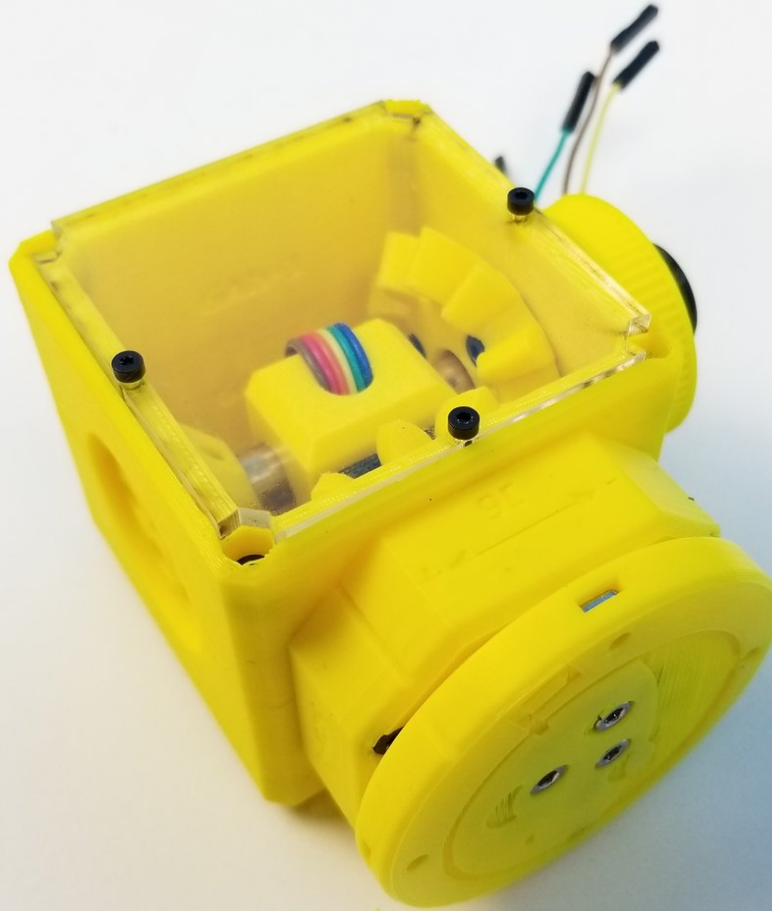


mcr

## 2. Picasso Box Assembly

Written By: Dan Royer

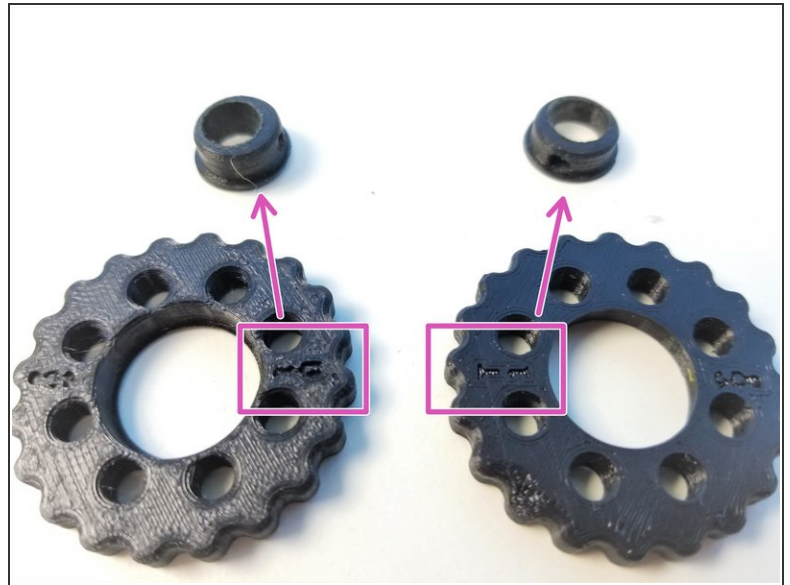
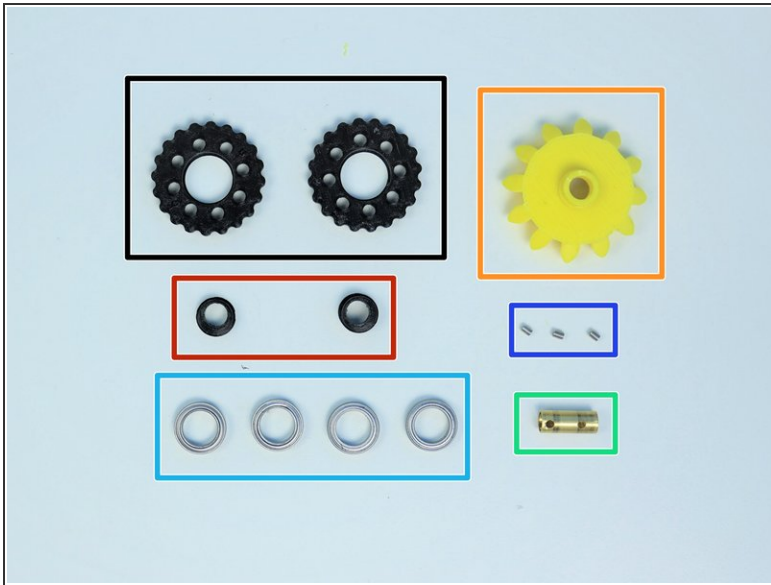


## Step 1 — Tools and Parts Required for This Chapter



- Package #6
- Alan Keys
- Needle Nose Plier

## Step 2 — Hand Gearbox - Input Shaft & Rotor Parts

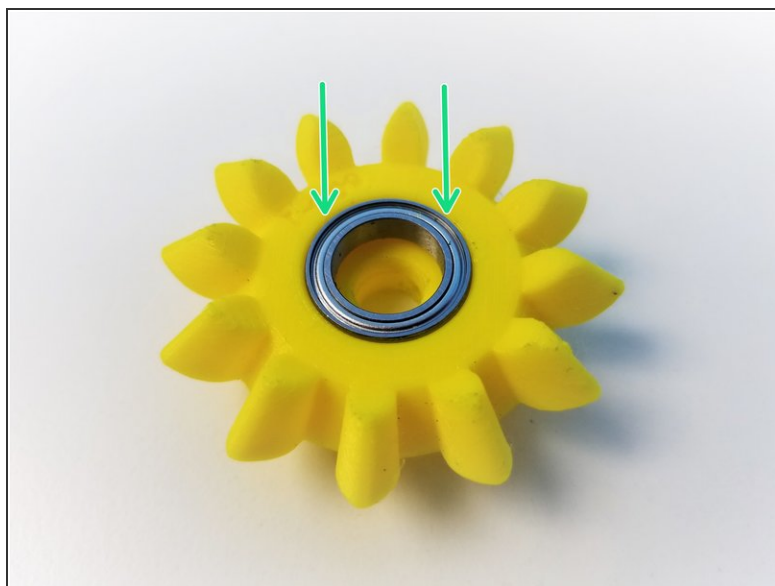
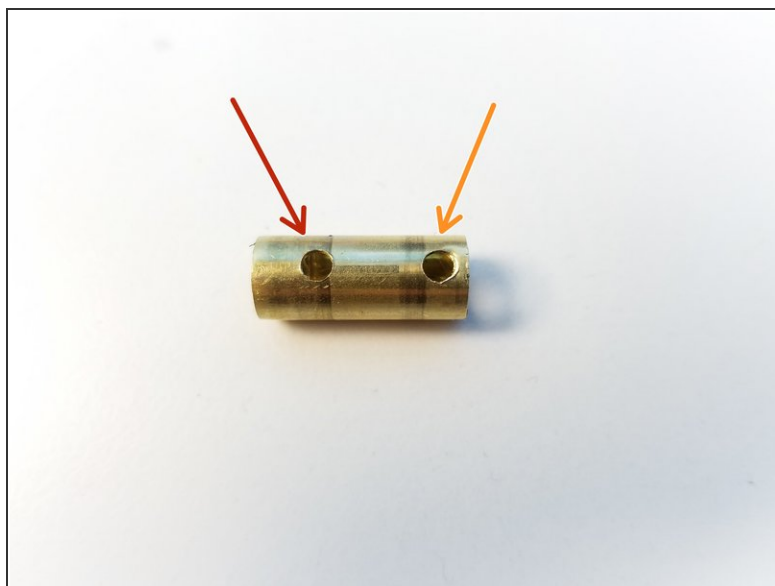


