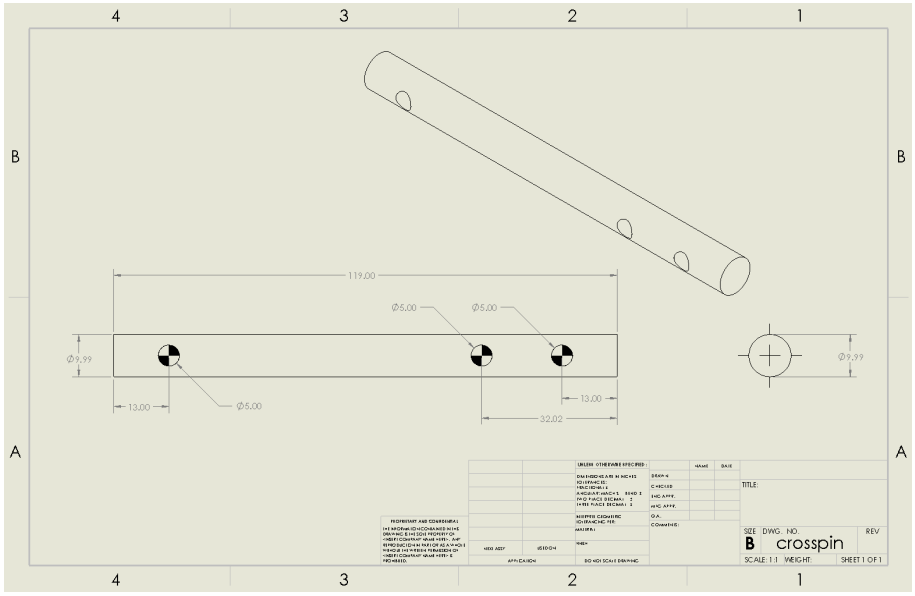

Figure 9: Crosspin drawing

1. In the TEAM Lab, start with 1” HDPE cylindrical stock. Lathe the piece down to 10mm diameter.
2. Using a 5mm bit, on the mill drill three holes in the crosspin in the locations illustrated in figure 9.

Gearbox to Driveshaft Adapter

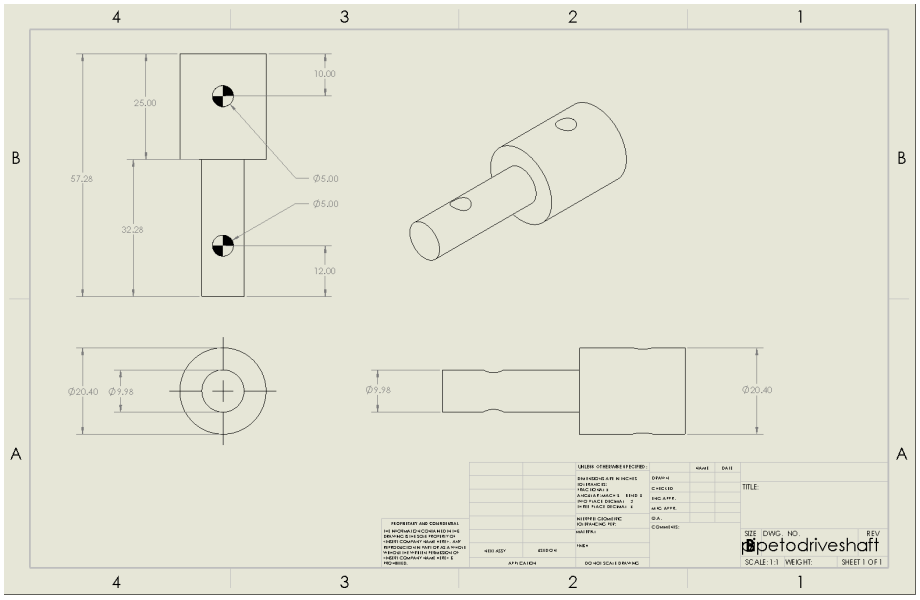

Figure 10: Gearbox to Driveshaft Adapter

1. In the TEAM Lab, start with 1” HDPE cylindrical stock. Lath 32.28mm length to 10mm diameter.
2. Lathe the next 25mm down to 20.4mm diameter.
3. Part the piece off to a 57.28mm length.
4. Using a 5mm bit, on the mill drill two holes in the adapter in the locations illustrated in figure 10.

