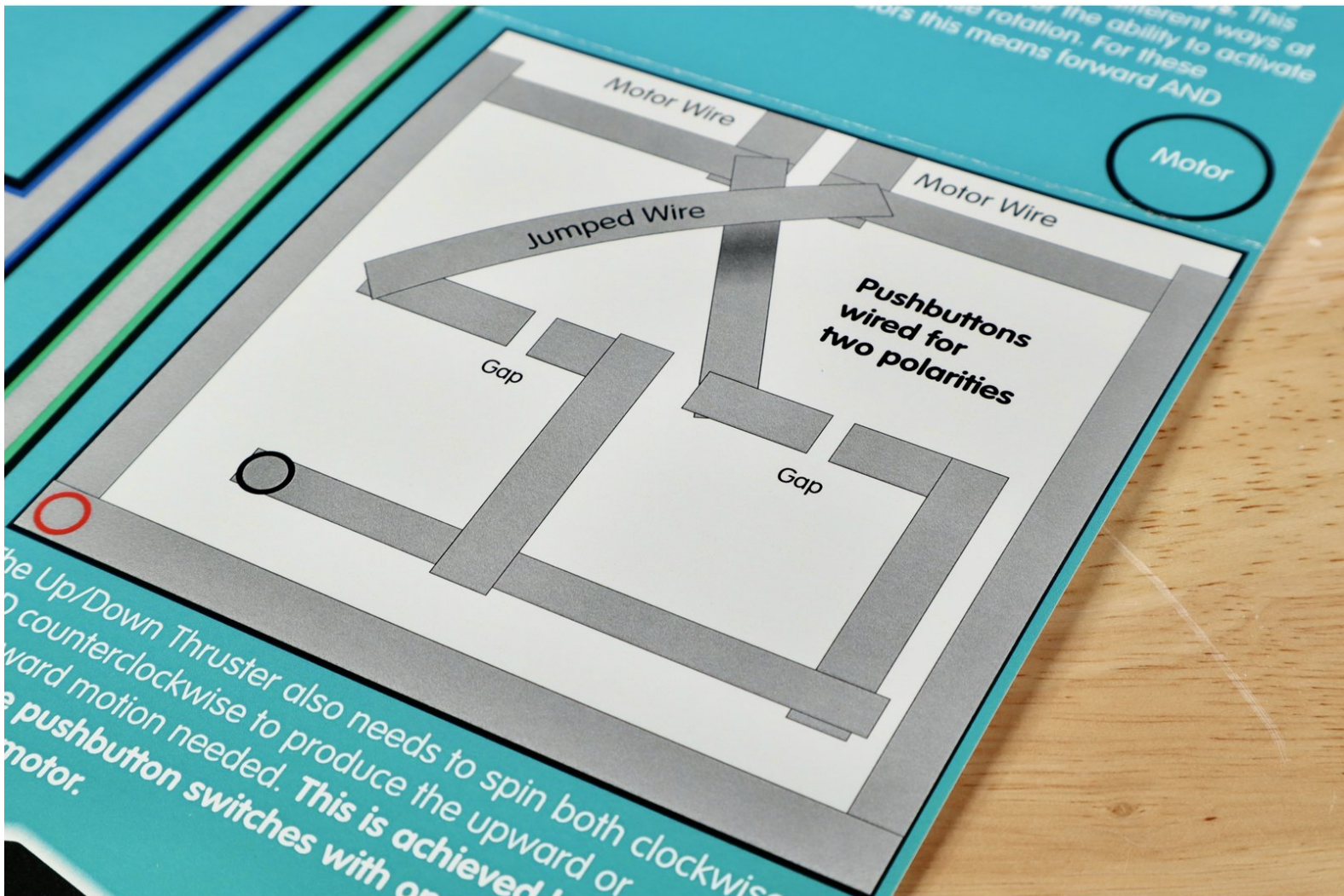




Activity 4: Pushbutton Switch Improvement

Use this guide and video to create the "Pushbuttons Wired For Two Polarities" circuit. This explains a final improvement on the basic control box.

Written By: Andy Wallus



INTRODUCTION

[video: <https://youtu.be/uSPryx17w3M>]

Use this guide and video to create the "Pushbuttons Wired For Two Polarities" circuit. This explains a final improvement on the basic control box.