### **i** Prepare the following components:

- [3D] - 6Da Hand GB Rotors
- [3D] - 6Da Hand GB Eccentric Cams
- [3D] - 6Db Hand GB Bevel Gear
- Brass Tube [5/16" x 19.5mm]
- 6701 Bearing [12x18x4mm] (x4)
- M3x4mm SetScrew (x3)

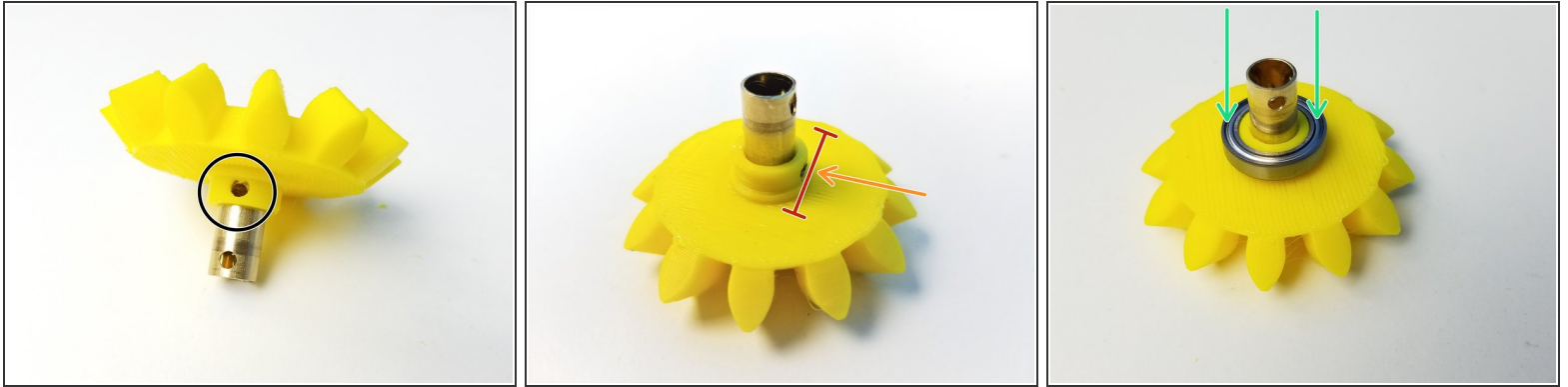
**i** **Rotors** are Labelled "**T**" and "**B**" for Top and Bottom according to **Eccentric Cams'** Top and Bottom, Thick Piece = Bottom and Thin Piece = Top

### Step 3 — Hand Gearbox - Input Shaft 1



- ① Brass Tube has one side that has 2 holes
  - Furthest away from the edge is for **Bevel Gear Set Screw**
  - Closest to the right edge is for **Top Eccentric Cam Set Screw**
- Insert **6701 Bearing** in the **Bevel Gear**

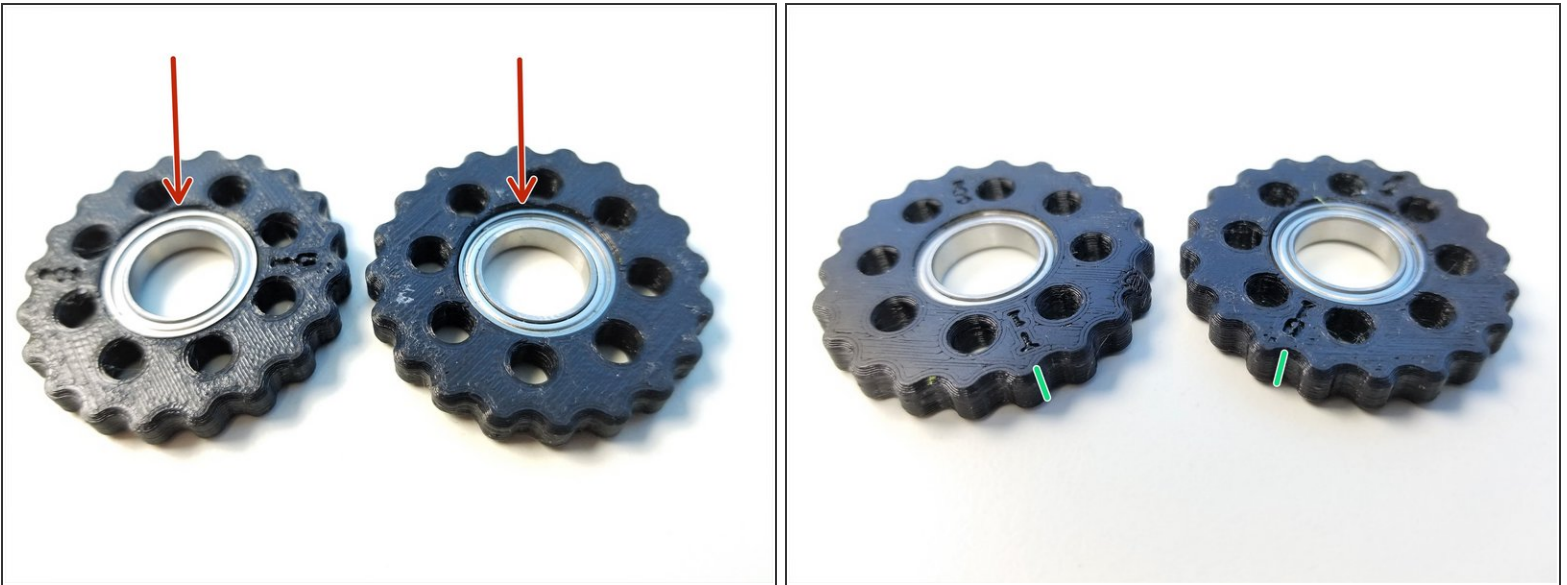
## Step 4 — Hand Gearbox - Input Shaft 2



- Align the **Brass Tube Hole** to the *Bevel Gear Set Screw Hole*
- Secure the Gear using **M3 Set Screw**
  - ⚠ Make sure the **Set Screw goes in just enough** for the bearing to go on, NO MORE THAN THAT
- Slide the **6701 Bearing** over the *Set Screw Hole on Bevel Gear*