Phantom Bed

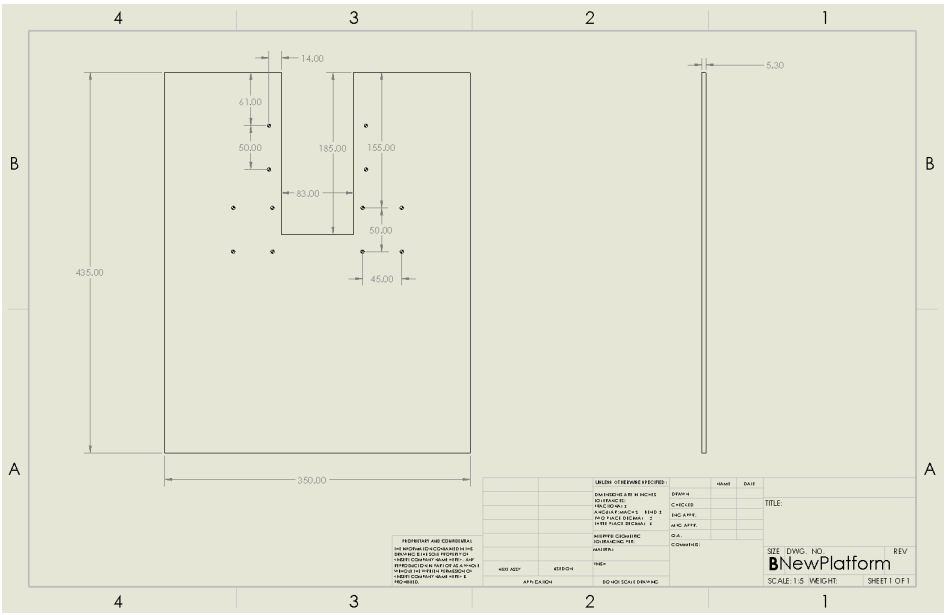

Figure 11: Phantom Bed drawing

1. In the TEAM Lab, cut an acrylic sheet to 350mm by 435mm on a table saw.
2. Using a bandsaw, cut a 83mm by 185mm rectangle from the center of the 350mm side, as illustrated in figure 11.
3. Using a drill press, drill 12 M4 holes according to the drawing illustrated in figure 11.

