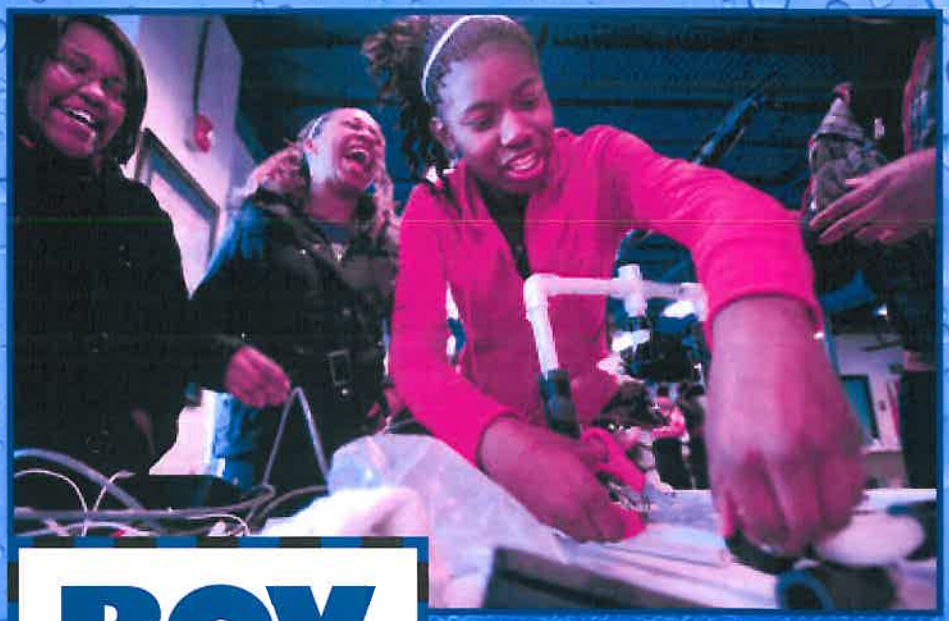


ROV in a Bag

For Students, Teachers & ROV Enthusiasts

Kits are available assembled or un-assembled. Each kit contains all of the parts and pieces to build one ROV. Cameras, lights and/or manipulators are not included.

