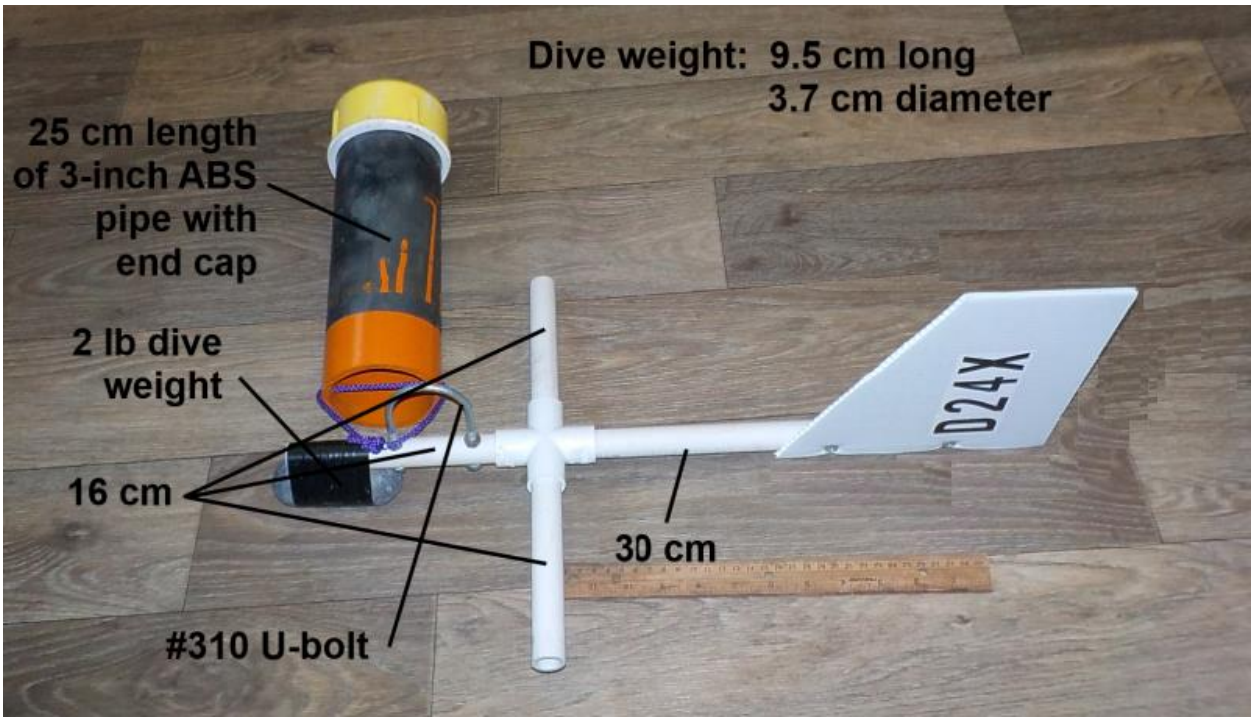
SCOUT Product demonstration prop building instructions

SolidWorks files will be available soon for all product demonstration props. Contact the MATE competition coordinator for access to the SCOUT SolidWorks files. SolidWorks Student Edition is free for MATE competitors. The eDrawings Viewer is a free download that allows the Solidworks files to be viewed dynamically.

Task 1: Aircraft

Aircraft:
The aircraft is constructed of ½-inch PVC pipe. A lift bag, constructed of 3-inch pipe and a 2-lb weight, is attached to the front end of the aircraft. A number-letter combination on the tail will help companies identify the aircraft. The tail shape and tail number will correspond to one of the 18 examples in the **SCOUT Aircraft Identification Handbook**.



The 25 cm of 3-inch ABS pipe with PVC end cap is positively buoyant and will float approximately 15 cm above the bottom of the pool. If ABS pipe is not available in your area, PVC pipe can be substituted. However, additional flotation may need to be added to make the lift bag positively buoyant in water. For example, 3-inch PVC pipe may need to be cut to a longer length (longer than 25 cm) to compensate for the additional weight of the pipe in water.

A 30 cm length of rope (colors may vary) will attach the lift bag to the #310 U-bolt on the aircraft.

The tail is constructed from corrugated plastic sheeting (check sign stores) with 2-inch black on white letters and numbers attached to one side.

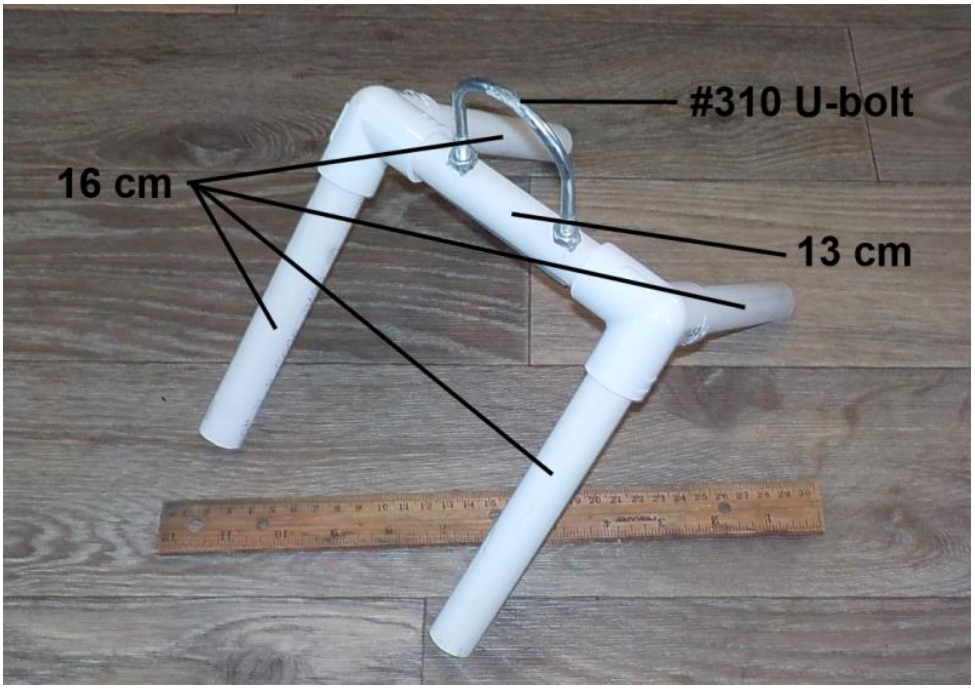
Lift bag:

A bicycle pump with 3/16-inch airline tubing will be used to inflate the lift bag. Note: the type of bicycle pump at your regional competition may differ.

Drill two holes on opposite sides of the bottom of the lift bag. String 30 cm of rope through the holes and tie the ends of the rope together through the #310 U-bolt.

Debris:

The debris is constructed from ½-inch PVC pipe with a #310 U-bolt on top.