Full Gearbox Assembly

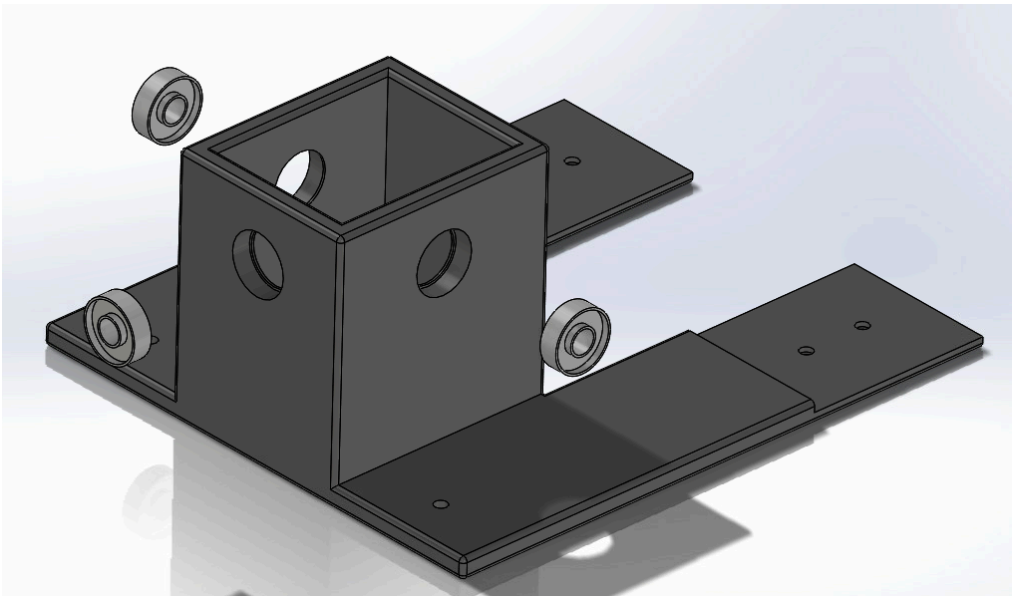

Figure 12: Adding bearings to gearbox

1. Insert three glass ball bearings into the gearbox as illustrated in figure 12.

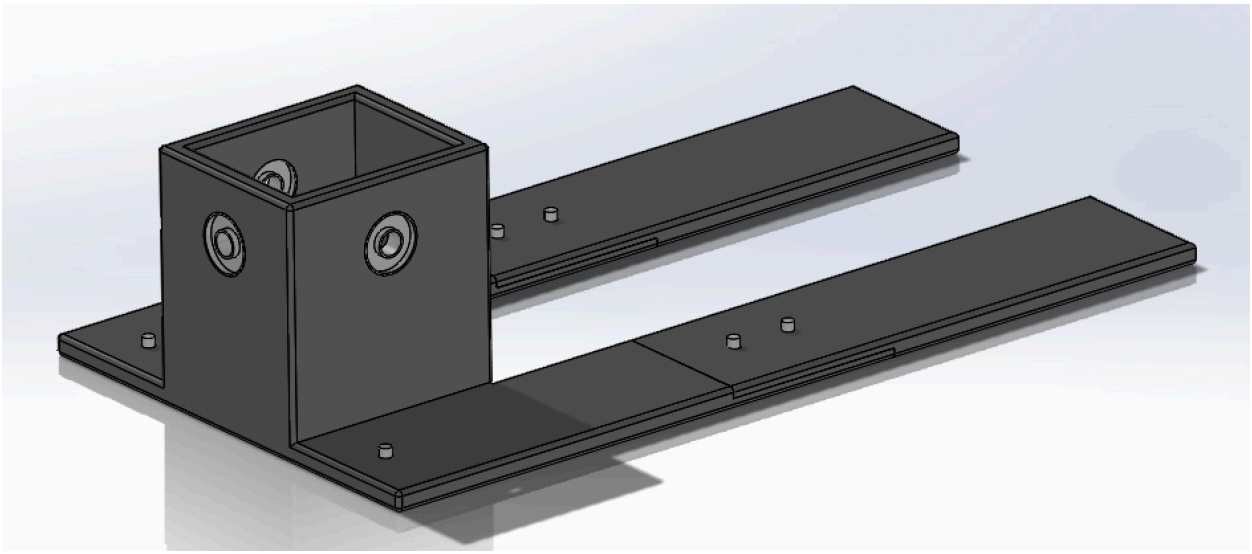

Figure 13: Adding Gearbox extensions

2. Connect 3D printed gearbox extension pieces to the gearbox via six M5 screws, as shown in figure 13. Screws should be screwed in from the bottom up.

