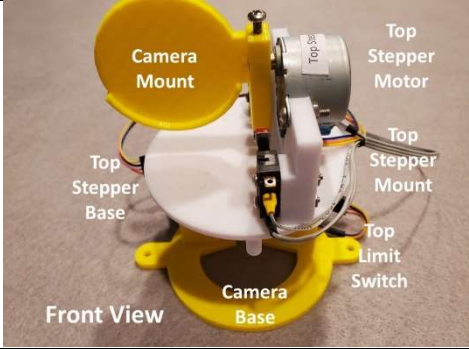
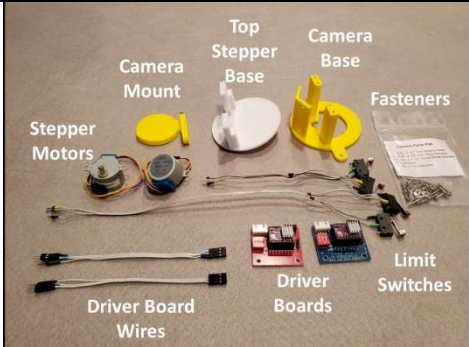



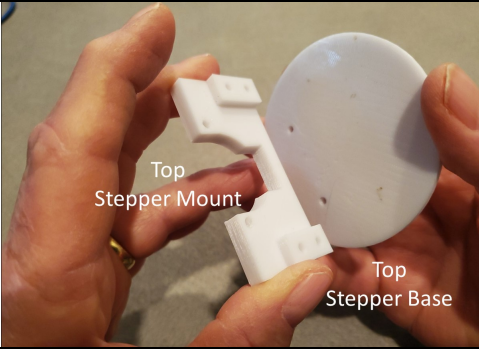
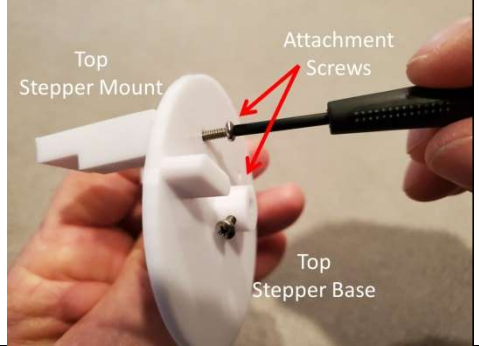
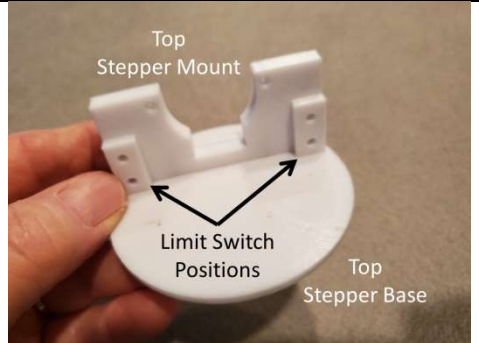
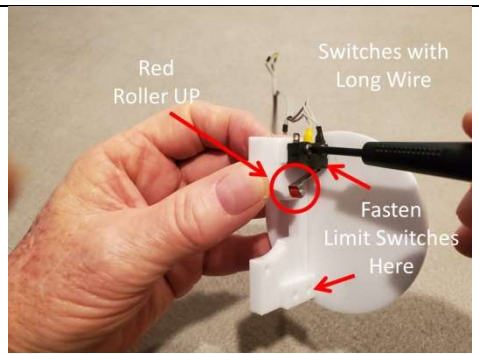
Rover Camera Mount Assembly

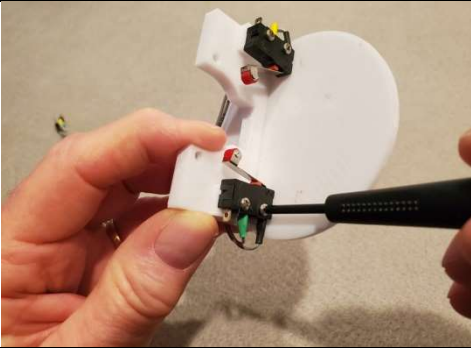


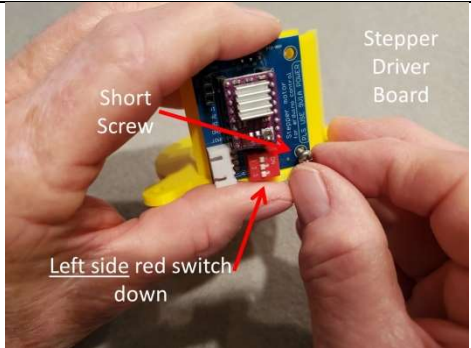
Jackson State University MARRS STEM Workshop