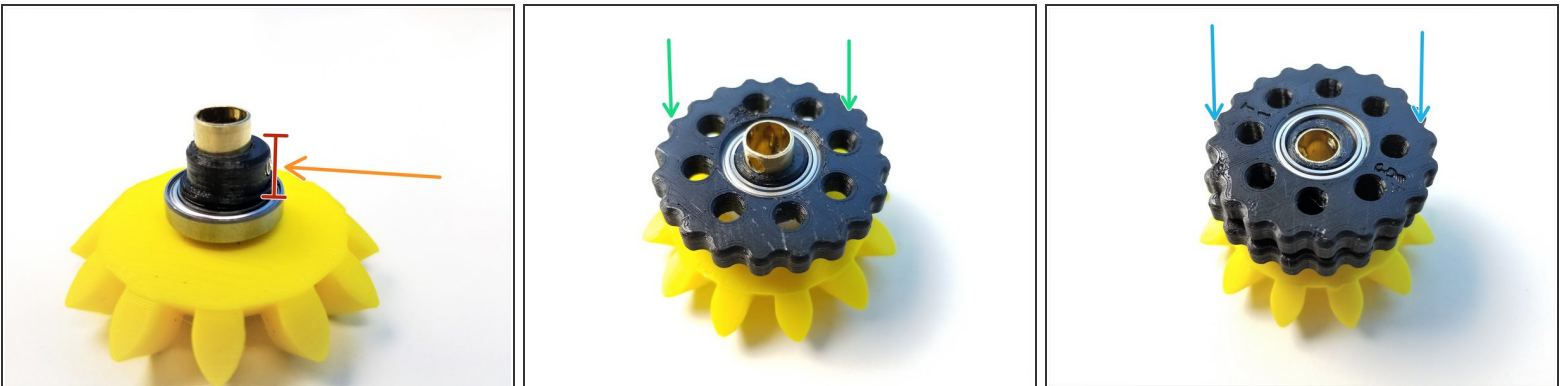


## Step 5 — Hand Gearbox - Rotors



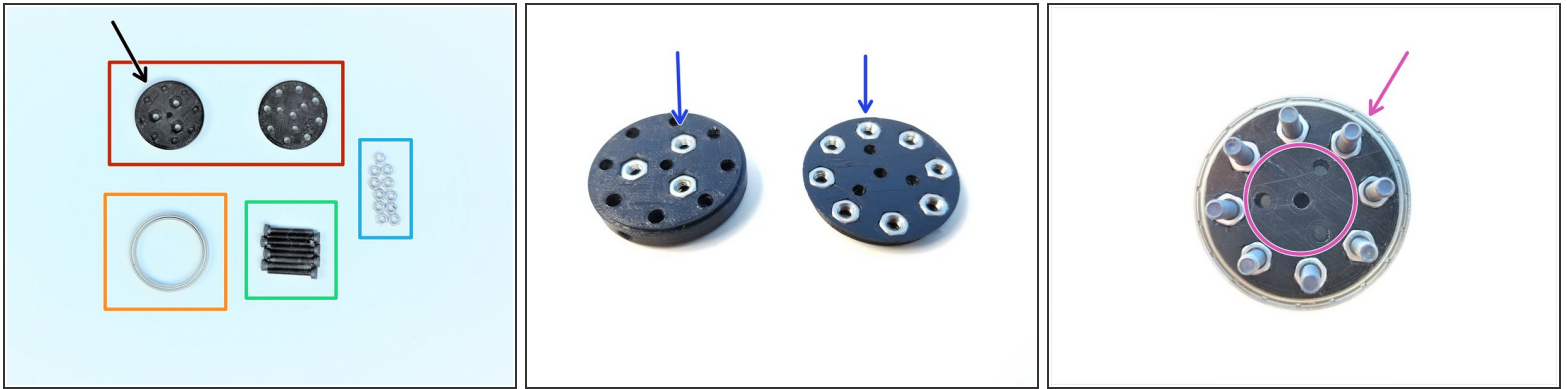
- Insert **6701 Bearings** into each Rotor. *Make sure they are fully inserted*
- Make a **sharpie mark on the side of the Rotors** along the **"T" and "B" label**. This will help the *alignment process* in the future.

## Step 6 — Hand Gearbox - Input Shaft & Rotor



- Align the **Thick Eccentric Cam** {Bottom} and use the **M3 Set Screw** to secure its location  
 ⚠ **Make sure the Set Screw goes in just enough for the bearing to slide over NO MORE!!**
- Place the **"B" Rotor** onto the eccentric cam with the "B" label facing the Bevel Gear
- Repeat with the **Thin Eccentric Cam** {Top} and **"T" Rotor** with "T" label facing up

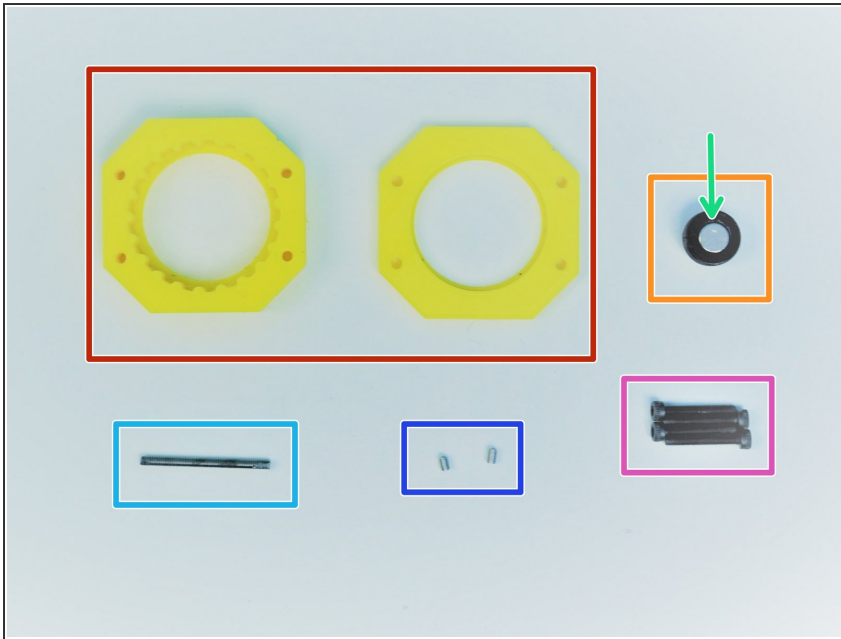
## Step 7 — Hand Gearbox - Output Disks



### Prepare the following components:

- [3D] - 6Da Hand GB Output Disks
  - **Thicker Output Disk** is considered "Top"
- 6706 Bearing [30x37x4mm] (x1)
- M3x20mm Screws (x8)
- M3 Hex Nuts (x11)
- Insert **M3 Hex Nuts** in the nut inserts of Both Output Disks
- Align the **3 middle holes** of Top and Bottom Disks. Clamp the **6706 bearing** with the Output Disks using **M3x20mm Screws**