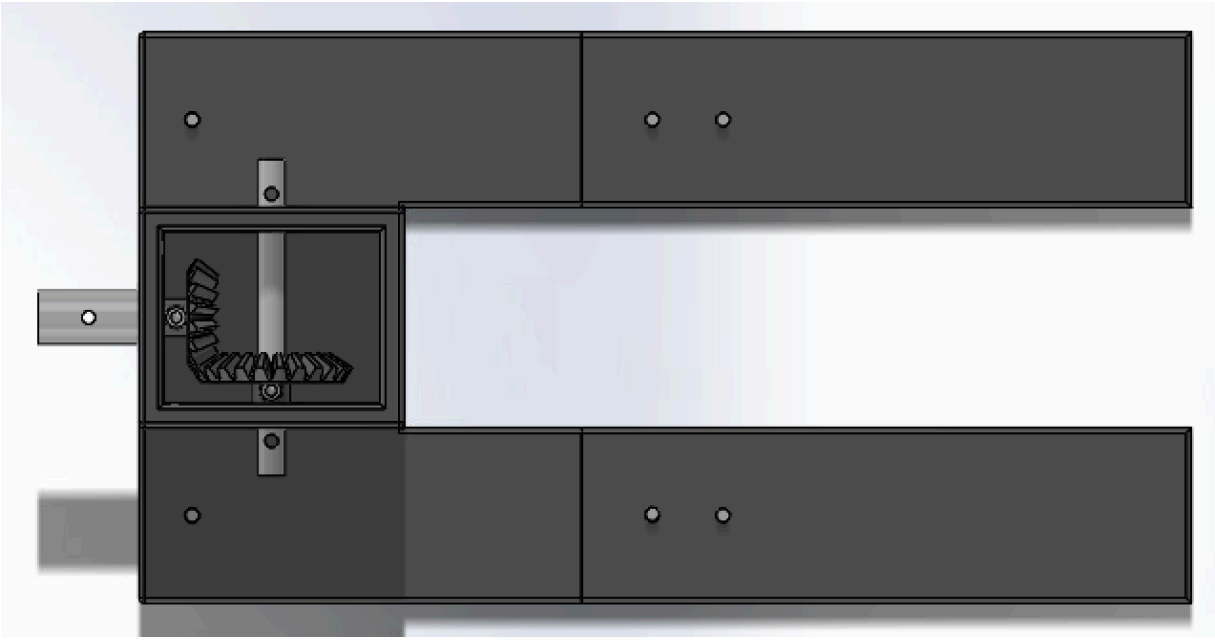

Figure 14: Adding internal components to gearbox

3. Add Gearbox to Driveshaft adapter, Crosspin, and bevel gears in the configuration illustrated in figure 14.
4. Using two M5 screws, anchor the bevel gears to the crosspin and adapter.

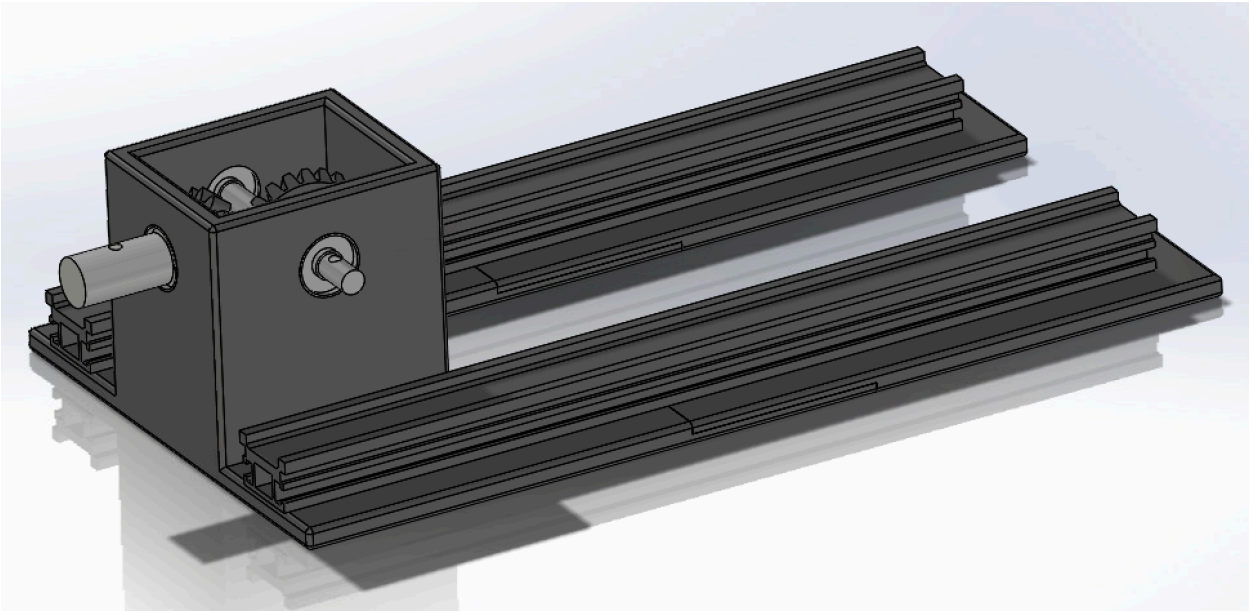

Figure 15: Adding linear rails to assembly

5. Using the same six M5 screws to connect the gearbox to the gearbox extensions, connect two linear rails as illustrated in figure 15.