$150

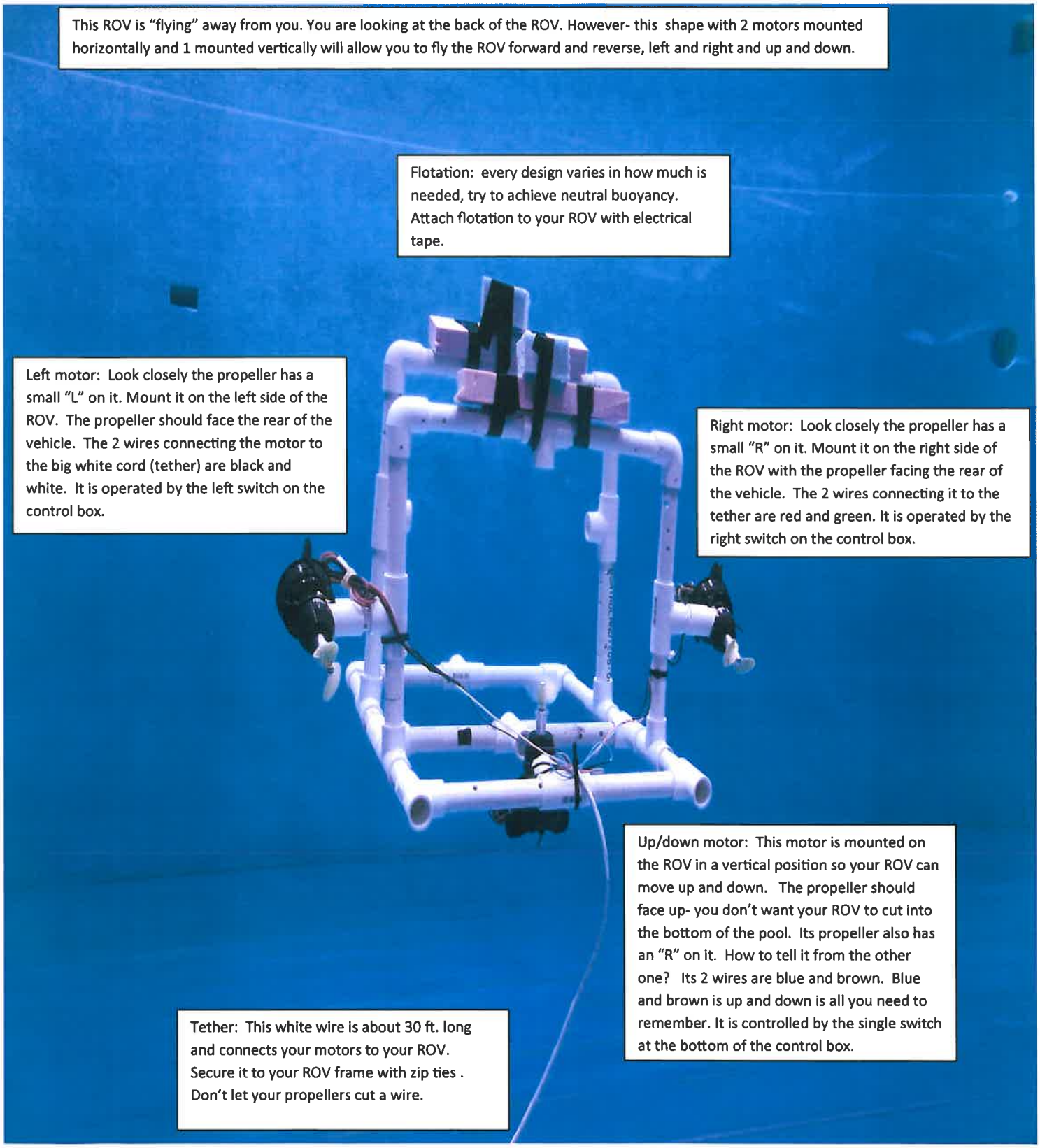
MATE

Inquire about the availaability of a free kit info@marinetech.org or www.marinetech.org

Marine Advanced Technology Education Center

National Science Foundation

MTS marine technology society


This ROV is "flying" away from you. You are looking at the back of the ROV. However- this shape with 2 motors mounted horizontally and 1 mounted vertically will allow you to fly the ROV forward and reverse, left and right and up and down.
Flotation: every design varies in how much is needed, try to achieve neutral buoyancy. Attach flotation to your ROV with electrical tape.
Left motor: Look closely the propeller has a small "L" on it. Mount it on the left side of the ROV. The propeller should face the rear of the vehicle. The 2 wires connecting the motor to the big white cord (tether) are black and white. It is operated by the left switch on the control box.
Right motor: Look closely the propeller has a small "R" on it. Mount it on the right side of the ROV with the propeller facing the rear of the vehicle. The 2 wires connecting it to the tether are red and green. It is operated by the right switch on the control box.
Up/down motor: This motor is mounted on the ROV in a vertical position so your ROV can move up and down. The propeller should face up- you don't want your ROV to cut into the bottom of the pool. Its propeller also has an "R" on it. How to tell it from the other one? Its 2 wires are blue and brown. Blue and brown is up and down is all you need to remember. It is controlled by the single switch at the bottom of the control box.
Tether: This white wire is about 30 ft. long and connects your motors to your ROV. Secure it to your ROV frame with zip ties . Don't let your propellers cut a wire.

Descriptions of ROV Building Supplies and Tools

18-Gauge 6 Conduit Plenum Jacket Wire - ~30 feet – This is the white or grey wire with 6 colored strands inside it. This wire is the tether or umbilical of your ROV. It sends the message from your switches to the motors, lights or manipulators on your ROV.