## Step 8 — Hand Gearbox Housing - Parts

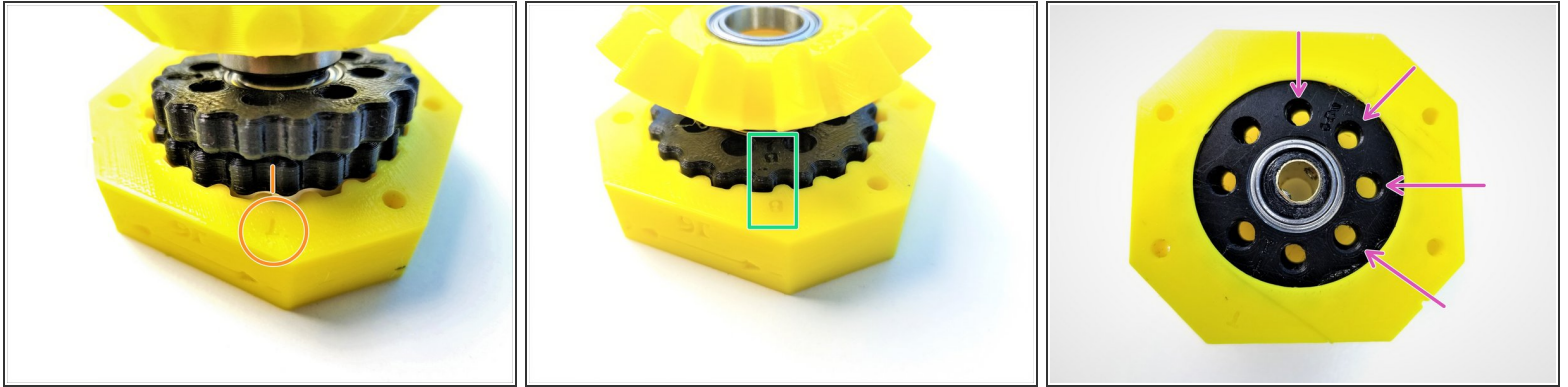


### Prepare the following components:

- [3D] - 6Da Hand GB Housing {Top & Bottom}
- [3D] - 6Da Hand GB Magnet Holder
- 8x2.5mm Neodymium Magnet
- M3x35mm Threaded Rod
  - ⚠ Since February 2020, this is replaced with **Brass Tube [1/8"x35mm]**
- M3x4mm Set Screws (x2)
- M3x20mm Screws (x4)



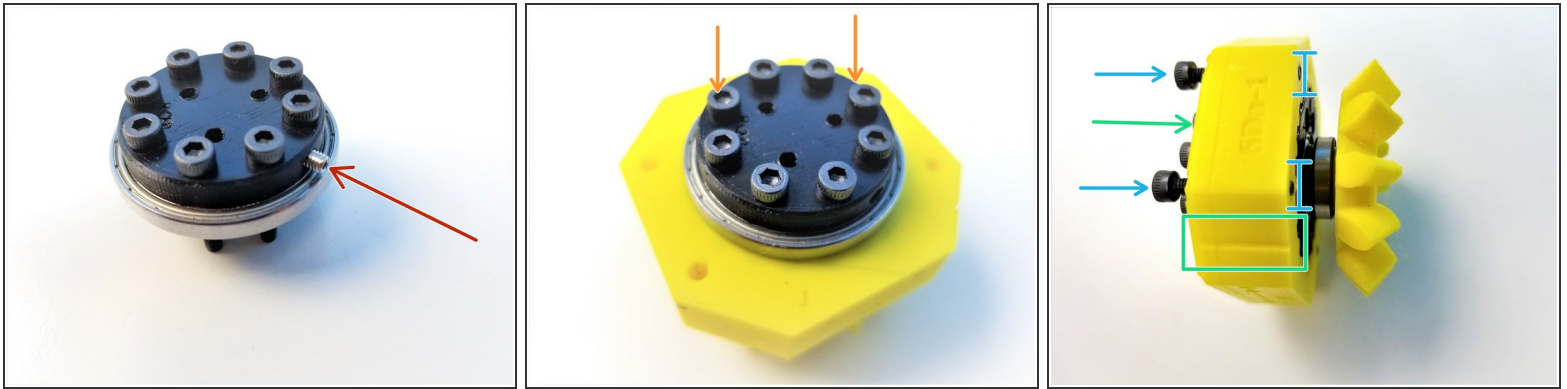
## Step 9 — Hand Gearbox Housing - Rotor Alignment



**⚠ Rotor Alignment** is very IMPORTANT! Follow the pictures carefully!

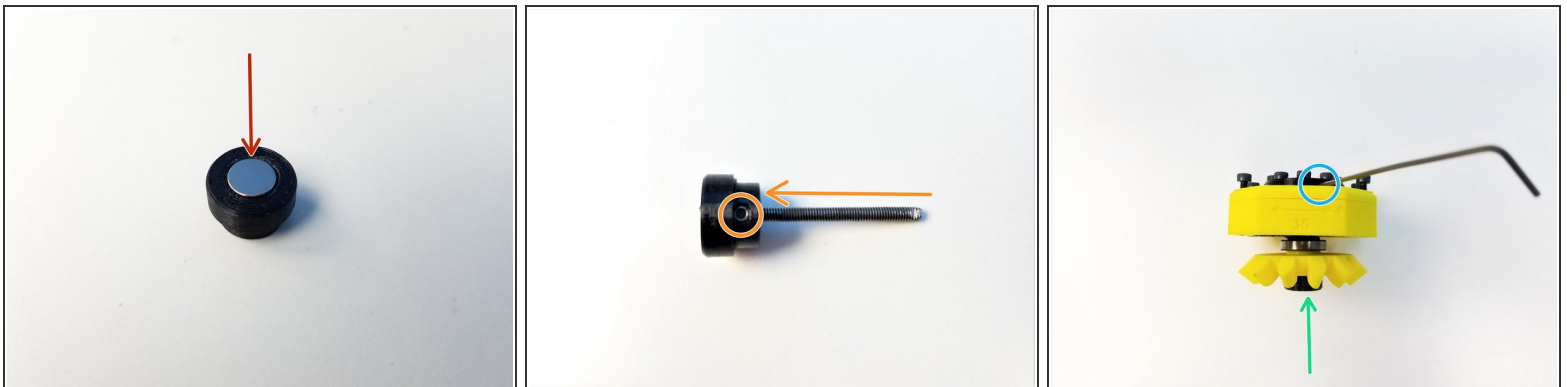
- ✦ Make sure there are sharpie marks on the side of the Rotors where it lines up with **"T"** and **"B"** on the rotors
- Align the **Side Mark of "T" Rotor** to the "T" on the Housing, and only insert Top Rotor into the housing.
- Align the **Side Mark of "B" Rotor** to the "B" on the Housing, and insert the Bottom Rotor
- When aligned properly all 8 holes made by 2 rotors intersecting should have equal spacing
- ⓘ Verify that you can manually turn the eccentric shaft in the center and that the rotors smoothly turn inside the housing. Tight printing and misaligned rotors can cause the gearbox to jam.

## Step 10 — Hand Gearbox Housing - Top Housing



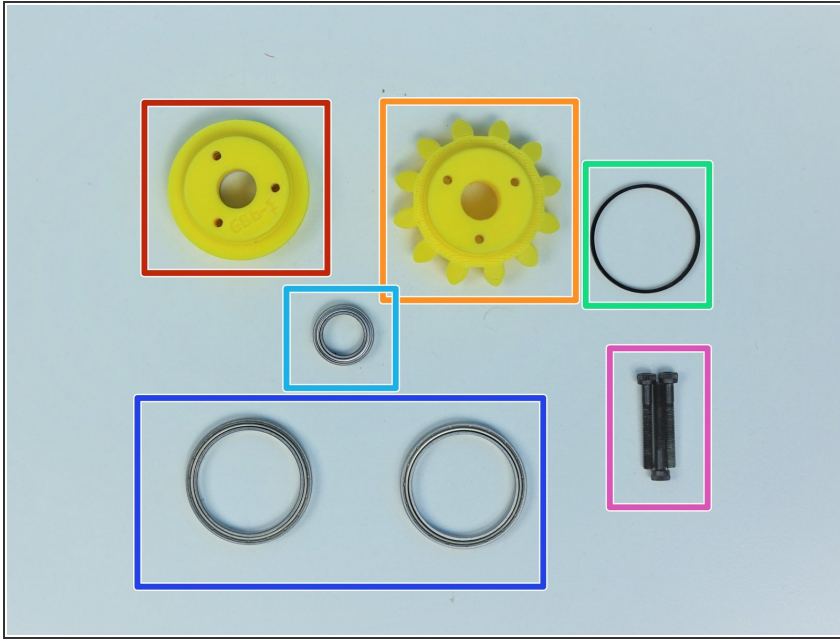
- Insert **M3 Set Screw** on the side of the Output disk
- Insert the **Assembled Output Disk pins** through the Rotors
- Slide in the **Top Housing** to 6706 Bearings on the Output Disk and align the Top & Main Housings along the alignment markers
- Secure its position using **M3x20mm Screws**. ONLY screw in until it's *flushed to the face of the housing*