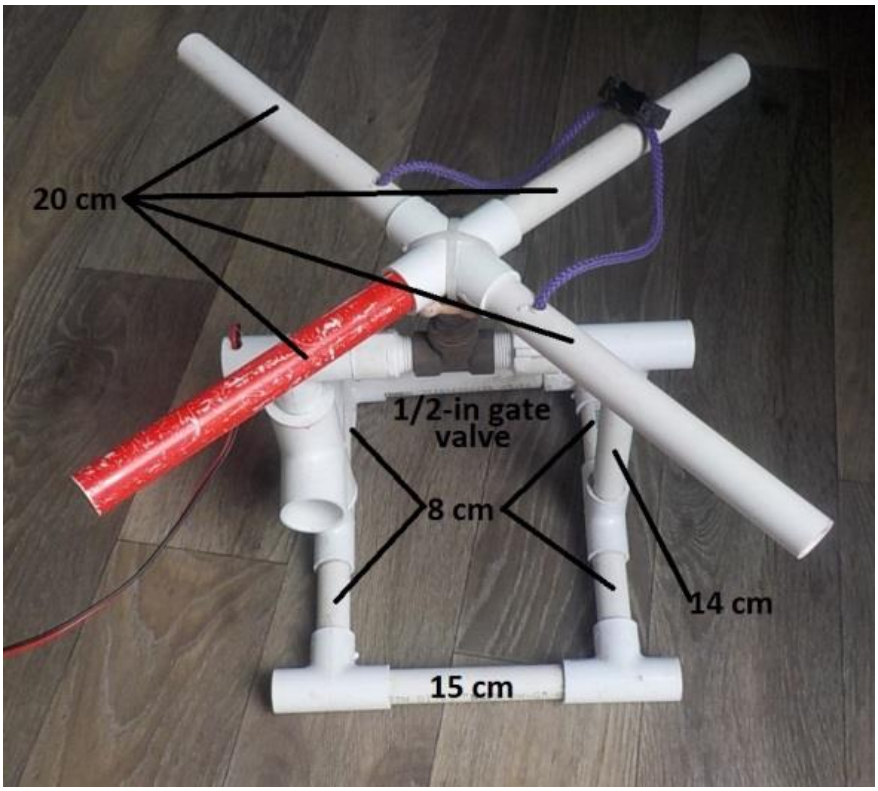


Debris on aircraft:

Task 2: Earthquakes

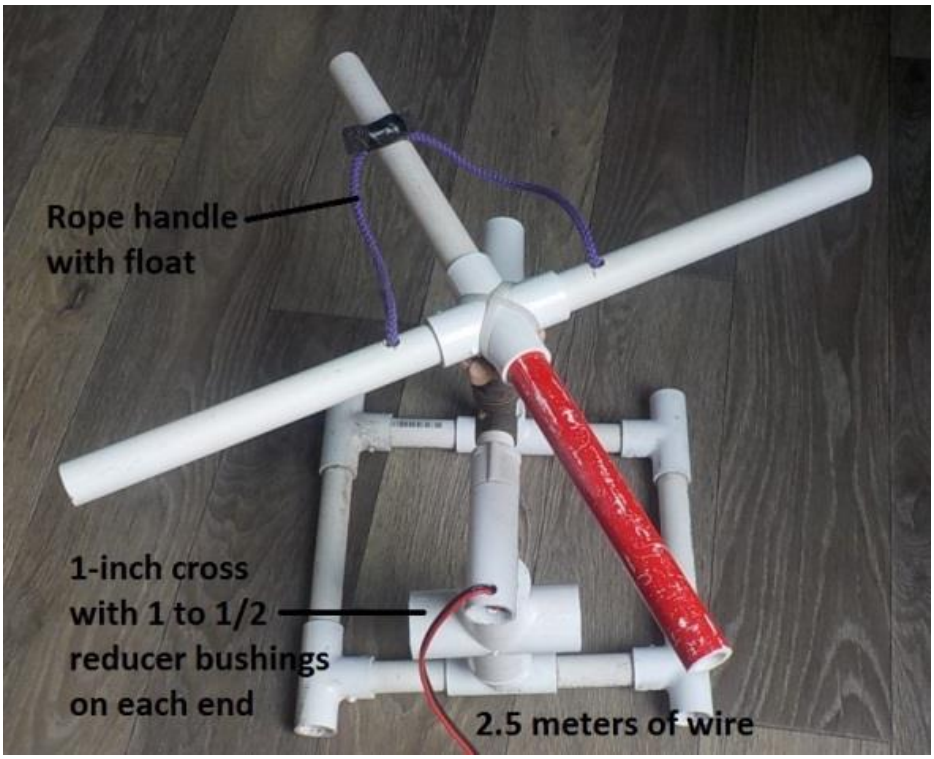
OBS (front view):

The OBS is constructed from ½-inch PVC pipe with a 1-inch PVC cross and a ½-inch gate valve. A ½-inch PVC cross is zip-tied to the top of the gate valve. One of the four handles is painted red. The 1-inch cross has two 1-inch to ½-inch reducer bushings to connect it to the 1/2-inch structure. Companies will turn the handle attached to a ½-inch gate valve 360^{o} (one time around) clockwise to level the OBS.



Flotation will be added into the PVC of the handle to make the OBS weight less than 5 Newtons in water.

OBS (side view):

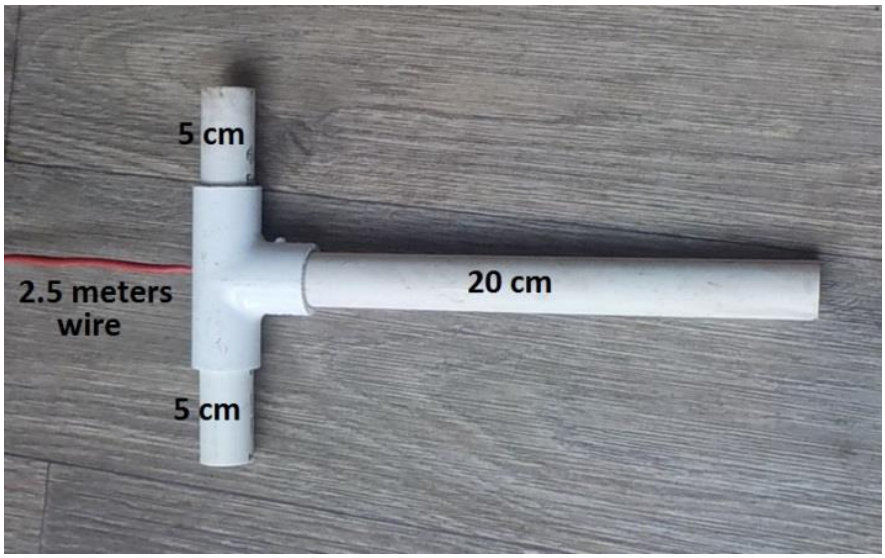


A 40 cm length of rope (colors may vary) may be used as a grab point to move the OBS. The two ends of the rope are approximately 12 cm apart. A small section of foam is attached to center of the rope to provide flotation.

