You are making great progress and are about halfway done with your build.

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INTRODUCTION

You will gain more soldering experience while connecting all of the motors.

TOOLS:

- Utility Knife (1)
- Needle Nose Pliers (1)
- Soldering Iron and Solder (1)
- Heat Gun (1)
- Safety Glasses (1)
- Super Glue (1)
- Disposable Rubber Glove (1)
- Flush Cutter (1)
- Wire Strippers (1)
- Scissors (1)
Step 1 — Propellers

- Use a razor blade or hobby knife to remove excess plastic from the propellers.

Step 2

- Remove the existing nuts and washers from the threaded rod on all three motor bells.
- Using a set of pliers, hold stationary the locknut (with the nylon insert) and rotate the motor bell to thread the nut until it protrudes out the other side.
- Take off the nut, then put it back on backwards, nylon side first. Thread it down as shown in image 3.
Step 3

- While holding the bell with one hand and the propeller in the other hand, thread the propeller onto the threaded shaft.

⚠️ The edges of the propeller can be very sharp. Please use caution and use a cloth or gloves if you are worried about getting cut.

- Tighten the propeller very snugly.

- There should be a gap between the locknut and the propeller.
Step 4

- Back the locknut up against the propeller while holding the bell in one hand.
- Tighten this very snugly.
- You should still be able to remove the propeller if needed, but it should not rotate freely.
- If you are concerned about the propeller coming loose, repeat this process until tight.
- Do this to all your motors and props.

ℹ️ Threadlocking compounds can be used to further ensure that the propeller will not come unscrewed during operation. This would be recommended for long deployments or usage in harsh environments.
Step 5 — Wiring Harness

- With the 1/2" wire sleeve, begin wrapping the wires starting at the end cap. **Do not wrap entire length just yet!!** You'll need to pull two wires out first and it will be easier to organize wires while they are out of the sleeve.

- Place end cap to port side of structure. This will help you measure out the length of wire.

- Locate and separate the bright green and striped bright green/black wires. These will be for the starboard battery tube. Wrap the rest of the wires with the black cable wrap and around the frame.

* The ROV is upside down in this image.

Step 6

- Now that you have the length of the wires to the notch, have the bundle travel along the structure as shown in image 2.

* Make sure the green and black/green wires are sticking out on top.

- Zip tie the bundles together by threading the zip tie through the slits on the acrylic piece.
Step 7

- Have the wire bundle go over the middle acrylic piece. As you wrap it over take out wires in respective order.
  - Solid green (3 wires)
  - Grey wires with stripes (4 wires)
  - Solid blue (3 wires)
  - Solid yellow (2 wires)
  - Solid red (3 wires)

- On the other side, pull out the orange and black/orange wires. This will be for the port side battery tube and will stick out of the wire wrap similar to starboard side battery tube wires on top of the acrylic.

- The 6 gray auxiliary wires will continue past where the orange and black/orange exit the sleeve.
Step 8

- For the gray wires and sleeve, wrap up the rest of the wires all the way and measure out the length as it wraps over vertical structure and down to the base.

- Cut the wires and sleeve where you estimate they reach the base.
Step 9

- Pull the six gray wires out of the sleeve.
- Cut six lengths of heat shrink and put at the ends of the grey wires.
- With a heat gun, heat up the heat shrink.
- Do this for all grey wires.

⚠️ When using a heat gun be careful as these wires will get hot.

ℹ️ The heatshrink has an adhesive on the inside that will provides a waterproof layer between the wires and the water.

- Re-wrap the six gray wires into the sleeve after the heatshrink cools.
Step 10

- With a zip tie, tie the sleeve and wires to the acrylic structure.
- Cut the excess zip-tie on both ends.

Step 11

- Cut the 4 I2C wires (the grey wires with the colored stripes) about 6 cm from where they come out of the base of the sleeve.
- Using the same process apply heat shrink to the end to waterproof the ends of these wires.
- Tuck them back into the sleeve when complete.
Step 12

Now to solder on and mount the motors. The colored wires refer to a specific propeller. Match up the propellers with their respective wires designated in the images.

- Green - starboard motor
- Blue - vertical motor
- Red - port motor

The frame is upside down right now.
Step 13

- There are two different types of insulation on the motors.

- The first type has writing on the insulation and is sealed on the inside. No further preparation work is needed. **Skip to step 17.**

- The second type has no writing on the insulation and is not sealed on the inside. There are a few preparation steps that must be completed in order to ensure a waterproof connection.

Step 14

- Using your fingernails you can remove the insulation a little at a time. You need to remove enough to expose the enamel (as seen in the next step).
Step 15

- Copper wire tinned with solder (silver in color). Not safe from water.
- Bare wire (dull copper). Also not safe from water.
- Enamel coated wire (shiny, wet-looking copper). Safe from water.

Step 16

- Once you can see the enamel, use flush cutters to cut some of the tinned wire. Do not cut off all the tinned wire. Some must be exposed to solder the wires onto.
Step 17 — Starboard Motor (Green Wires)

- Starting with the starboard side, measure out where you should cut the green wires to solder the motor on.

You want a length/location that you will be able to tuck the wires back into the sleeve AND avoid getting caught in the propeller AND not rub against the motor bell when it runs.

- Cut the wires at the desired location and strip the ends.

- Slide a strip of heat shrink on each leg of the motor. **REMEMBER TO MATCH THE CORRECT PROPELLER TO THE CORRECT SIDE.**
Step 18

- Solder motor wires to the 3 green wires. The order of the three wires from the motor to the 3 green wires does not matter.

- Slide the heat shrink over the solder joints and use a heat gun on all 3 joints. Make sure it is entirely heated on all sides to ensure the adhesive is melted inside the heat shrink and encapsulating the joint.

- If you had to make the modifications to your motor insulation make sure that the heatshrink completely covers all the bare wire. The enameled wire will be protected against seawater, but the bare wire or the soldered area should be completely covered by completely melted heatshrink.

⚠️ When soldering it is recommended that you wear safety glasses and have air circulation in the room you are working.
Step 19

- Tuck the wires into the sleeve.
- Place in the flange and tighten screws to mount motor.

Step 20 — Vertical Motor (Blue Wires)

- Place the vertical motor in the flange. Have the wires curl over the side as shown in image 1.
- Estimate the length of the wires along the blue wires.
- Cut blue wires at estimated length. Strip the ends.
Step 21

- Slide heat shrink on the motor wires.
- Solder on the motor wires to the blue wires.
- Use the heat gun to heat up the heat shrink over the solder joints.

Step 22

- Tuck the blue wires into the sleeve.
**Step 23**

- Attach the motor to the flange and screw down the screws to hold the motor in place.

**Step 24 — Port Motor (Red Wires)**

- Place port motor in flange and estimate red wire length.
- Cut at the estimated length marker.
- Slide heat shrink on the motor wires.
Step 25

- Solder on motor wires to red wires.
- Heat gun the heat shrink on the solder joints.

Step 26

- Tuck the wires into the sleeve.
Step 27

- Attach motor to flange and tighten the screws to mount the motor.

Step 28

- Put zip ties to hold down the wire sleeve away from the motor bells. Do it for both sides.

  Spin the motors with your fingers and ensure that it isn't rubbing against any wires, or the sleeve.
Step 29

- Continue your build by progressing to Guide 5.