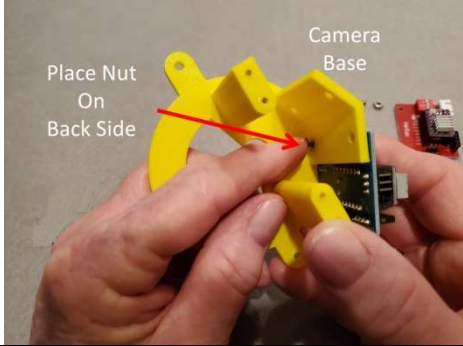
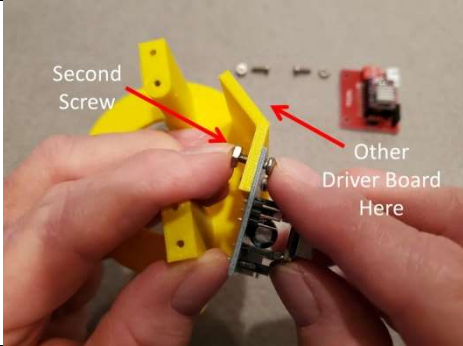
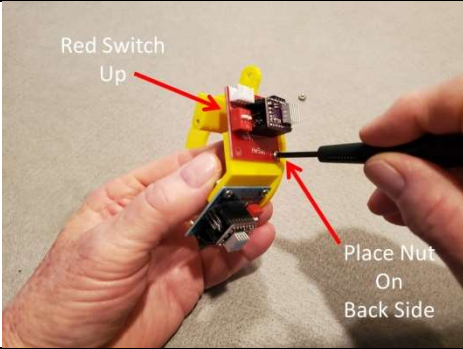
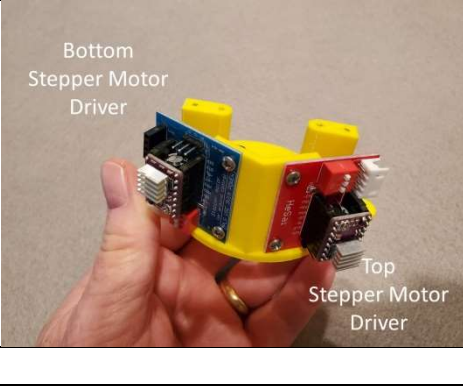
Objective:

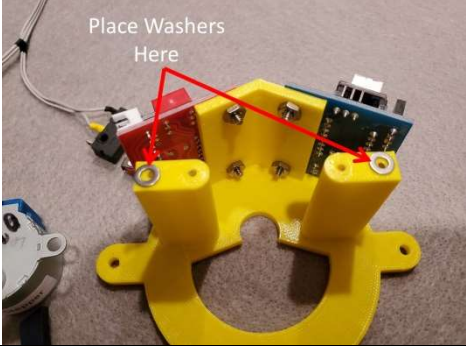
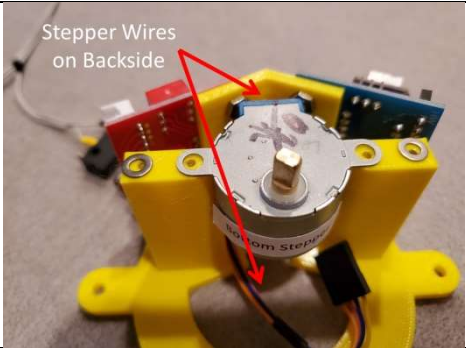
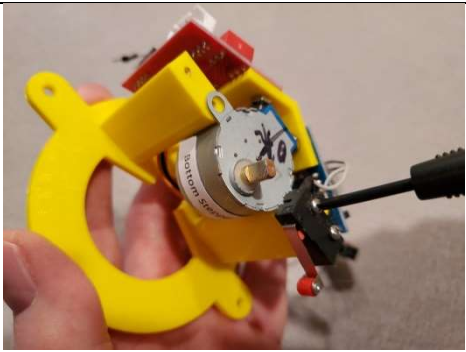
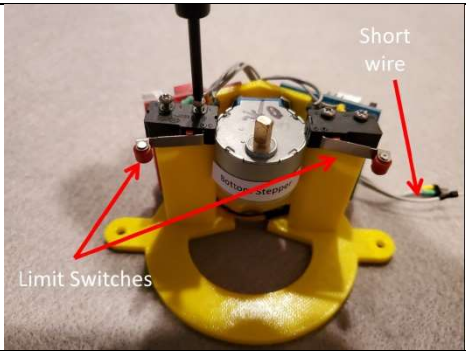
Complete the Camera Mount assembly and process successfully.
Tools and materials