2.5 meters of cable will connect the OBS to the cable connector. The cable will be constructed from flexible wire.

Cable connector:

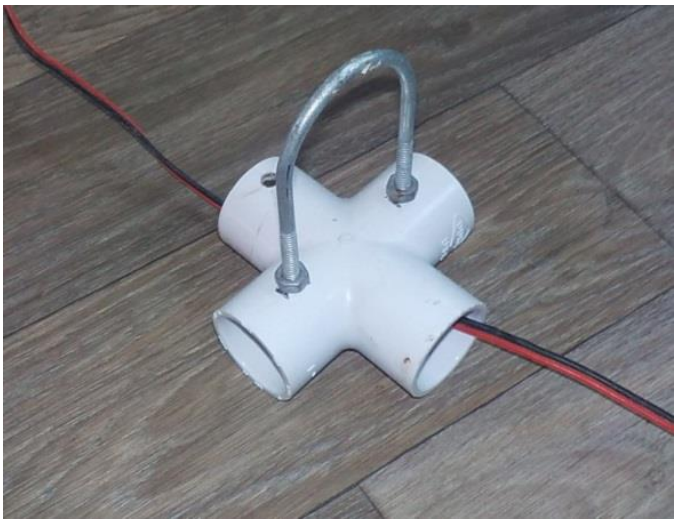
The cable connector is constructed from ½-inch PVC pipe.



Drill a hole into the top of the ½-inch tee. Tie an overhand knot in the wire to secure it inside the tee.

Cable grab point:

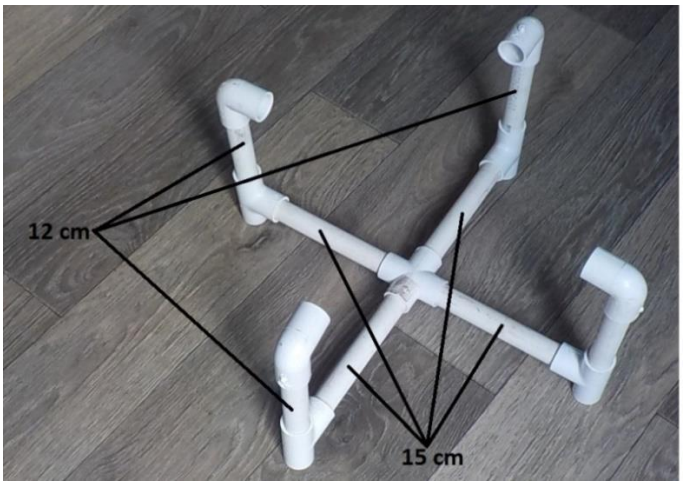
A grab point will be situated along the 2.5 meters of wire. Companies may use the grab point to position the wire inside the waypoint. The grab point is constructed from a 1-inch PVC cross with a #310 U-bolt attached.

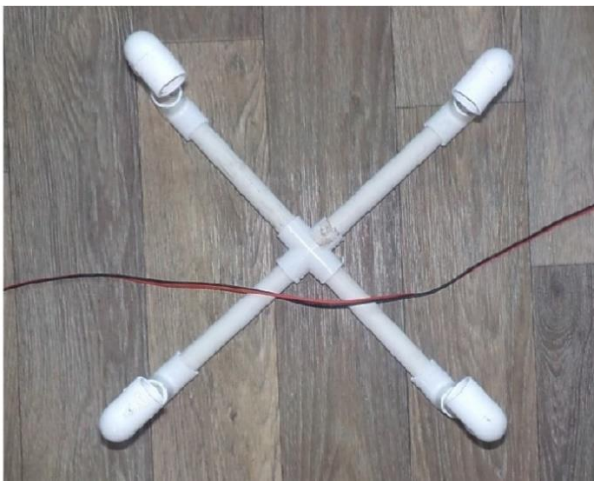


The wire will not be attached to the grab point, but will run through the cross.

Waypoint:

The waypoint is constructed from ½-inch PVC pipe.

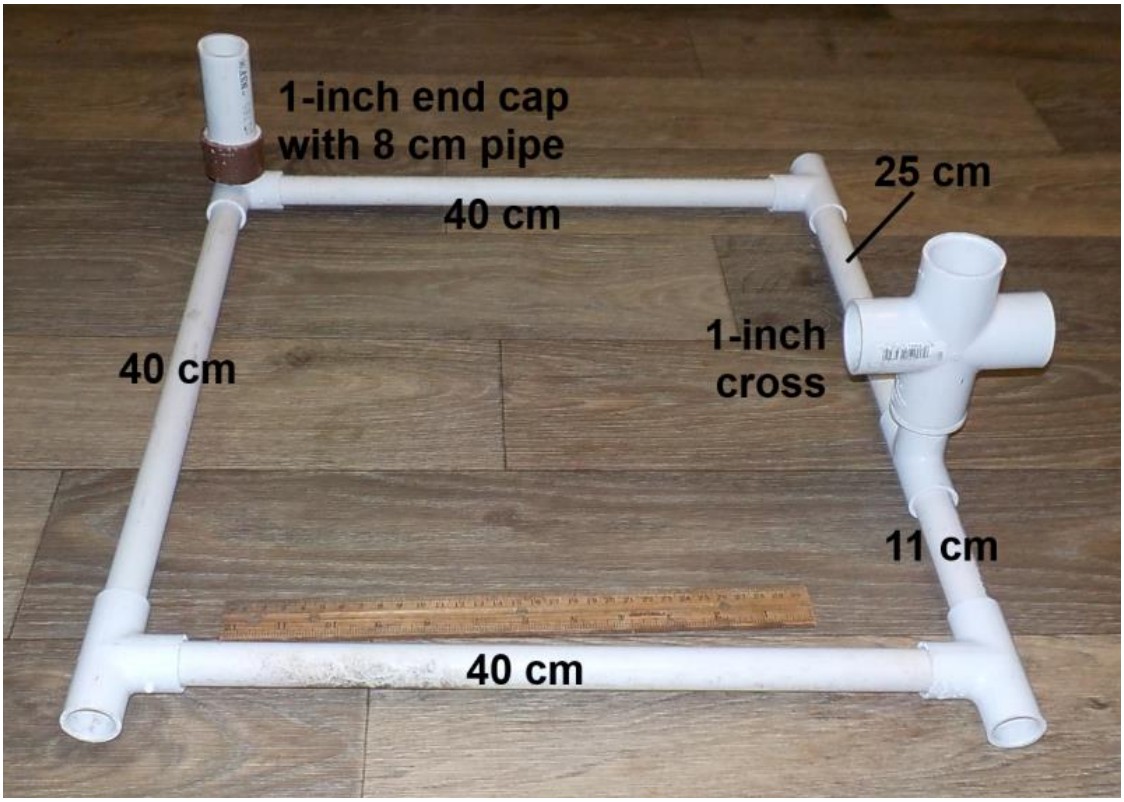




The cable must go through at least one “leg” of the waypoint. The photo on the right show the cable through two “legs” of the waypoint.