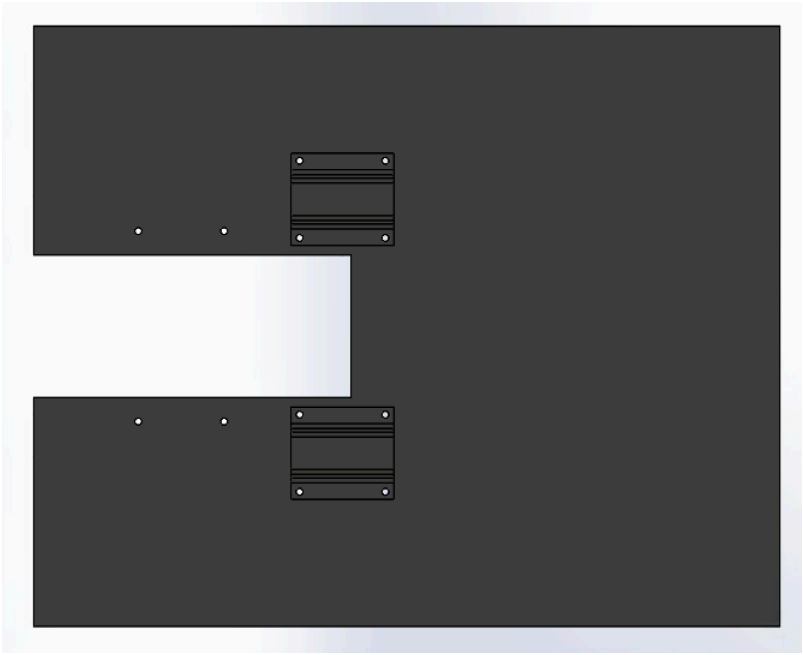

Figure 16: Adding linear slides to assembly

6. Using eight M4 screws, attach two linear slides to the bottom of the phantom bed as illustrated in figure 16.

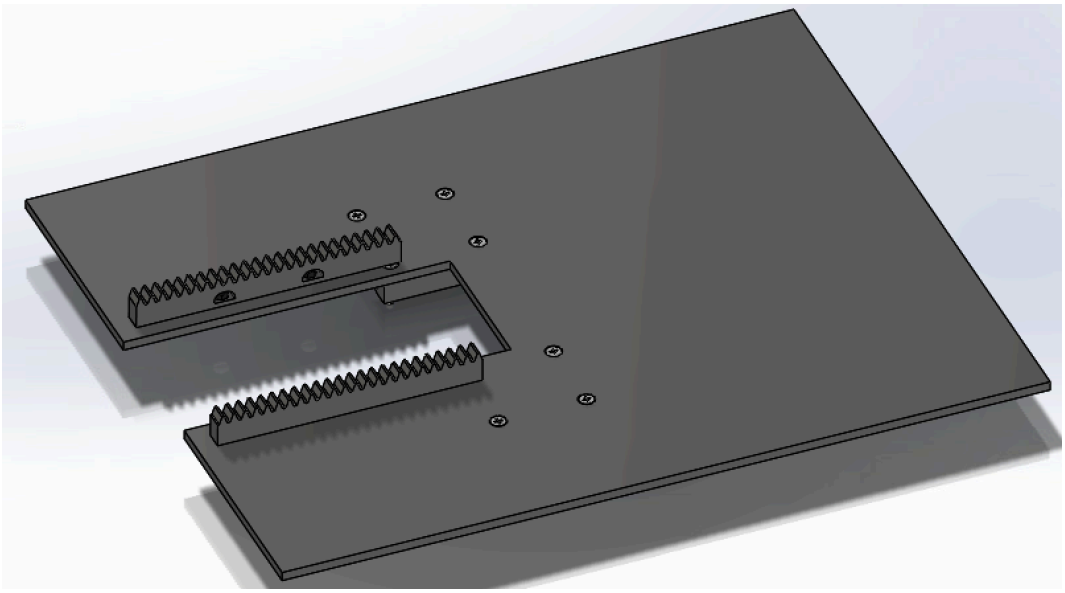

Figure 17: Adding rails to phantom bed

7. Using four M4 screws and nuts (two per rail) attach rails to the phantom bed as illustrated in figure 17.

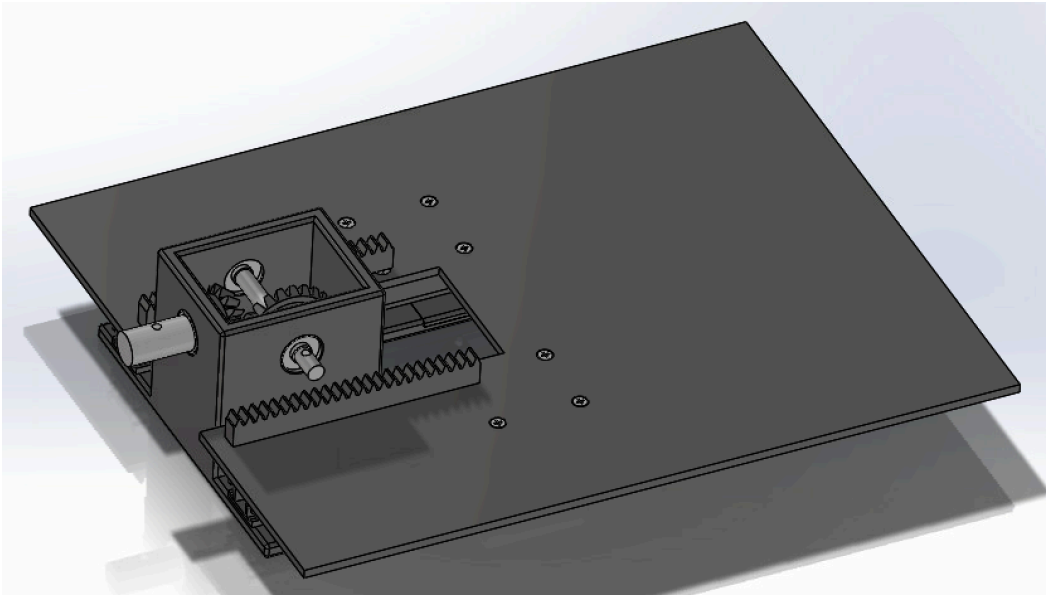

Figure 18: Adding phantom bed to gearbox

8. Slide the linear slides on the bottom of the phantom bed on top of the linear rails attached to the gearbox as illustrated in figure 18.