## Step 11 — Hand Gearbox Sensor Magnet



- Insert the **Neodymium Magnet** in the Hand Sensor Magnet Holder, if you haven't yet.
- Insert **M3 Threaded Rod** in the Magnet Holder. Secure the Rod using the **M3 Set Screw**
- Feed the *other end of the Rod* to through the Input Shaft Tube all the way to **Output Disk**
- Secure that end with a **M3 Set Screw** in the Output Disk

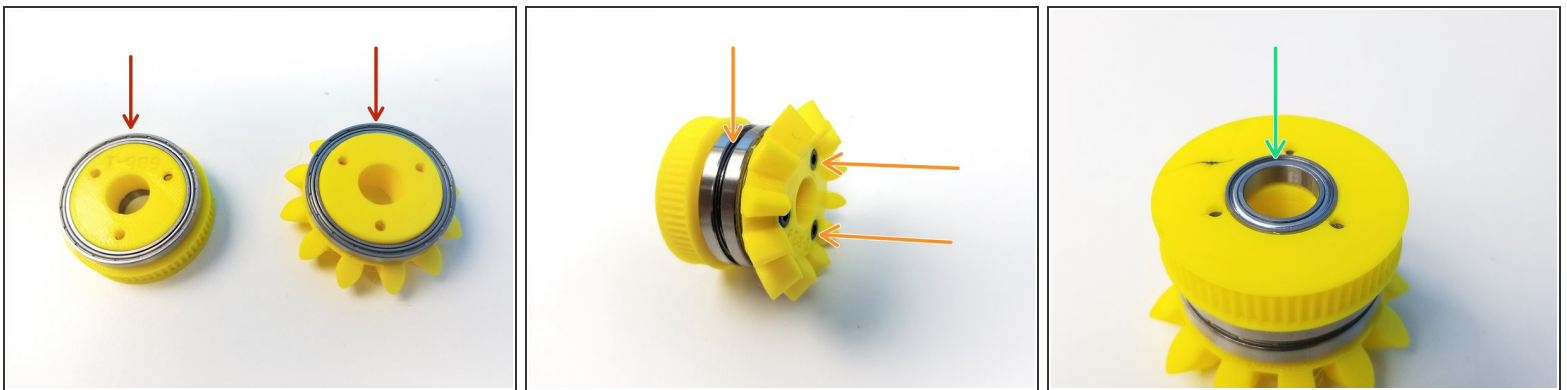
## Step 12 — Side Bevel Gear - Parts



### Prepare the following parts:

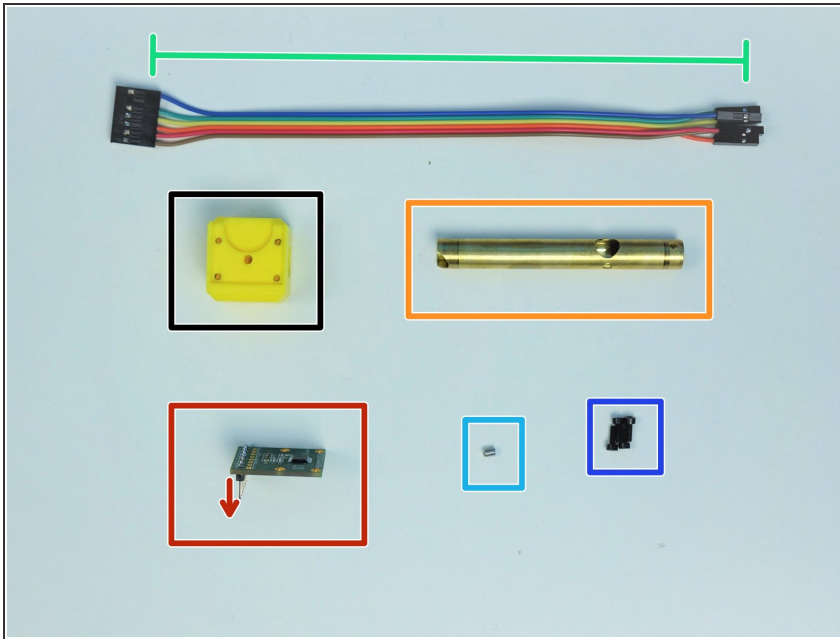
- [3D] - 6PI Pulley Gear
- [3D] - 6Ba Bevel Gear
- [3D] - 6Bc Bearing Spacer
- 6701 Bearing [12x18x4mm] (x1)
- 6706 Bearing [30x37x4mm] (x2)
- M3x25mm Screws (x3)

## Step 13 — Side Bevel Gear



- Slide in **6706 Bearings** on the Pulley and Bevel Gear
- Clamp the **Bearing Spacer** between the Pulley and the Bevel Gear using **M3x25mm Screws**
- Insert the **6701 Bearing** in the Pulley Gear

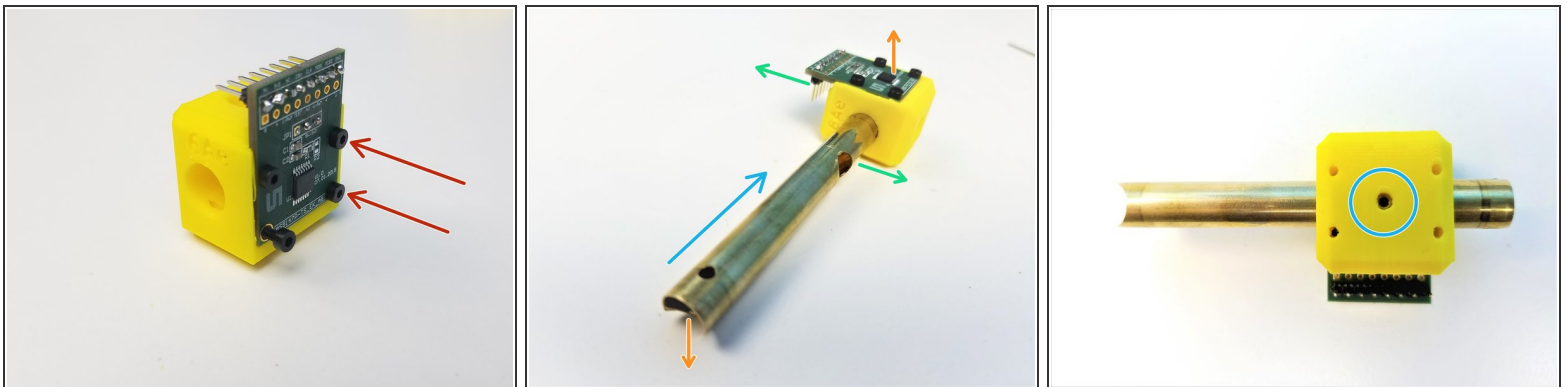
## Step 14 — Sensor Shaft - Parts



### Prepare the following parts

- [3D] - 6Ae Hand Sensor Holder
- AS5147 Sensor {straight header on the label side}
- Brass Tube [3/8"x76.5mm]
- 6-pin Ribbon Cable F/F - Brown to Blue {sensor 5 Hand Ext.} - [210mm]
- M3x4mm Set Screws (x1)
- M2x6mm Screws (x4)