TOOLS:

- [Scissors](#) (1)
 - [Markers, Crayons, or Colored Pencils](#) (1)
- Red and Black



PARTS:

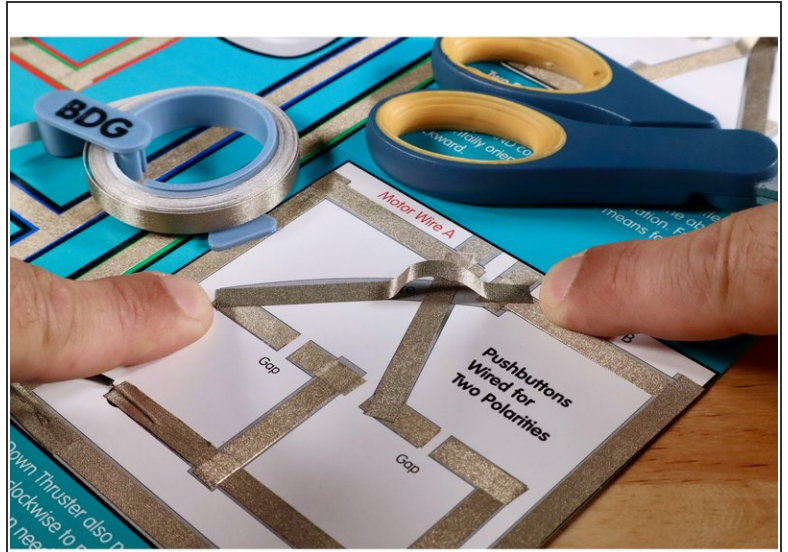
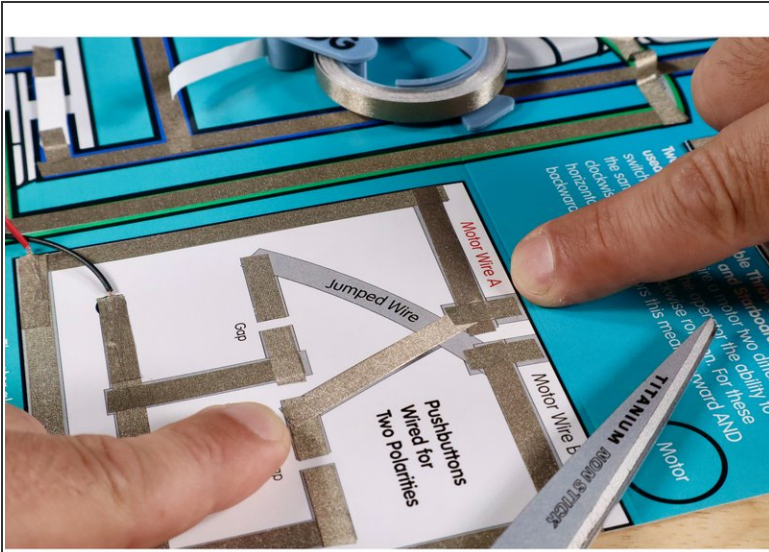
- [DC Motor with Fan Blade](#) (1)
 - [Self-Stick Hook and Loop Dot](#) (1)
 - [2 AAA Battery Holder](#) (1)
 - [AAA Batteries](#) (2)
 - [Maker Tape](#) (1)
- 1/4"
- ["Pushbuttons Wired For Two Polarities" Circuit Template](#) (1)
 - [Double Pole Pushbutton Switch Template](#) (2)
 - [Printable Data Sheet \(Educator Version\)](#) (1)
 - [Printable Data Sheet \(Student Version\)](#) (1)
 - [Flat Fish Kit](#) (1)

