Pre-Launch Testing & Troubleshooting

Using the pieces you've put together its time to test and then launch your ROV. Note the suggested position of the thrusters in the frame as pictured in the introductory chapter.

Once you've finished building your design, it will be time to "dry" test it. Hook the power wires up to the battery source and test each thruster individually.

Make certain that when you do this "bench test" that the propellers will not spin into the table or wires. Then, test each thruster with each switch and confirm that all the propellers are spinning in the same direction when the switch is engaged in the same direction. At this time engage both switch positions to make sure that the props spin when the switch is engaged in both directions.

1. **If none of the thrusters are spinning, make certain that the 12v power source is charged and has the power to run the thrusters. Use a multitester to make sure that at least 12 volts are coming from the battery source.**

   A. If no propellers are spinning and you've verified that power is coming from your 12v source, then its likely that one of your power wires has come loose from inside the controller jar. You should be able to see this through the controller jar. If you can't you'll have to open the controller and gently pull the lid away from the jar. You can make it easier to pull the lid from the jar if you cut the two cable ties that were installed on the outside, bottom of the jar where the tether comes through.

2. **If the propellers are not all spinning in the same direction when the switches are engaged in the same direction** there are several options to correct this. Only one of the Thrusters can be spinning differently than the other two. If there is an "opposite" spinner, it means the power wire from the switch has been "reversed". Don't panic…

   a. Isolate the switch in the controller that is controlling the "culprit". Unscrew the controller top from the controller jar. Carefully reach under the controller top and turn that switch 180 degrees. Be careful that the wires to it are not too tight. Put the lid back on the controller. All props will now be turning in the same direction when the switch is engaged "up" or "down".

   b. If you don't want to mess with the controller jar there is another option. Isolate the tether wire that is leading to the thruster that is spinning in the opposite direction. Anywhere along that tether's speaker wire snip it. Strip the four ends of the cut wire. Now wire the copper end to the silver end and the silver enc to the copper end. Tape the splices w/ electrical tape. Tape the two splices together so the tether is "one".

doug.levin@noaa.gov
757.710.1631

3. **Before you start integrating the thrusters into the ROV you should test to see which the controller switches runs which thruster.** Ideally, and ergonomically best, the lower left switch should control the port thruster, the lower right switch the starboard thruster.

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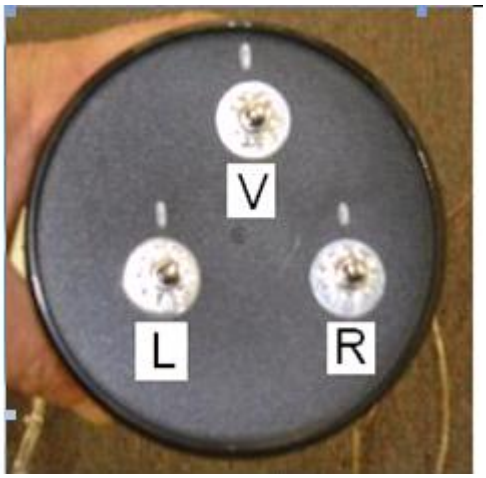
   a. As a bench test, connect the controller/thruster assembly to your battery power (see the first bullet).The switch at the top of the controller's triangular switch array (labeled "V" below) should be assigned to the thruster that controls the up and down movement of the ROV. As a "quick pick" hint, I put a rubber band around the thruster motor that is run by the "V" switch.



4. **Before you launch the ROV use your allen wrenches and soft pliers to make sure that the props and prop adapters are snug on the bilge cartridge hub.** If they spin off on the test put 'em back on. Check the propeller hub nut and also the smaller set screw that keeps the propeller attached to the hub. The smaller set screw is small and somewhat delicate. Don't over tighten these, they'll break.

doug.levin@noaa.gov
757.710.1631

5. **These ROVs are designed and wired for use in freshwater. Freshwater is forgiving when it comes to electricity. If the components of the ROV happen to get wet with freshwater, they'll likely survive** with some air drying or even accelerated drying with a hair dryer. In saltwater or dirty water short circuits in the wiring that is not waterproofed may cause the switches to stop working. The bilge pump cartridges on the ROV are waterproof, submersible (tested to 15', should work to deeper depths) and will work in salt water.