## Step 15 — Sensor Shaft - Hand Sensor Holder



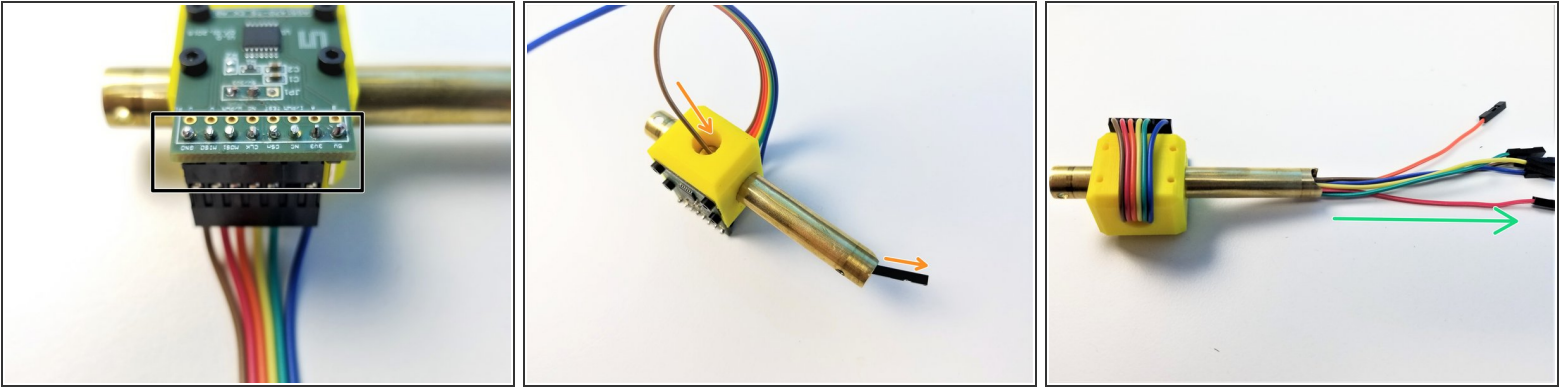
- Mount the **AS5147 Sensor** on the Sensor Holder using the **M2 Screws**


 **Alignment of the Brass Tube is important!!**

- **Moon Cut** is facing away from the **Sensor Chip**
- **Sensor Cable Hole** is away from the **Headers**
- Insert the **Brass Tube** through the **Sensor Holder** Use **M3 Set Screw** to secure the Sensor Holder

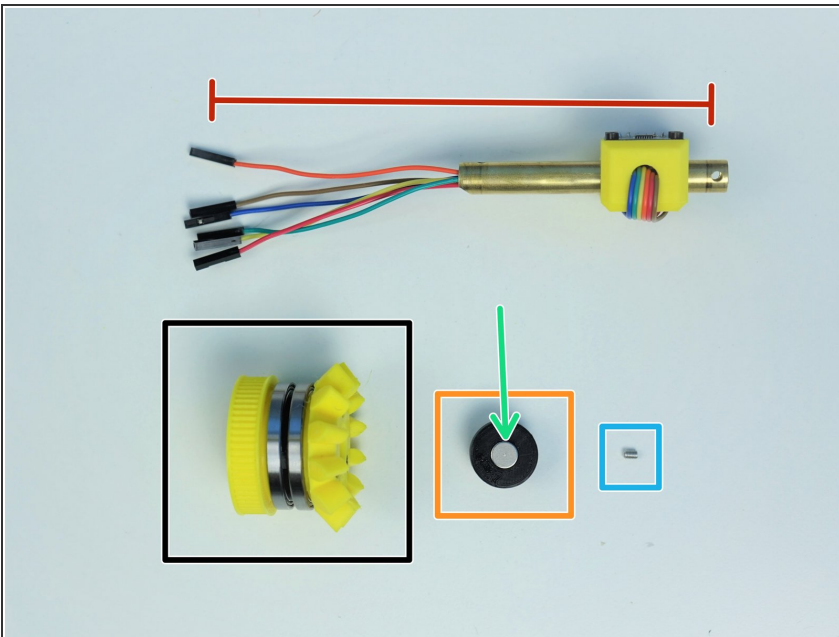



## Step 16 — Sensor Shaft - Hand Sensor Cable



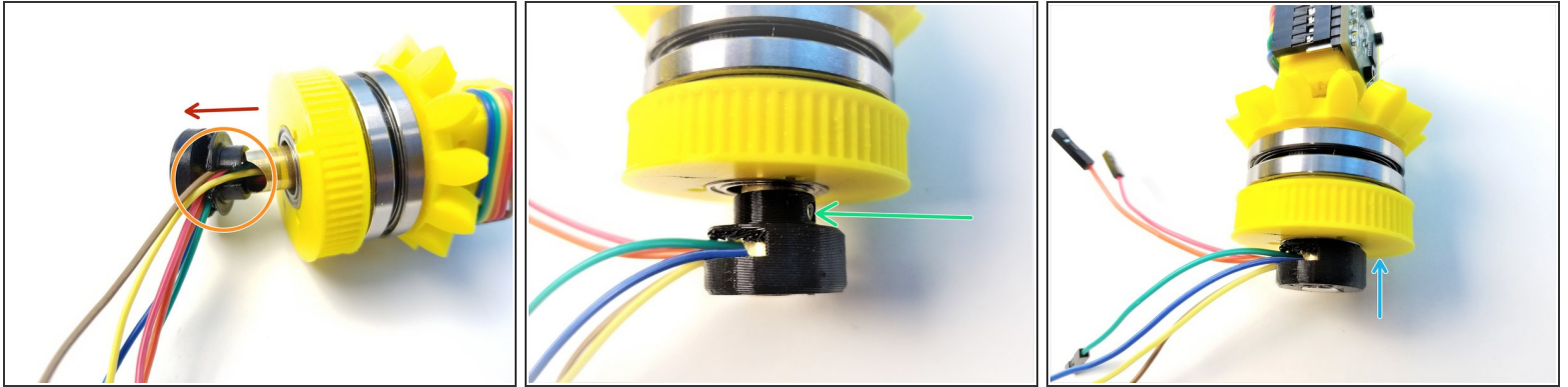
- Connect the Cable to the **AS5147 Sensor** as shown in the picture  
 **COLOR CODE MATTERS!!**
- One wire at a time, feed the **jumper wires** through the **Brass Tube**
- Make sure the **Jumper Wires** comes out of the **Brass Tube** as far as it can. NO LOOSE Cables

## Step 17 — Picasso Wrist Magnet Holder - Parts



-  **Prepare the following components:**
- Assembled Side Bevel Gear
  - Assembled Sensor Shaft
  - [3D] - 6Mc Picasso Magnet Holder
  - 8x2.5mm Neodymium Magnet (x1)
  - M3x4mm Set Screw (x1)

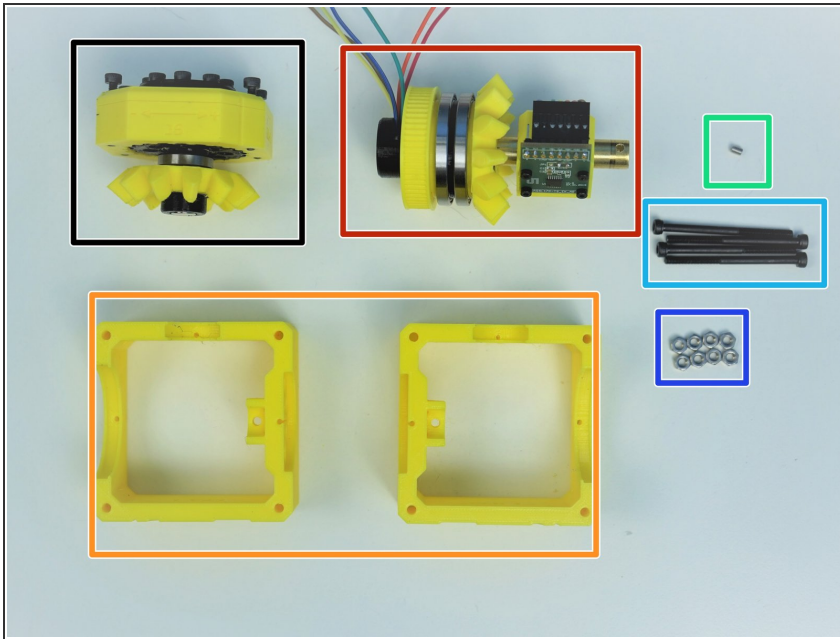
## Step 18 — Picasso Wrist Magnet Holder