Step 1 — Wire power to and from switch



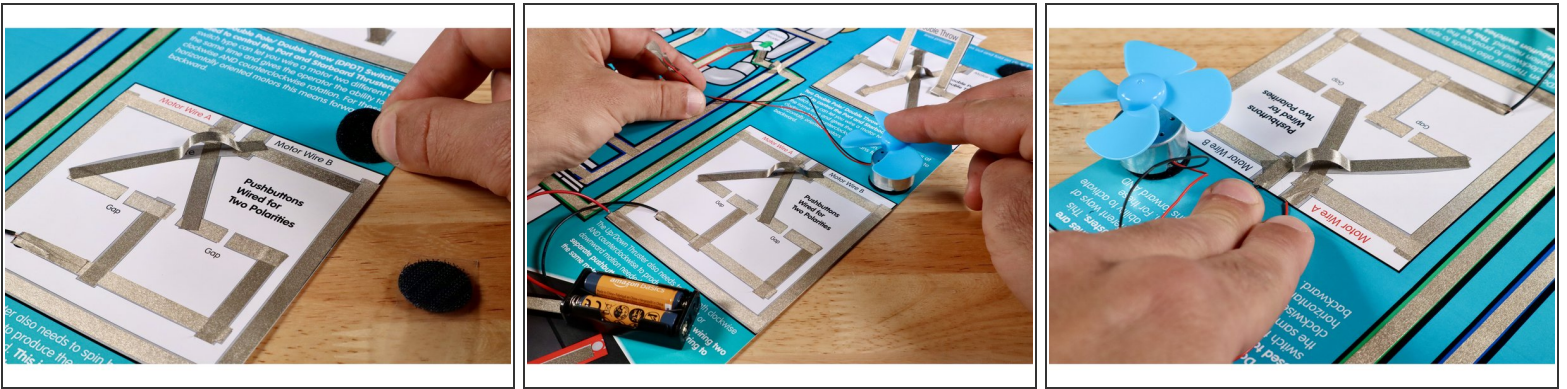
- **Locate the project template labeled "Pushbuttons Wired For Two Polarities".** It is located on the lower half of the right hand side of the Flat Fish project poster.
- **Measure, cut, peel, and stick Maker Tape paths shown in the first image.** The Negative (-) Black Circle Path will bring electricity into the switches. The Positive (+) Red Circle Paths will allow the current to return to the voltage source.
- **Remove battery pack from the Double Pole Double Throw Switch Circuit.** Using the third photo as a reference **connect each of the battery pack wires to the appropriate paths on this new circuit template** with small pieces of Maker Tape. They may still be reuse-able from the previous circuit but it's fine to cut and use new ones.

Step 2 — Create Criss-Cross Paths



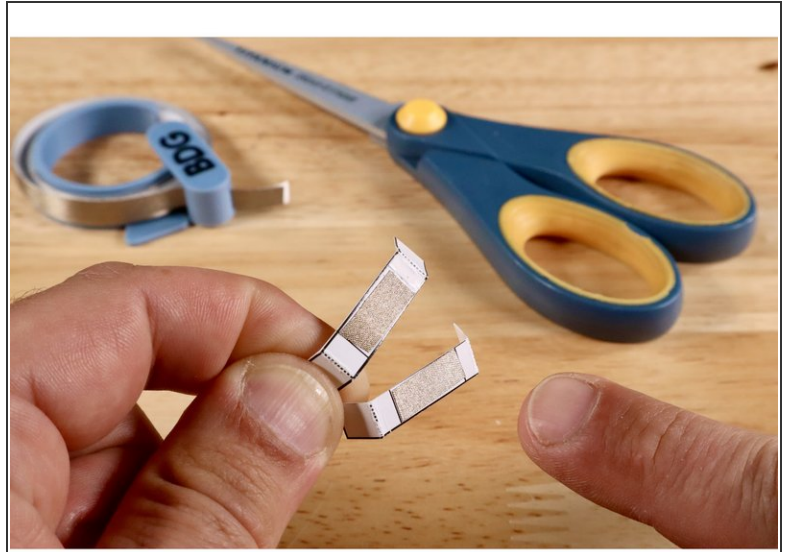
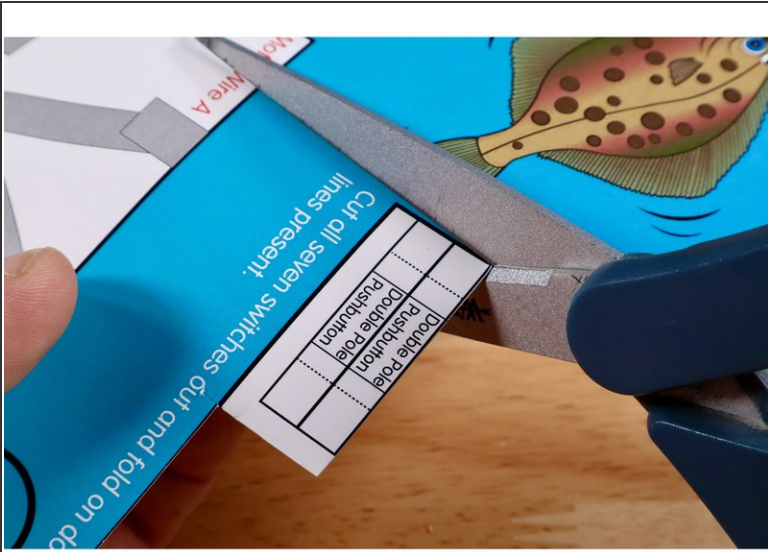
- **Measure, cut, peel, and stick the Maker Tape segments** of the **lower** part of the criss-cross as shown. Take care to **maintain the pictured gap**.
- **Measure, cut, peel, and stick the upper part of the criss-cross. This involves a jumped wire** just like you saw in the Green and White LED/ROV Outcome paths. **Use extra length** to enable this path to cross over and above the lower part without touching it.