16-Gauge Double Stranded Speaker Wire -~ 10 feet – This is also a white or brown wire with 2 strands melded together. This wire is the power cord and is also called "lampshade" cord. One end will connect to your power source and the other end enters your control box and gives power to your switches. If you purchase a 16 gauge double strand that has one rigid strand and the other smooth you should note that electrical technicians typically couple the ridged half with red or positive terminals while the smooth strand is coupled with black or negative terminals.

You can purchase a 100' roll from Radio Shack. The part # is 278-1116. Radio Shack often offers and gives an educator discount, so be sure to tell them you are an educator!

Black Control Box – This box is where your switches are mounted. It is called a Project box. The size is 6x4x2. It is Radio Shack part # 270-1806. If you want room for more switches or less you can change the box size. Radio Shack carries a wide variety. NOTE- If you buy a project box off the store shelf- the box also comes with an aluminum mounting plate. Open the package and recycle the metal plate. Don't use the metal plates with switches, electricity and water! To make it easier to solder the switch terminals with wires, mount the switches on the plate rather than inside the deep portion of the box. The plate is also easier to hold in place for soldering.

Double Pole/Double Throw Switches –The three switches are Radio Shack part number #275-0709. They are called 20 amp DPDT (meaning double pole or pull and double throw) or the can be sold as: Heavy-Duty, Momentary Auto-Flip Switches. These switches come in two styles. The first style is momentary on/off and the other style is center off. Momentary on/off is a very fluid movement between direction. Center off means the switch comes back to center to the off position and then can be pulled in another position. Each "action" item you want to operate needs its own switch in our model. Three motors = 3 switches.

Motors –The three motors that propel your ROV are 500 or 600 gph Mayfair Marine Bilge Pump Cartridges. These operate bilge pumps on a boat and are already water proof and can be purchased in a variety of "gallon per hour speeds" the higher the number the more "gallons per hour" it can pump and in our case the faster your ROV will go. They are available at most boating or marine supply stores.

Propellers –The propellers will be attached to the three motors. The brand we have used is Octura, which comes in right-handed spin and left-handed spin. A left-handed propeller should be used on the left side of your ROV- for forward, reverse and turning. A right-handed propeller should be used on the right side of your ROV- for forward, reverse and turning. Either a right or left prop can be mounted on the up/down positioned motor. Hand spin does not matter much in the vertical movement of your ROV. So if you order props for a 3 motor ROV, order 2 lefts and 1 right or 2 rights and 1 left.

Octura Brand parts are # OCT-1250 and OCT-1250L. Hobby stores can get them for you.

Note - Traxxa also makes a very good prop and can be ordered through local hobby stores, you may want to experiment with this brand as well as several others on the market.

3 Motor Mounts – To get the propellers attached to the shaft of the motors you need what ROV folks refer to as "prop adapters" or "motor mounts" or "master air screws". These can be purchased from hobby shops. These mounts are called MAS3200. Some catalogs (and GOOGLE) refer to them as 05 prop adapters. These are the ones that fit the propellers. IF you change propeller size you may need to change the adapter to get the propeller connected to the motor.

The machine screw that comes with the master air screw is usually not long enough to fit through the shaft of the propeller and into the air screw. I replace it with a 3/4" long or 1" long stainless steel screw and a nut. As long as the screw is a 10-24 threading count it will fit the shaft of the propeller and thread into the top of the master air screw.

PVC Slip Fittings and Zip ties- 3 of these were used to create a mount fitting that easily allows your motor to pop on/off various locations on the frame. This system was created by Jeremy Hertzberg at MATE and is only one way to mount motors onto a frame. This mount takes a drill press and 2 3/4" hole saw to create.

Cable Ties or Zip Ties or tie Wraps – You will need a minimum of six. They are most often used to connect the umbilical to the frame of your ROV. Connecting the umbilical to the frame insures that no propellers cut or damage loose wires. A bag of 100 can be purchased at Home Depot for about $3.

PVC Pipe – The PVC pipe typically used is ½". Any grade or thickness is fine and a 20' section at Home Depot is just a few dollars. The ½" PVC is easy to use and easier for most people to cut including students. For a stronger ROV use 3" PVC or 2 ½" PVC.