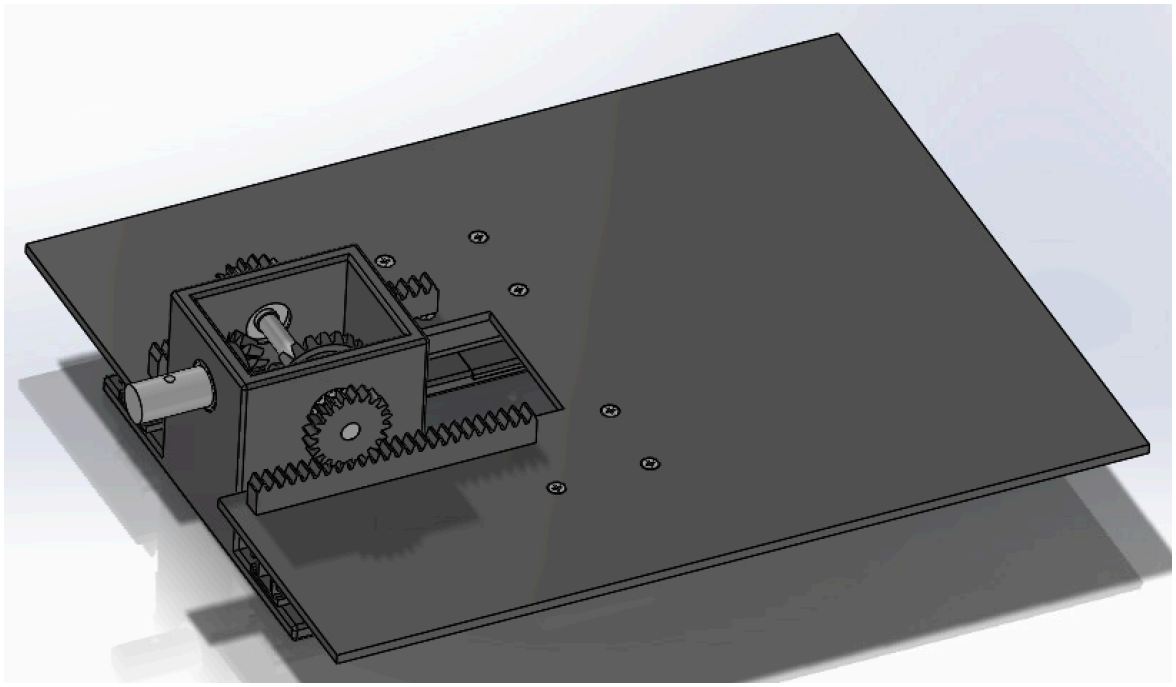

Figure 19: Adding pinion gears to assembly

9. Slide pinion gears onto both sides of the crosspin as shown in figure 19.
10. Using two M5 screws, anchor pinion gears to crosspin.

Driveshaft

1. Cut a 10’ long ¾” pvc pipe into two pieces. One measuring 4’ and the other 6’. Only the 4’ long pieces will be used in the full prototype assembly.
2. In the TEAM Lab, using a drill press, drill a 10mm hole 8mm from one end of the pipe.
3. Using a drill press, drill a 5mm 10mm from the other end of the pipe.