Elevator:

The elevator is constructed from 1/2-inch PVC pipe with two sections of 1-inch PVC pipe.



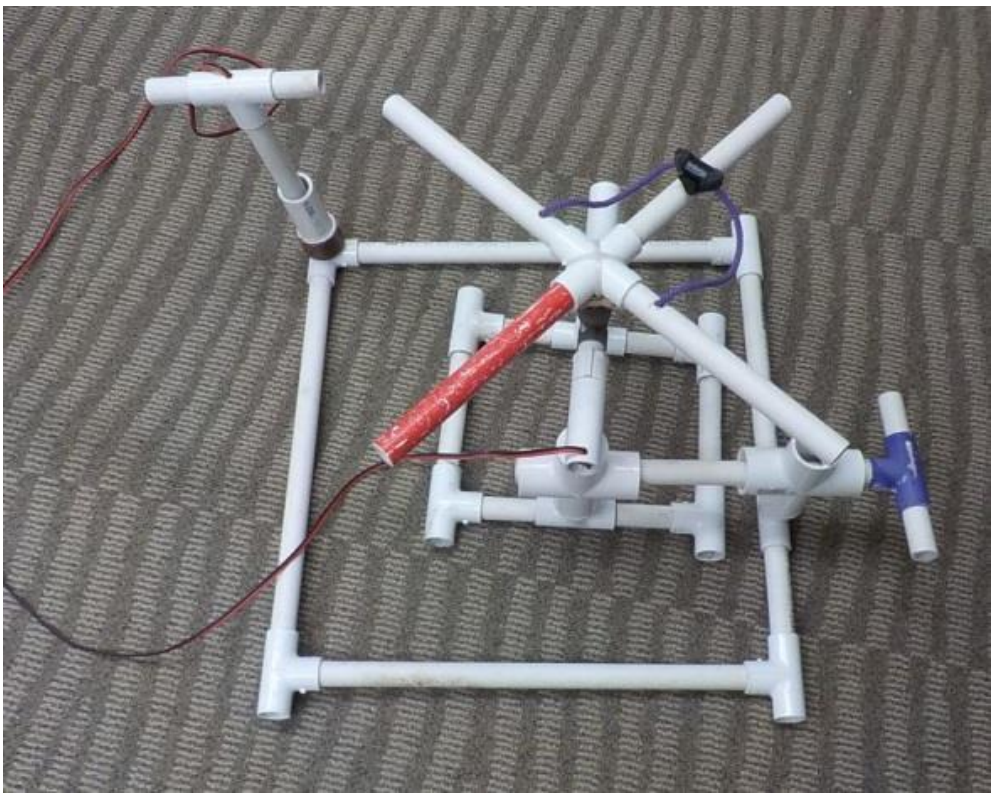
Screw the 1-inch end cap into the tee at corner of the elevator.

The 1-inch cross is connected to the elevator using a 1-inch to ½-inch reducer bushing.

Pin:

The pin is constructed from ½-inch PVC pipe.

The elevator (with equipment):

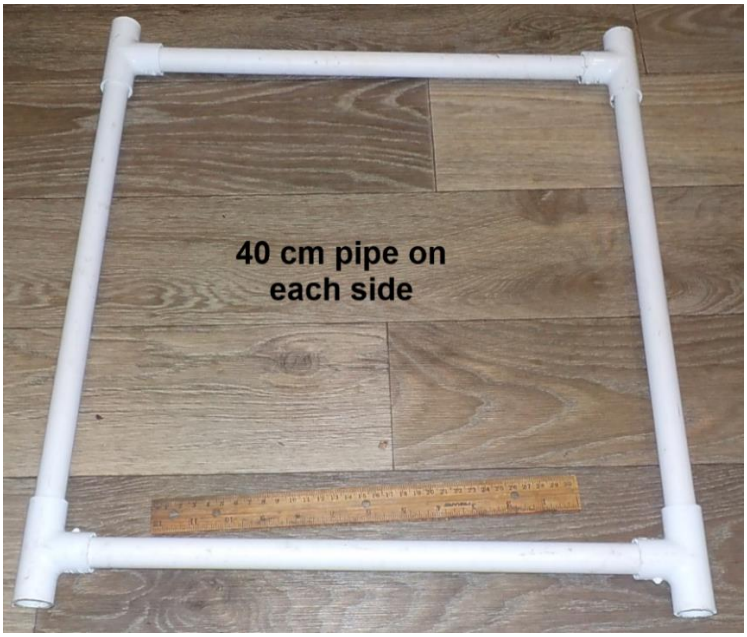


The cable connector is in its holder.

The pin is inserted through the 1-inch cross on the elevator and through the 1-inch cross on the OBS.

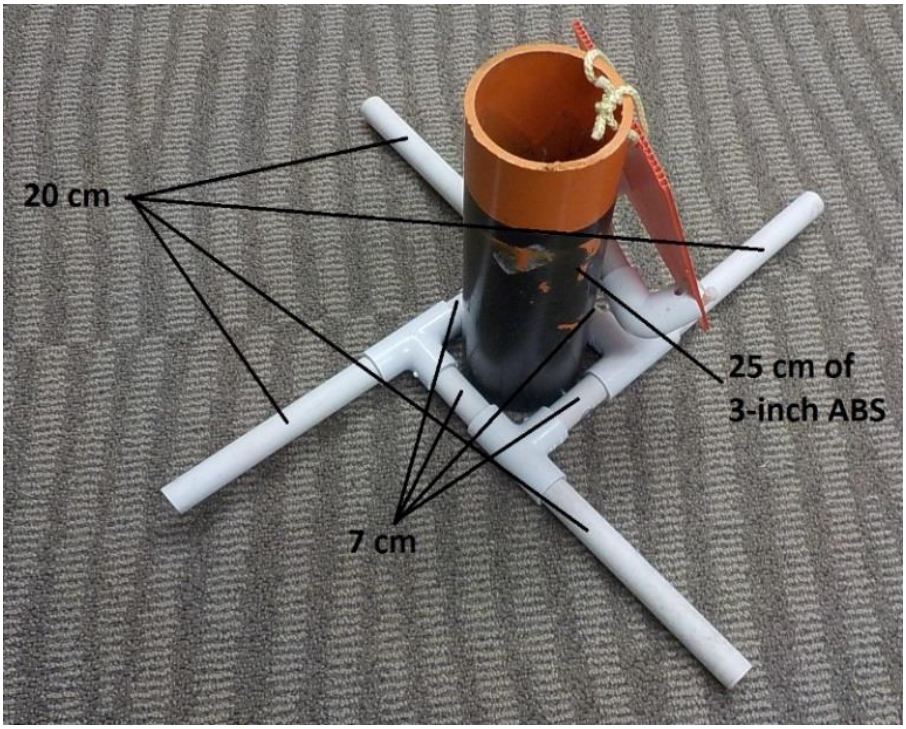
OBS Designated area:

The OBS designated area is constructed of ½-inch PVC pipe.