<p>Assembled Rover Camera Mount. The major parts are the camera mount base, top stepper base; top stepper mount, camera mount, top and bottom stepper motors, top and bottom limit switches. The miniature video camera (not shown) is attached to the camera mount with a magnetic plate.</p>	
<p>Verify your Camera Mount package has all required parts. The parts include the camera base, top stepper base, camera mount, two stepper motors – both are the same, two pairs of limit switches (top switches have long wires and bottom switches have short wires), two driver boards (blue and/or red), one fastener package (screws and nuts), and a pair of driver board wires.</p>	
<p>Fasteners used in the assembly of the camera mount are machine screws and nuts and self-tapping sheet metal screws.</p> <p>These parts are easily lost. It is recommended that a towel or other fabric be used to cover your work area.</p>	

<p>The holes for the top camera mount are pre-drilled. Observe the orientation to the top stepper mount and the top stepper base.</p>	
<p>Insert one of the self-tapping sheet metal screws through the bottom of the top stepper base. Don't fully tighten the first screw. Adjust the two parts so the second self-tapping sheet metal screw can be inserted through the top stepper base. Gently tighten both of the screws so that the two parts are stable. Over-tightening may damage the top stepper mount.</p>	
<p>When the top stepper mount and stepper based are assembled correctly the limit switch "pads" will appear as shown.</p>	
<p>Attach the limit switches to the top stepper mount. There are two sets of limit switches. The pair of switches with the long wire is placed on the top stepper mount.</p> <p>The RED roller on the switches face upward as shown. Two self-tapping sheet metal screws are used to attach each switch to the stepper mount.</p>	

<p>Attach the second limit switch as shown. Note that the RED rollers face each other and upward.</p> <p>A limit switch is a simple On-OFF switch that may be used for controlling the motion of a moving object.</p>	
<p>Attach the top stepper motor to the top stepper mount. The stepper motor wires are oriented downward. Use two long screws and nuts to attach the stepper motor.</p> <p>A stepper motor is a special type of motor that moves in steps rather than freely rotating. The number of steps can be controlled using electrical control circuits.</p>	
<p>Fit the second screw and nut to secure the other side of the stepper motor. Note that the stepper motor is mounted on the same side as the limit switches.</p>	
<p>There are two stepper motor driver boards that are mounted on the camera base. You may have red or blue boards. They are both the same only different colors.</p> <p>Position the driver board with the <u>red</u> switch block <u>down</u>.</p> <p>Attach the board using two short screws and nuts as shown.</p>	 <p>Short Screw</p> <p>Left side red switch down</p> <p>Stepper Driver Board</p>

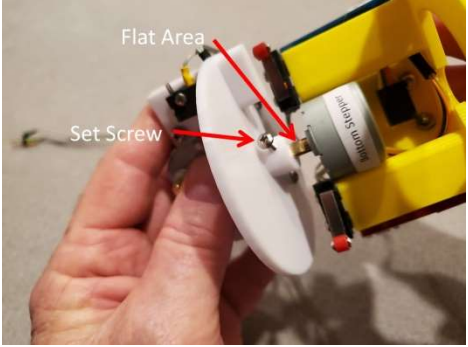
<p>Hold the camera base and driver board in one hand with your finger on the screw holding the assembly in place.</p> <p>Carefully place a nut on the screw turning the nut clockwise.</p>	
<p>Install the second screw. Gently tighten both screws to complete the assembly.</p>	
<p>Attach the second stepper driver board using two short screws. Note that the red switch block is in the up position as shown.</p>	
<p>The camera base with both driver boards should appear as shown. The boards may red or blue.</p> <p>The left board controls the bottom stepper motor and the right board controls the top stepper motor.</p>	