Step 3 — Prepare And Connect Motor



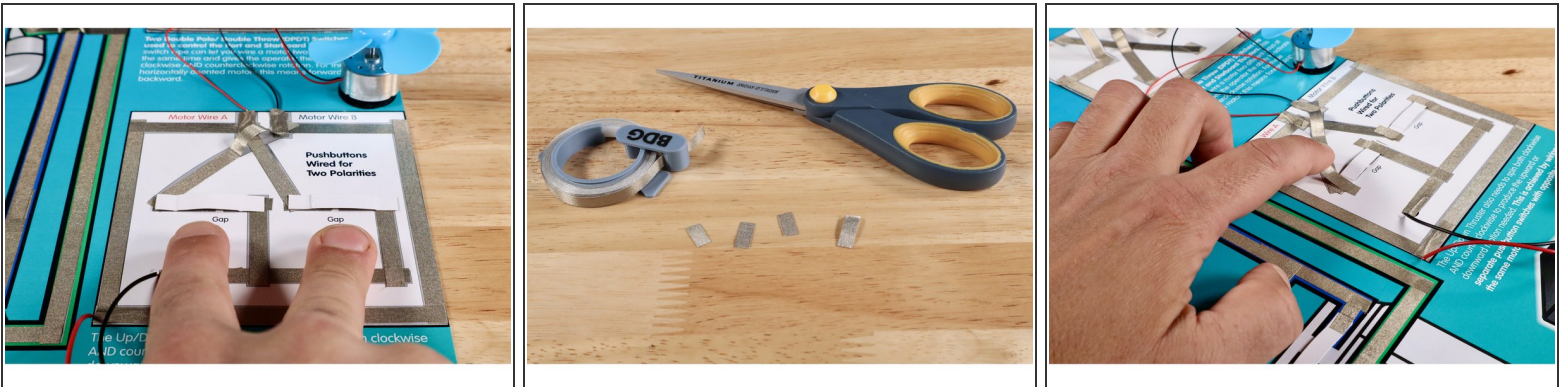
- **Peel and stick the remaining fuzzy half** of your remaining hook and loop dots onto the circle labeled "motor".
- **Now remove the motor** from the previous circuit and **mount the motor and fan to the new fuzzy dot**.
- **Connect the black motor wire** to the end of the upper part of the criss-cross nearest to the "Motor Wire B" label. Use a small piece of Maker Tape that you measure, cut, peel, and stick as shown.
- **Connect the red motor wire** to the end of the lower part of the criss-cross nearest to the "Motor Wire A" label. Use a small piece of Maker Tape that you measure, cut, peel, and stick as shown.