Power and communication hub:

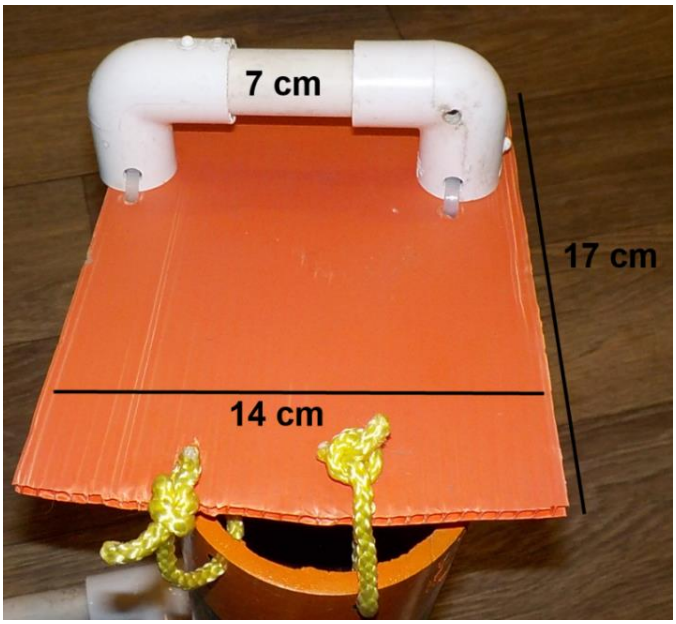
The power and communication hub is constructed from 3-inch ABS (or PVC pipe) screwed into a ½-inch PVC pipe base.



Use 2-inch screws to attach the 3-inch ABS pipe to the PVC base. The screws will go through the ½-inch pipe and into the base of the 25 cm length of 3-inch ABS. Note: 3-inch PVC pipe can be substituted for ABS pipe.

Door of power and communication hub:

The door of the power and communications hub is constructed from corrugated plastic sheeting (check sign stores) with a PVC pipe handle. The door is attached to the top of the power and communications hub by ropes.



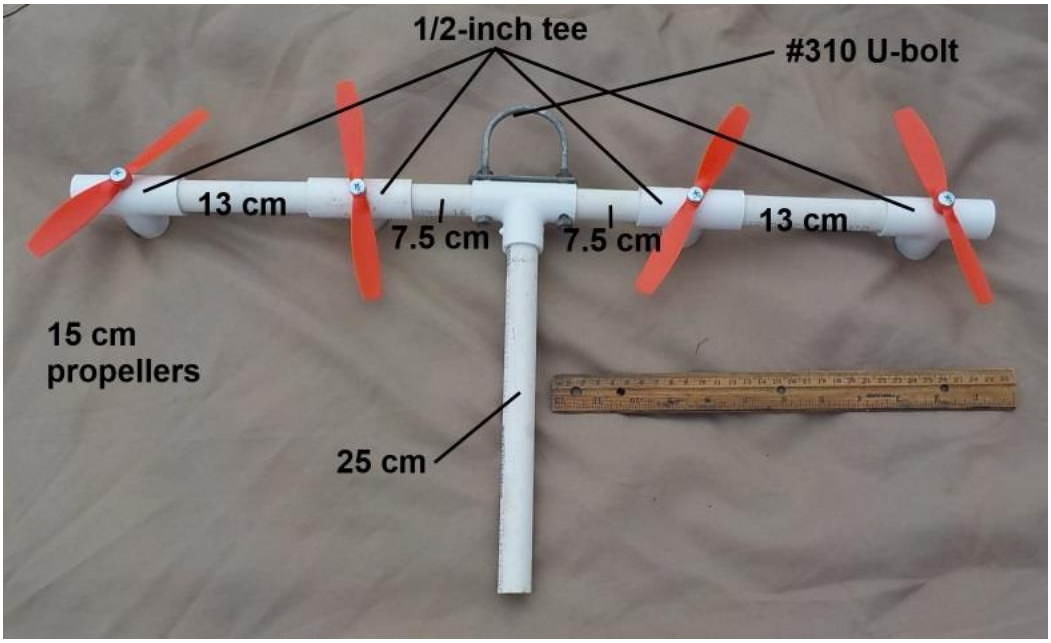
Two 20 cm of rope (colors may vary) are used to attach the door to the top of the hub. The door is 17 cm by 14 cm.

Cable connector inserted into power and communication hub:

Task 3: Energy

Tidal turbine:

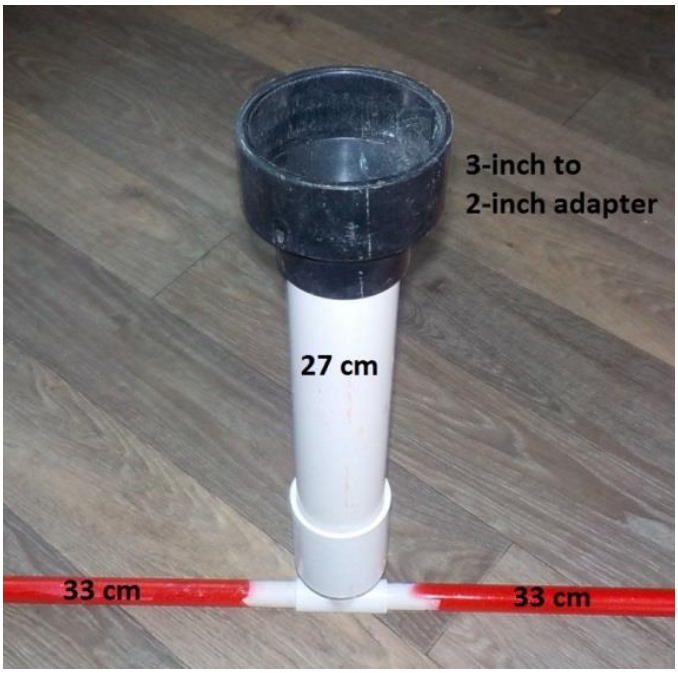
The tidal turbine is constructed from ½-inch PVC pipe. Four propellers are attached to ½-inch PVC tees. A #310 U-bolt is located in the top center of the turbine. The U-bolt goes all the way through the tee.



A red stripe (red plastic tape) will be added approximately 8 cm from the bottom of the tidal turbine. This stripe must be completely within the turbine stand to successfully install the tidal turbine.