Full Prototype Assembly

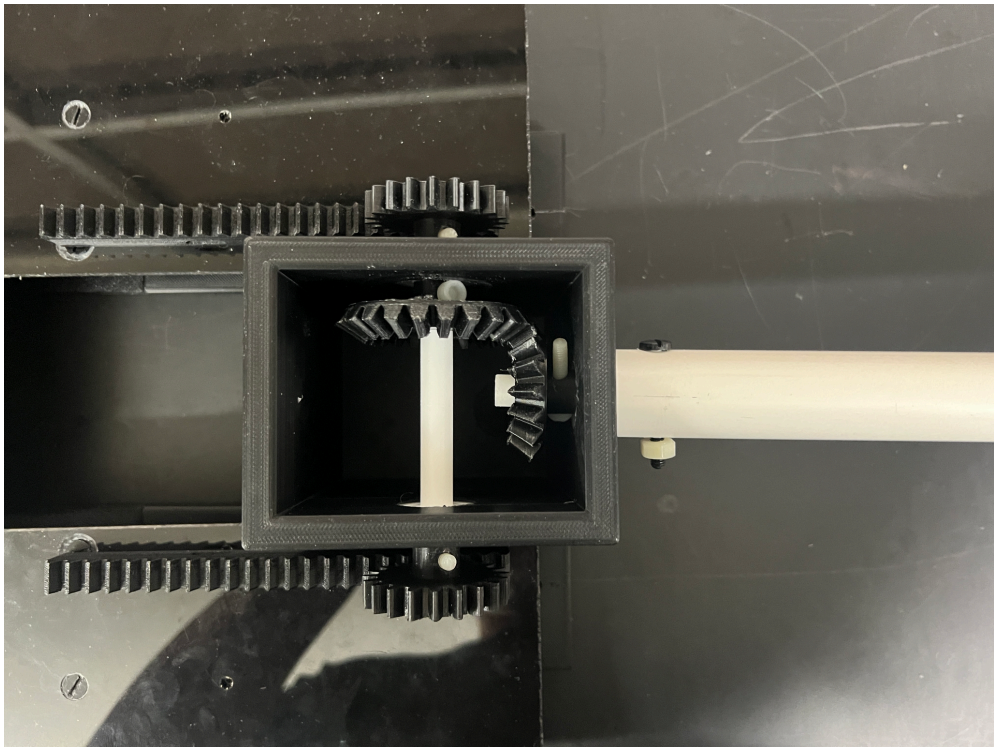

Figure 20: Attaching driveshaft to gearbox

1. Connect one side of the 4’ driveshaft to the gearbox to driveshaft adapter via a M5 screw.

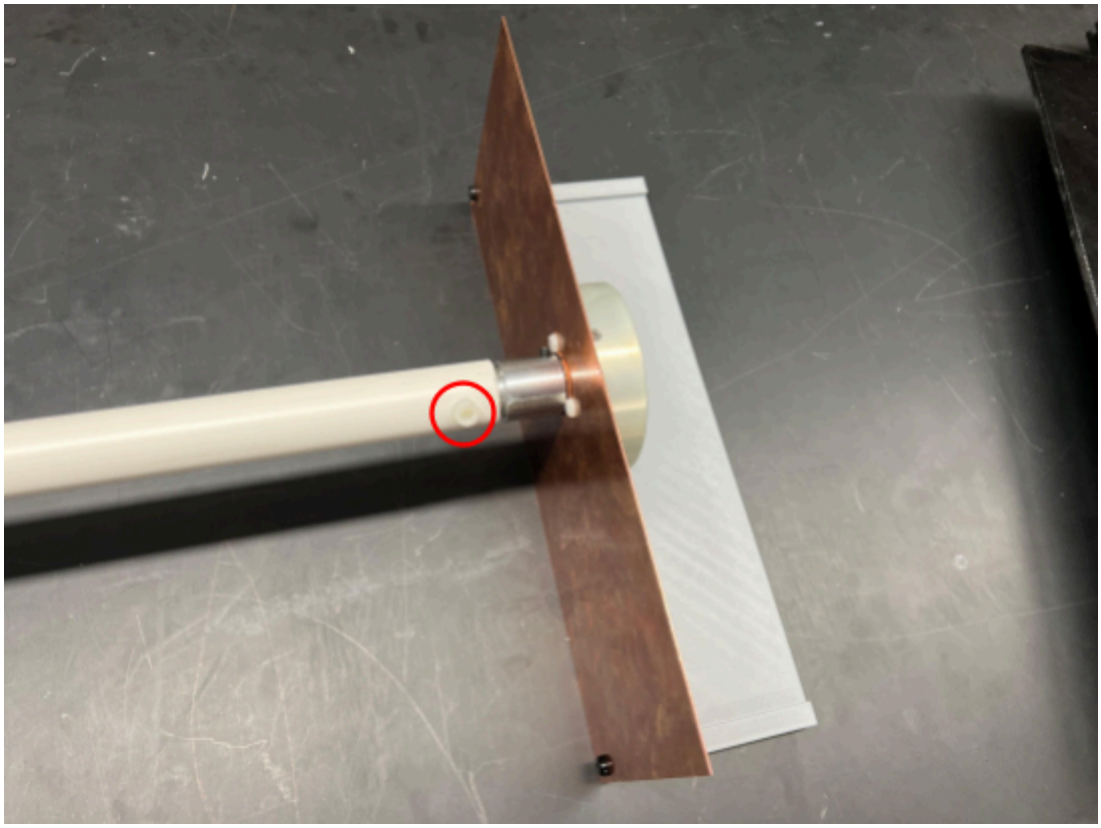