PVC Joints –Since each team's design will necessitate the kinds of PVC joints needed, it is best to have a wide variety on hand. The following are suggested types: crosses, tees, 90° elbows, 45° elbows, elbow side outlets (plumbers elbows), couplings, cap slips, etc.

Flotation – For flotation most anything will work that will provide buoyancy. Some possibilities that can be purchased from Home Depot and most other warehouse stores are: ½" copper pipe foam insulation, pool noodles, surf boards, ping pong balls, bike tires, and empty plastic bottles with screw caps.

12 Volt Battery or Jump Start and Charger – It is best to have one battery for every two ROVs. When powering the ROVs via a battery charger make sure to have it fully charged prior to use.

Extension Cords – It is good to have one per battery charger. Just make sure it is not in or near water!

Power/Surge Protector Strips – It is also fine to have multiple batteries operating on one power/surge protector strip. Just make sure it is not in or near water!

Other Tools and Supplies – You will also need or may want to have the following tools and supplies on hand before beginning an ROV building session

A standard drill-
A dremel tool and dremel saw blades and buffing adapters
Screwdrivers- a flathead and a Phillips-head
Pliers, wire cutters, wire strippers and crimpers
PVC cutters
A soldering iron and solder (no lead or low lead alloy)
Electrical tape and zip ties
A 1" hole saw drill bit and a ¼" drill bit for holes in the project box
Wire caps (the orange caps we used to hold some wires together)
Terminal either forked terminals, barrier strip terminals, gator clamps or banana plugs
Various types of glues or epoxies, such as JB Weld or 5 minute epoxy

Some helpful notes for your kits. You may want to print.

A) The 3 motors can be traced back to the switch that operates the motor by simply looking at the colors of the wire strands connected between the umbilical and the motor.

The motor connected to the red and green wires- operates the motor that should be mounted on the right side of the ROV. This motor is operated by the switch on the right side of the control box.

The motor connected to the black and white wires- operates the motor that should be mounted on the left side of the ROV. This motor is operated by the switch on the left side of the control box.

The motor connected to the blue and brown wires- operates the motor that should be mounted in the vertical position on the ROV. This motor is operated by the switch on the bottom of the control box.

The right motor, has a right handed propeller
The left motor, has a left handed propeller.
The vertical motor - does not matter for propeller spin.

B) The propellers are secured to the motor mounts (little silver top hats) with JB Weld. They should not come off. However, the motor mounts may come loose, after a lot of spinning. Glue should not be used as it can seep into the motor and freeze up the motor. There are 2 very tiny allen wrenches in a ziploc for your use. The motor mount has a tiny set screw to tighten the mount if it comes loose.

C) Electrical tape, not provided, is great for securing floats onto the pvc. The floats are pre-cut, but can and probably should be cut by participants as they work on understanding flotation and buoyancy.

D) Colorful zipties are in a ziploc as well. Once an ROV frame is built, it is wise to secure the umbilical to the frame. A loose umbilical can sustain damage from a propeller, avoid dangling wires. You have enough zip ties to go a round or two, but you will need to replenish or use electrical tape in the future.

E) The motors are mounted to a pipe clamp and a section of pvc pipe. The motors can be place anywhere on the ROV. However, a user may find that the motors are to close to the umbilical. The white umbilical has a white tread and an aluminum pull cord inside the plastic sheath. Pull down, cut away the aluminum shield and this will allow a user to obtain more slack to place the motors farther apart from each other.

F) If the ROV stops working, check the fuse first. The black fuse holder twists open and contains a glass 20 amp fuse inside. It should last awhile, but a 4 pack of replacements can be purchased at Radio

Shack for $1 or $2.

G) Switches- they are dpdt. It is best to give a quick lesson on "flying" the ROV. Top 2 switches up- forward. Top 2 switches down- reverse. Left one forward, right one down- turn left. and vice versa to turn right. To make the ROV go up- bottom switch up, to make the ROV sink- bottom switch down.

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