Tidal turbine base:

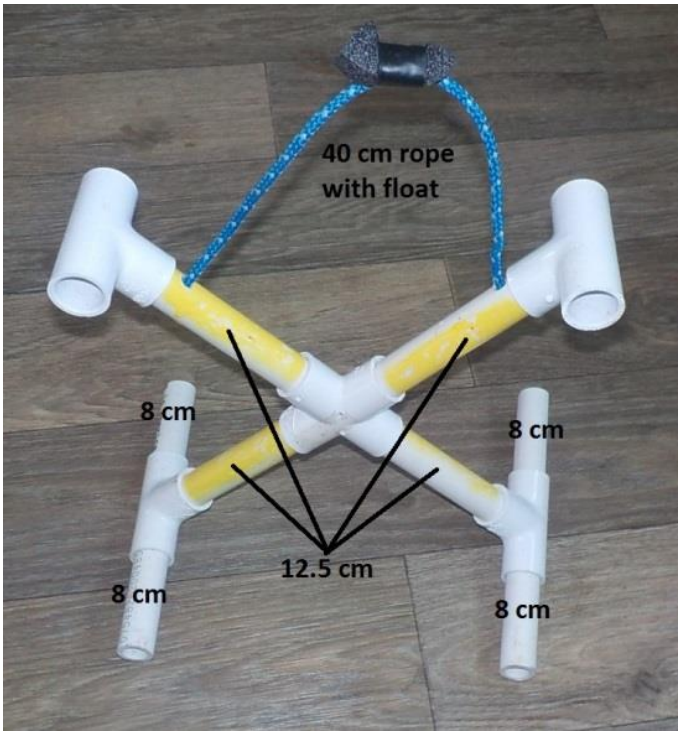
The turbine is constructed from a 3-inch to 2-inch ABS adapter, 2-inch PVC pipe and coupling, a 2-inch to ½-inch reducer bushing and ½-inch PVC pipe.



The 33 cm lengths of PVC pipe will attach to the designated area for the I-AMP and the designated area for the mooring (see below).

I-AMP:

The I-AMP is constructed from ½-inch PVC pipe.

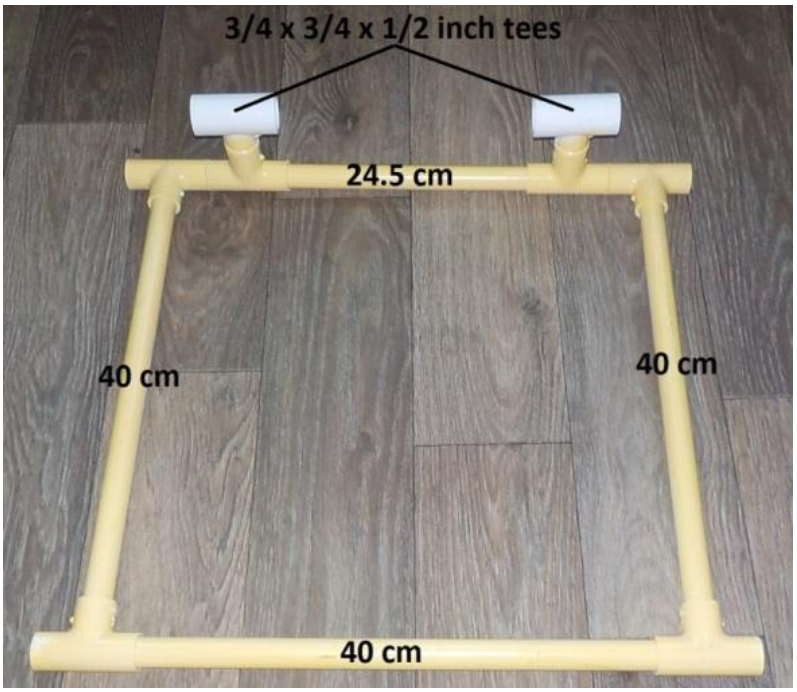


40 cm of rope (colors may vary) is used as a grab point. Drill two holes 0.5 cm below the tees. Insert the rope into the holes and tie an overhand knot to secure the rope in the pipe.

Flotation can be added to the top two 12.5 cm lengths of PVC pipe to help keep the I-AMP upright and to decrease its weight in water.

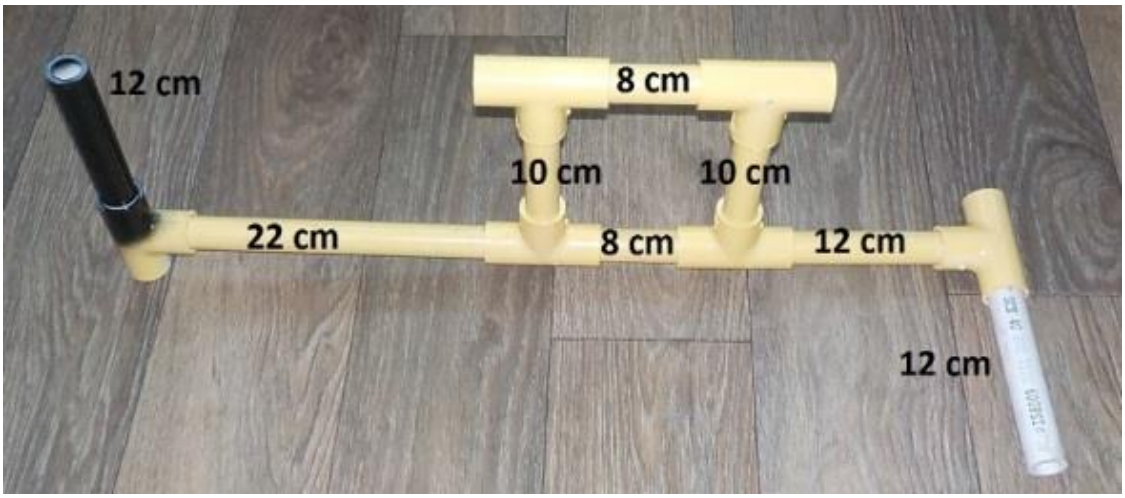
I-AMP designated area:

The designated area is constructed from ½-inch PVC pipe with two ¾-inch x ¾-inch x ½-inch reducing tee (note that the Home Depot website photo does not show the proper tee).



I-AMP locking mechanism:

The locking mechanism is constructed from ½-inch PVC pipe.



The 12 cm black handle should be parallel (in line with) the central yellow section.

The 12 cm black handle should be perpendicular (90^{o} off) the white handle, i.e. if the white handle is flat against the ground (as shown in photo) the black handle should be sticking straight up.