- Insert the the **cable end of the Brass Tube** {Sensor Shaft} through the *Assembled Side Bevel Gear*
- Insert **Picasso Magnet Holder** on the Brass Tube and *align the set screw holes*
  - ⚠ When aligned properly, "**Half Moon Cut**" on the **Brass Tube** should line up with the opening on the **Magnet Holder**
- Secure the Magnet Holder using **M3 Set Screw**
- Push the **Magnet Holder** into the 6701 Bearing that's in the **Pulley Gear**



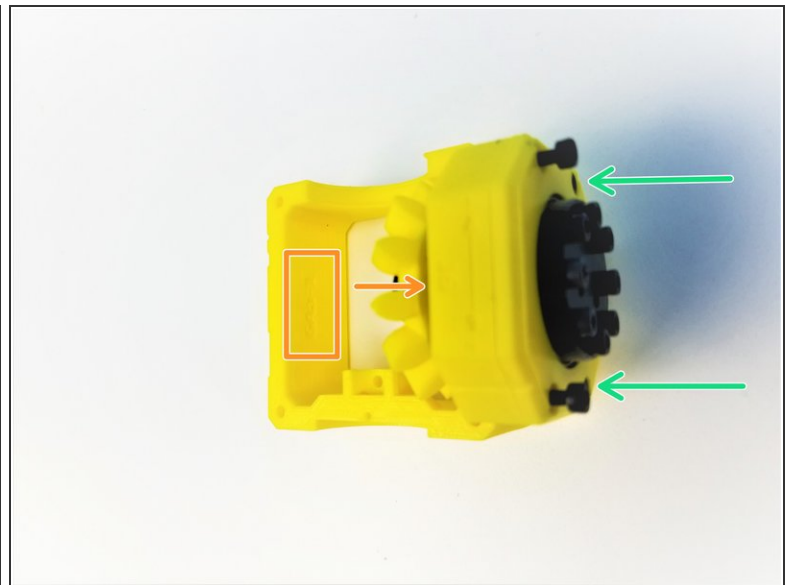
## Step 19 — Picasso Box Clamp - Parts



### **Prepare the following components:**

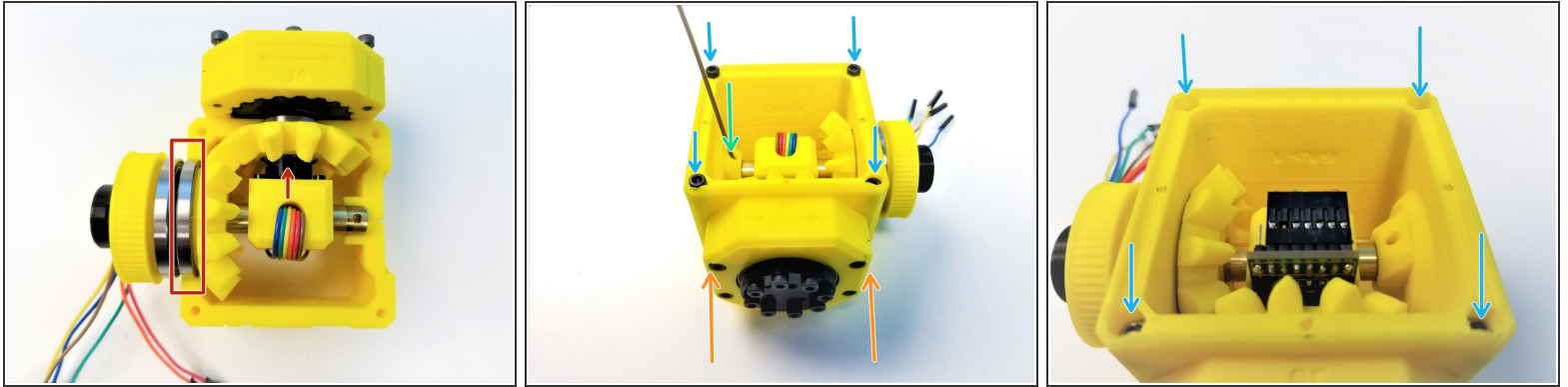
- Assembled Hand Gearbox
- Assembled Side Bevel Gearbox and Sensor Holder
- [3D] - Picasso Box {Top = 6Aa & Bottom = 6Ab}
- M3x4mm Set Screws (x1)
- M3x45mm Screws (x4)
- M3 Hex Nuts (x8)

## Step 20 — Picasso Box Clamp - Hand Gearbox



- Insert **M3 Nuts** on both **Picasso Box Parts**
- Insert **6701 Bearing** of the Hand Gearbox into the small bearing insert of the **6Aa Picasso Box**
- Secure the Hand Gearbox using the **M3x20mm Screws**

## Step 21 — Picasso Box Clamp - Side Bevel Gear



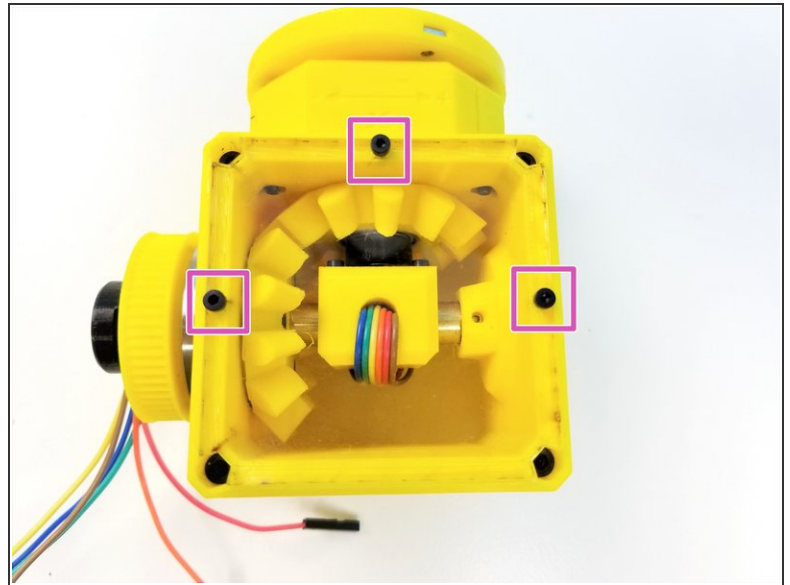
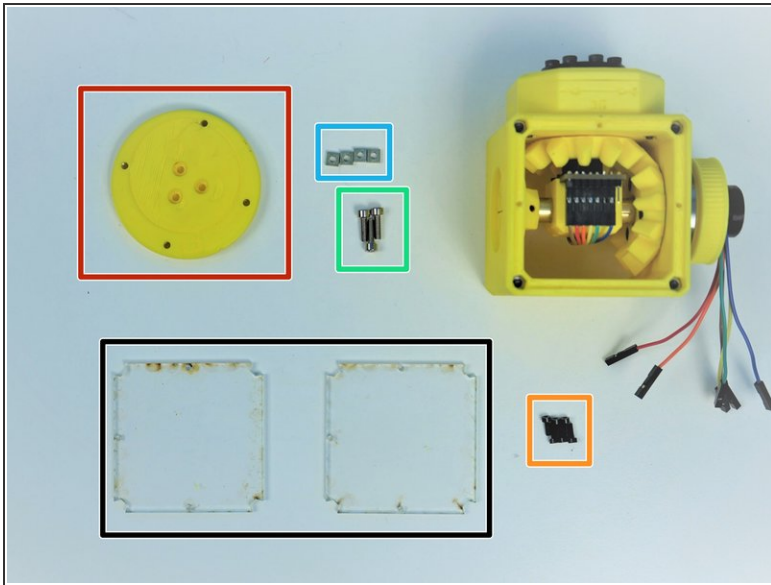
- Align the **6706 Bearing** closer to Bevel Gear to the Picasso bearing insert of 6Aa Picasso  
⚠ Hand Sensor Chip should be facing the Hand Gearbox
- Clamp the **6Ab Picasso** and secure it by tightening the M3x20mm Screws on the **Hand Gearbox**
- Use **M3 Set Screw** to secure the Sensor Shaft to the Picasso Box
- Insert **M3x45mm Screws** on one side and **M3 Nuts** on the other, to clamp the Picasso Box