Step 4 — Prepare Pushbuttons



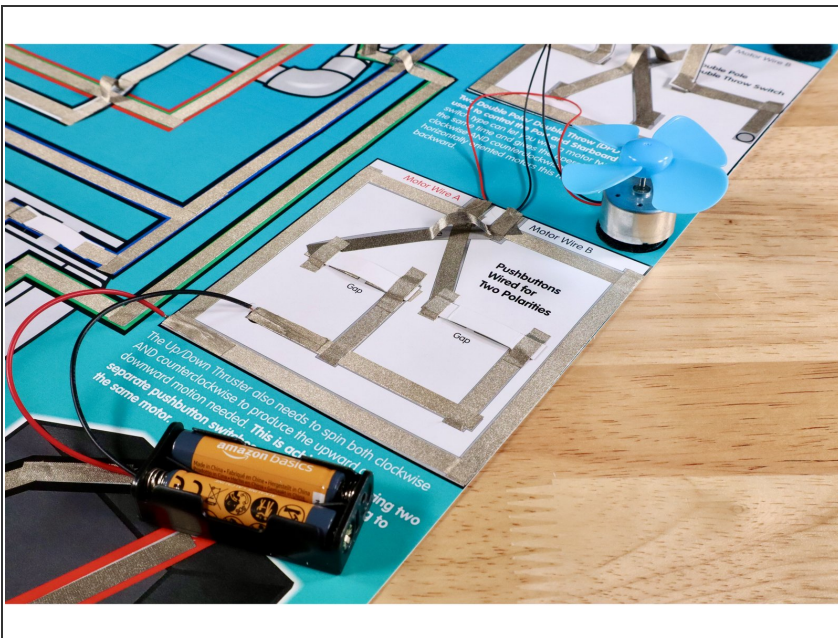
- **Cut and remove the 2 switch templates labeled "Double Pole Pushbutton"** from the switch template bank located in the upper right hand corner of the Flat Fish project poster.
- **Fold** on the 4 dotted lines as shown.
- **Measure, cut, peel, and stick Maker Tape paths** atop each of the two pushbutton templates as shown.

Step 5 — Connect Pushbuttons



- **Position each of the prepared pushbuttons** over each of the gaps as shown with the **Maker Tape side facing down** toward the rest of the existing pathways.
- **Measure and cut** 4 small pieces of Maker Tape.
- **Peel and stick the Maker Tape pieces atop the switches to secure them** in place as shown. The switches should have slight upward bend to them so that the conductive surface underneath is not normally in contact with the path ends/gap below.

Step 6 — Switch Use And Observation



- **Push the right button down** into contact with the contact points below; bridging the gap and completing this part of the circuit. **Observe** the direction of rotation at the motor.
- **Push the left button down** into contact with the contact points below; bridging the gap and completing this part of the circuit. **Observe** the direction of rotation at the motor.

Step 7 — Review And Assess

Circuit 3 Electron Flow Mapping

Name: _____

*Electricity goes into the circuit through the black wire and back out to the battery through the red.

Press the pushbutton on the left and observe the direction that the motor spins.

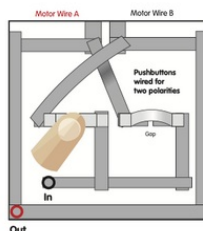
The left pushbutton path makes the motor fan spin

- 1.) Clockwise
- 2.) Counterclockwise

When the pushbutton on the left is pressed, the only complete path to the motor that the electricity can travel leads to:

- 1.) Motor Wire A
- 2.) Motor Wire B

Use black and red pens/markers to trace the flow of electricity from the black battery wire back to the red battery wire. Black should describe the path going INTO the motor and red should describe the path coming OUT OF the motor.



*Electricity goes into the circuit through the black wire and back out to the battery through the red.

Press the pushbutton on the right and observe the direction that the motor spins.

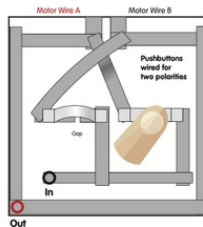
The right pushbutton path makes the motor fan spin

- 1.) Clockwise
- 2.) Counterclockwise

When the pushbutton on the right is pressed, the only complete path to the motor that the electricity can travel leads to:

- 1.) Motor Wire A
- 2.) Motor Wire B

Use black and red pens/markers to trace the flow of electricity from the black battery wire back to the red battery wire. Black should describe the path going INTO the motor and red should describe the path coming OUT OF the motor.



- Use the student sheet attached at the bottom of this guide to help assess comprehension. There is an educator copy as well.

Completing and testing this circuit/switch arrangement shows an improvement typically used to control blue thruster path on the first circuit. Now the outcome can be a motor instead of an LED and it can be made to go both forward AND backward instead of just on and off "one way". When that motor is oriented as shown on the graphic an ROV can go up OR down. Use attached worksheets to assess comprehension!