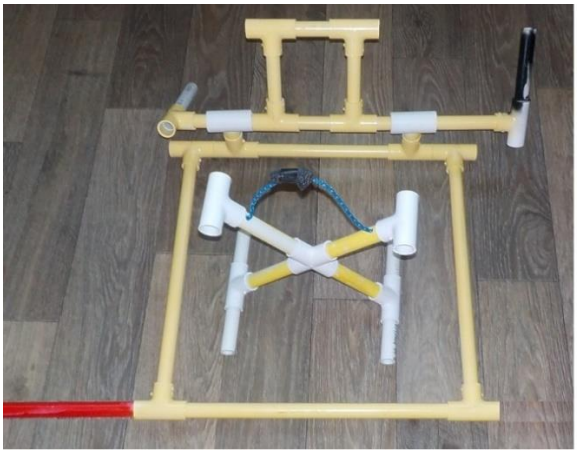
I-AMP base:

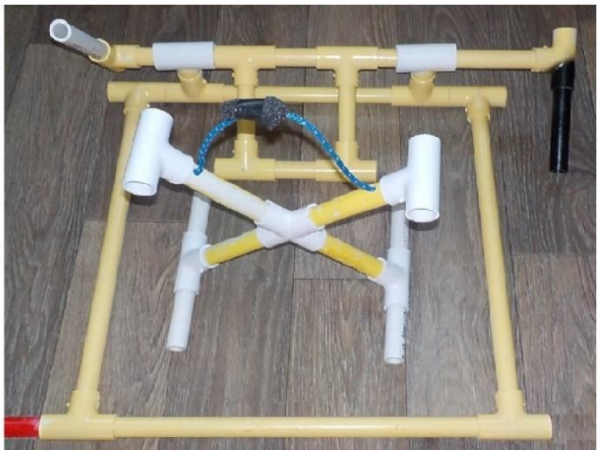
The I-AMP base is composed of the designated area and the locking mechanism.

The ½-inch pipe of the locking mechanism fits through the ¾-inch sections of the tees.

One corner of the I-AMP base is connected to the base for the tidal turbine. See below.

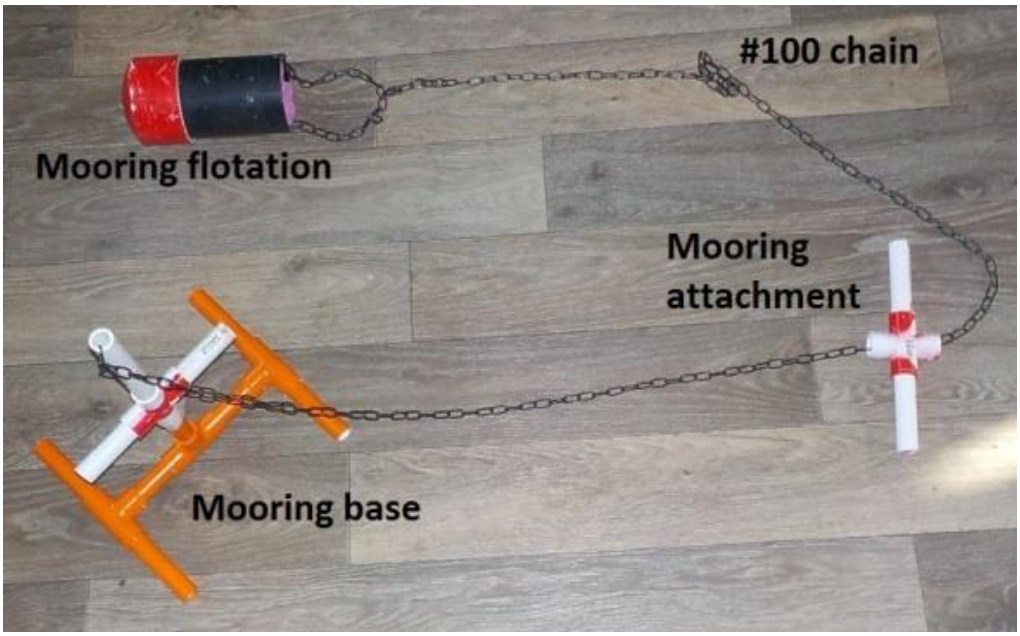
I-AMP installed in the I-AMP base and locked in the I-AMP base:





Mooring:

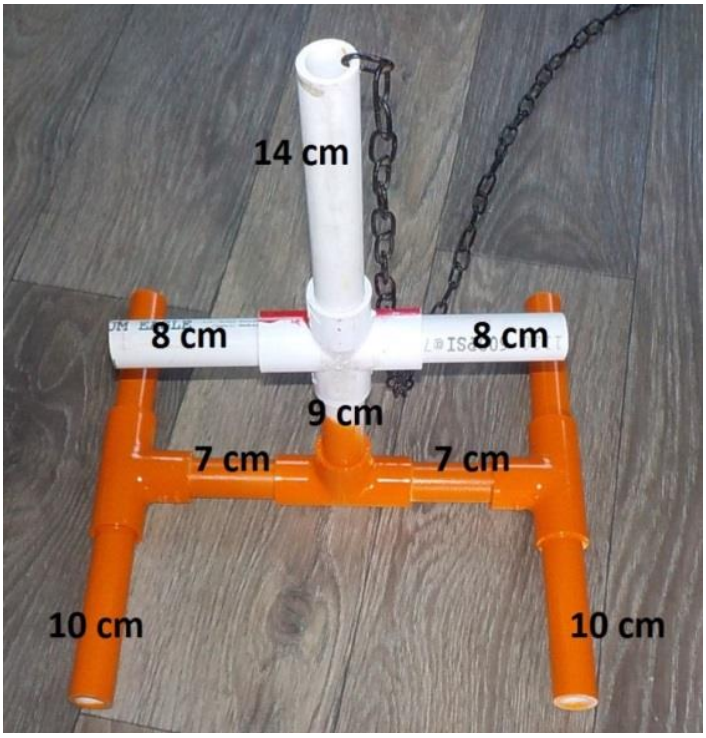
The mooring consists of three parts connected by #100 black chain. The length of the mooring, from the bottom of the base to the top of the flotation should be the depth of the pool plus 5 cm to 10 cm.



The mooring attachment should be approximately half way between the base and the flotation. Cut your chain lengths accordingly.

Mooring base:

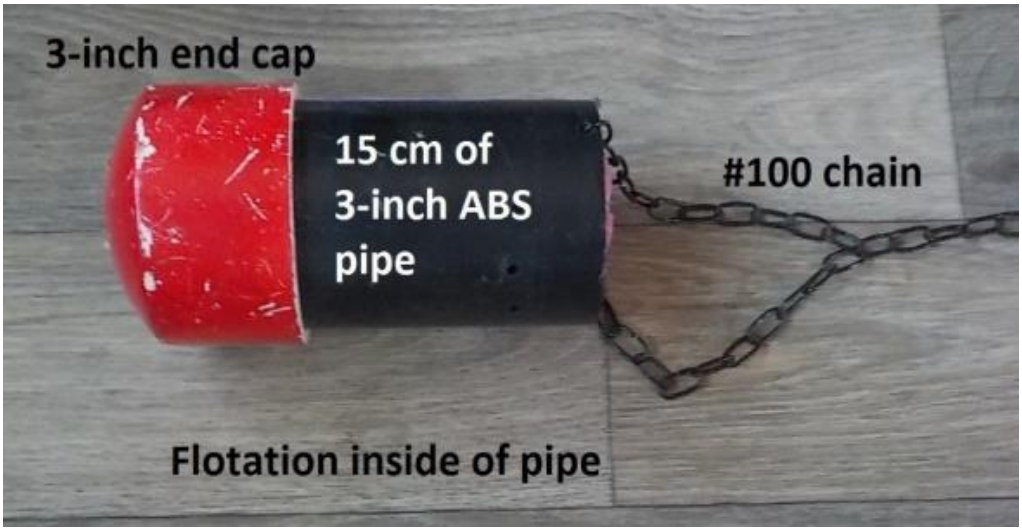
The mooring base is constructed from ½-inch PVC.