<p>Preparing to install the two bottom limit switches by placing a washer over the outside mounting holes for attaching the switches. The washers are used as spacers for mounting the stepper motors.</p> <p>The limit switches “limit” the amount of rotation of the stepper motor.</p>	
<p>Place a stepper motor on the camera base as shown. The motor wires are routed behind the motor. Both motors are the same.</p>	
<p>Select the limit switch pair with the short leads. Obtain one self-tapping sheet metal screw and install through the switch mounting hole and the washer into the camera base. Note that the red roller is in the outward most position. Gently tighten the screw to secure the switch.</p> <p>Obtain a second screw and fit into the second switch mounting hole. You may have to align the switch and motor mounting tab to allow the screw to “thread” into the mounting hole.</p>	
<p>Install the second limit switch following the procedure above. Place a washer over the outer most mounding hole and place the switch over the washer and motor mounting tab. Tighten both of the screws.</p> <p>Note that booth of the red rollers on the switch levers are facing outward..</p>	

Assemble the top stepper base to the camera base. The top stepper base has a hole and set screw to secure it to the bottom stepper motor shaft as shown.

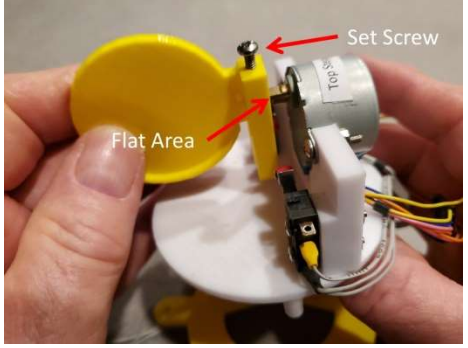
Notice that there is a small “flat” on the stepper motor shaft. The flat should align with the set screw. You may need to rotate the stepper shaft with your pliers.

Gently tighten the set screw.
Overtightening the screw will damage the top stepper base.



Attach the camera mount on the stepper motor shaft with the set screw pointing upward. It may be necessary to rotate the motor shaft in one direction or the other so that the “flat” area of the shaft is horizontal.

It is suggested that you use a twisting motion to fit the camera mount on the motor shaft.



Gently tighten the set screw to hold the camera mount in place being careful not to over-tighten the set screw.

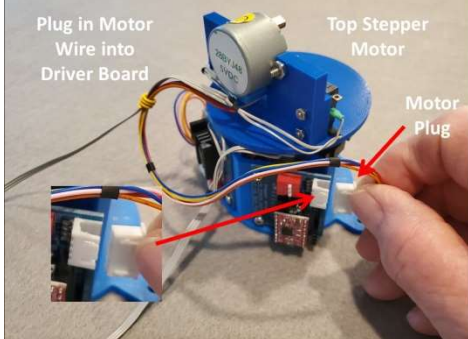
The camera mount should be in the vertical position when the assembly is completed.

The “arm” extending below the stepper motor shaft should move the red rollers when the camera mount is rotated side-to-side.



The final stage of the camera mount assembly is plugging-in the stepper motor connectors.

The top stepper motor connector is show here. See the inset photo for details about the orientation of the connector. Note that the small “arrows” on the plug are facing outward.



The completed assembly should look like the example shown in the photo.

Note that the long limit switch wire comes from the top pair of limit switches. The short pair of wires are attached to the bottom limit switches.

Both stepper motor plugs are plugged into their respective connectors. The bottom motor cable is plugged into the right driver board. The top stepper motor is plugged into the left driver board.

Note that the “small arrows” on the plugs are facing outward as shown in the previous photo. Additionally, the yellow wire on the connector is oriented toward the *non-slotted end* of the connector.