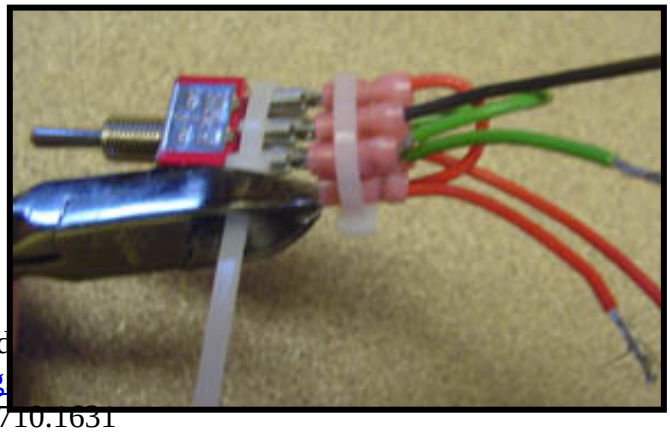
6. During thruster testing none of the thrusters spin when the switch is turned on.

a. Make sure that the power connectors are connected to the power source.

b. If the power is on and the power connections are certain it means that one of the wires has come loose molex within the controller jar from one of the power leads. You might be able to see the disconnected wire end by looking through the controller jar. If its not obvious, you'll have to unscrew the controller lid and look inside. This can be made easier by cutting the plastic wire ties that are located at the bottom of the controller jar. Then, gently, pull the lid away from the controller jar. Inspect the wire connections. This is more than likely the last likely spot where you'll have to look to solve your power/controller issue.

7. During thruster testing one or two of the three thrusters spins in one, or both directions.

This symptom generally means that one of the connectors has come loose from switch post. From your testing you have pinpointed which switch is the "suspect". Unscrew the lid from the controller jar (see 5b). Turn the lid upside down and inspect the "bad" switch. Most likely one of the molex connectors has come loose from its post. Another possibility is that one of the molex connectors is shorting against a neighboring connector. You'll be able to see the culprit connector with closer inspection. When you've located the problem here's the next step. Snip the small cable ties so you can get to the wire connector. You might want to put a slight crimp on the connector using your pliers (really slight). Reseat the connector onto the post. Test that the switch is working, and that all three controller switches are now powering the thrusters both forward and backward. When you're satisfied that all is in order apply the two plastic cable ties to the switch assembly.



Build
doug
757.710.1631

8. While holding the controller the easiest way to "steer" it corresponds with how the ROV moves through the water. After launching the ROV, if pushing the L and R switch forward, the ROV goes forward, you're in good shape. **If pushing the switch forward causes the ROV to reverse the solution is easy.** Just take the wires connected to the power source and switch them, i.e. switch the polarity. The ROV will now move forward when the horizontal thruster switches are pushed forward.

9. Once the ROV has been tested and you're satisfied that it's solidly constructed, lower the ROV into the pool. The top of the ROV Pontoons should float so that their tops are just slightly above water. This will show that a minimum amount of power is needed for the ROV to "dive". **If there is too much buoyancy then the ROV might not sink or "dive" when the downward thrust is applied.** If this is the case, then there might be two ways of assisting with the "dive" properties.

a. Propellers are more efficient in one direction than the other. In these thrusters if you put your hand behind the thruster and power it up you'll feel the breeze caused by the propeller. If you reverse the propeller's spin and put your hand in front of the thruster you'll feel the breeze. The stronger breeze should be felt when your hand is behind the propeller. Now, look at your vertical thruster. **If the propeller is pointed downward, you'll get the maximum thrust in the downward direction. If the propeller is pointed upward, you won't get an efficient downward thrust and the ROV might not sink.**

b. If your thrusters are pointed in the right direction and you're still having problems with the dive then try adding weights (lead weights, fishing weights). **You'll want just enough weights so that the ROV is slightly positively buoyant.** At this point your ROV will need the minimum amount of power to sink. In addition, if something happens to your ROV and it loses power, it will float to the surface.

10. If the balance of the ROV is not level, add weights or readjust the thruster configuration until it is level. Note, that if you are using three thrusters and only one of them is for up and down motion, you'll want to position it in the center of the ROV. If you don't the ROV will tilt "up" or "down". If the thruster is at either the bow or stern of the ROV you'll have to apply more weight to the other end to keep its "float plane" level.

You're Ready to Launch

11. When you're ready and the launch has been deemed successful, start driving. Its often helpful to have one person managing the 30' of tether while another is handling the controller jar. If you don't like your ROV as you've designed it, pull it out of the water, take it apart, and change it.. Good Luck… If you need help – email me at doug.levin@noaa.gov.

doug.levin@noaa.gov
757.710.1631