## Step 22 — Gearbox test



- Hold the picasso box with one hand and turn the input pulley of the Side Bevel Gearbox with the other.
- The input pulley and the hand should turn smoothly at different ratios, with little or no play.
- If the gearbox refuses to turn, it is very likely the 3D printed gears are too tight. Now is the time to reprint them before continuing with assembly.

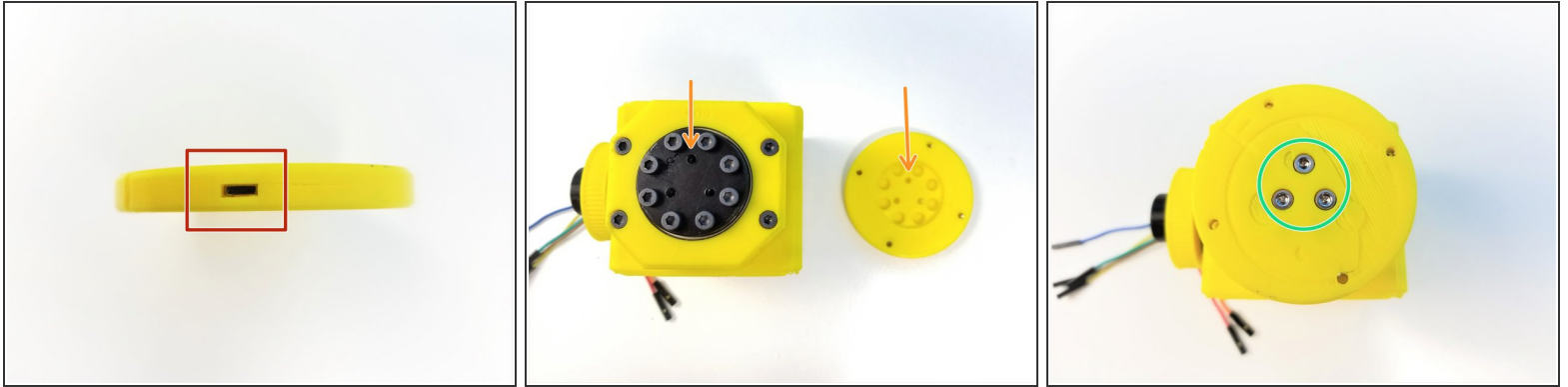
## Step 23 — Picasso Box - Finishing Touches 1



### Prepare the following parts:

- [LSR] - Acrylic Picasso Cover Plates (x2)
- [3D] - 6Da Hand Face
- M2x6mm Screws (x6)
- M3x10mm Screws (x3)
- M3 Square Nuts (x4)
- Screw the **Acrylic Plates** to Top AND Bottom of Picasso Box with **M2 Screws**

## Step 24 — Picasso Box - Finishing Touches 2

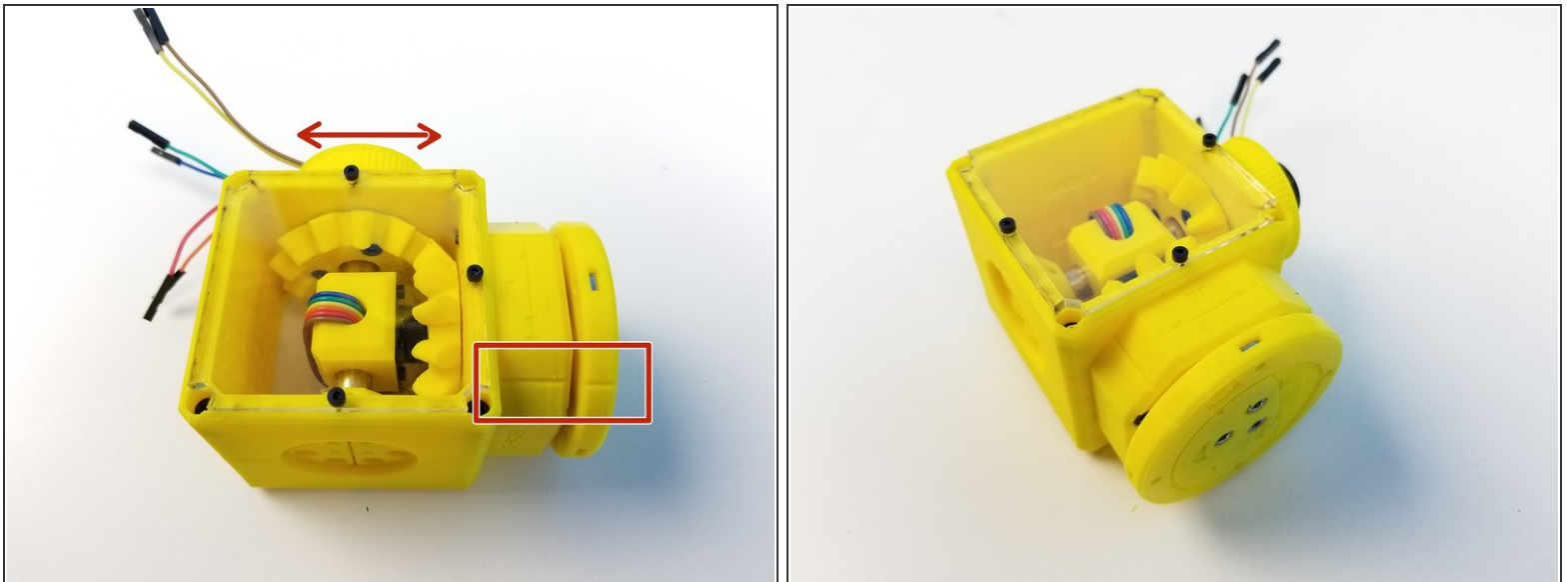


- Insert **M3 Square Nuts** on the *side of the Hand Face*

⚠ Align the **Screw Hole** on the ++Hand Gearbox Output and Hand Face++

- One of three holes are in between the **Screw Head**
- Secure the Face to the Output Disk using **M3x10mm Screws**

## Step 25 — Finish!



- Align the Hand Face to the Hand Gearbox Housing by rotating the **Pulley Gear**

📄 Congratulations! you have your Picasso Box assembled!!!