Figure 21: Attaching driveshaft to Motor assembly

2. Connect the other side of the 4’ driveshaft to motor assembly via a M10 screw and nut as illustrated in figure 21.

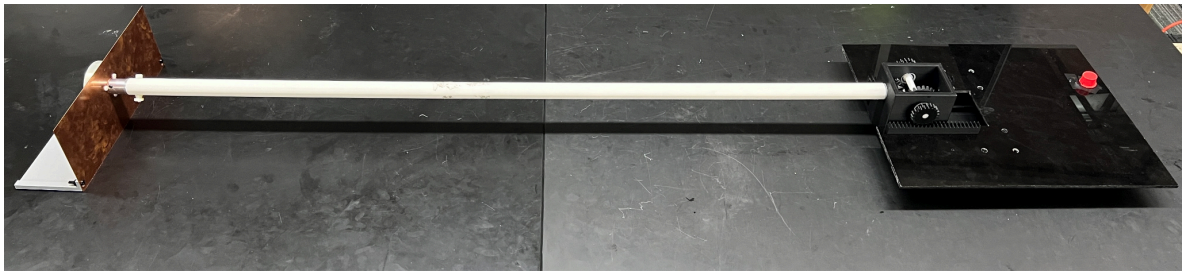

Figure 22: Full prototype assembly

3. Full prototype has been completed.