Drill a 1/8-inch hole in the top of the 14 cm length of pipe. Use needle nose pliers to open one link of the chain, insert it through the drilled hole, then push the chain link back together.

Mooring flotation:

The mooring is constructed from 3-inch ABS pipe with a 3-inch end cap attached. #100 chain attaches the mooring flotation to the mooring attachment.



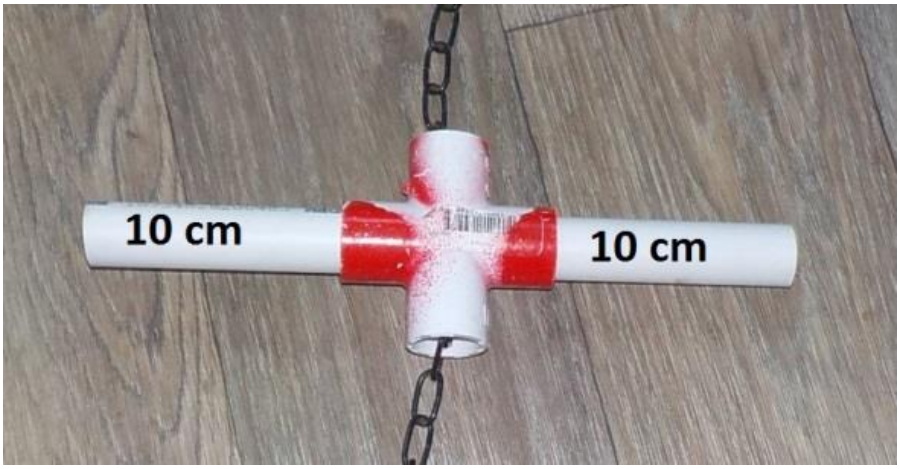
The mooring is constructed from a 15 cm length of 3-inch ABS pipe and a 3-inch PVC end cap. PVC pipe can be substituted for ABS.

Drill two holes in the end of the 3-inch ABS pipe. Use needle nose pliers to open the chain links on both ends of a 30 cm length of chain. Insert the links through the holes and use the pliers to push the link back together.

Add foam into the mooring flotation. The flotation should be 3 Newtons positively buoyant in water.

Mooring attachment:

The mooring attachment is constructed from a ½-inch PVC.

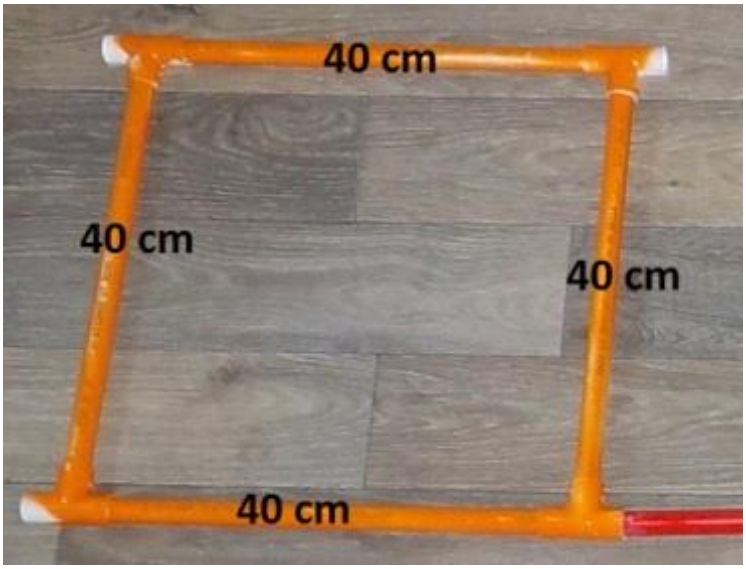


Drill a hole in opposite ends of the ½-inch cross (two holes total). Use needle nose pliers to open the chain links on the ends of the chains attached to the mooring flotation and the mooring base. Insert the open link for the chain leading to the flotation on one side. Insert the open link for the chain leading to the base on the other side of the cross. Use the pliers to push the link back together.

Add foam flotation into each 10 cm length of PVC pipe. The attachment mechanism should be positively buoyant.

Mooring designated area:

The mooring designated area will be a 40 cm square painted orange. The mooring designated area will be attached to the tidal turbine base.



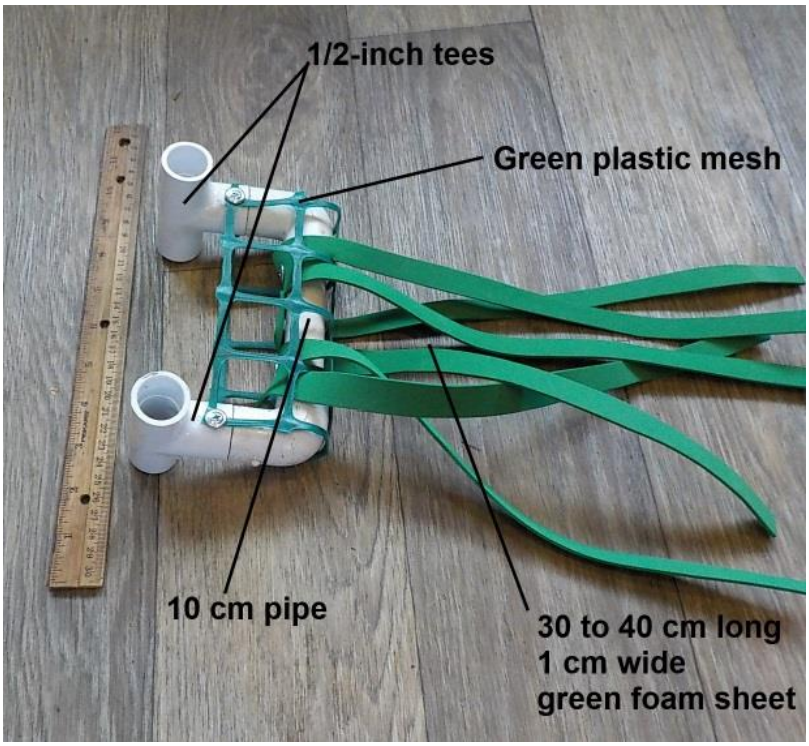
Mooring base installed into the designated area:

Bases and designated area:

The tidal turbine base, the I-AMP base area, and the mooring designated area will all be combined.

B**ases and designated area with components installed:**

Eelgrass samples and frames:



Foam sheeting is available at Michael's craft store.

Eelgrass frames have green plastic mesh. Eelgrass samples do not have the green plastic mesh.

Eelgrass area: