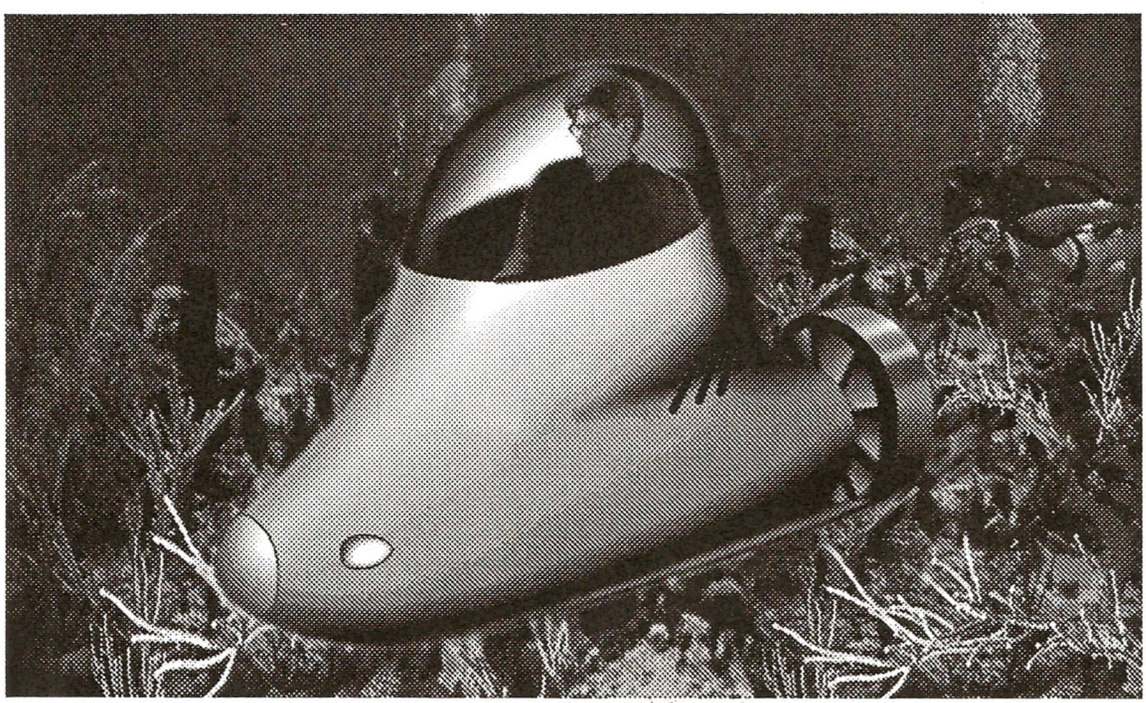
# HOMEBUILT SUBMARINE

Design by *PowerSub Corp.*



*PowerSub* disclaims any responsibility for the quality, condition, design or workmanship and materials of the watercraft built from these palns, and for its proper or safe functioning as a submarine.

# Homebuilt Submarine

Designed by ***PowerSub*** *Corp.*

The PowerSub submarine represents the culmination of considerable thought in designing a low-cost and safe under-water vehicle. The PowerSub submarine is a semi-dry type submarine in which the upper portion of the vehicle is filled with an airpocket - to enclose the pilot and provide buoyancy force. The buoyancy forces always pull upward, while the ballast and batteries (gravity force) always pull down. The amount of airpocket filled is constantly adjusted to control the floating/descending. The ballast and batteries are located at the bottom of the sub, so it can maintain the natural position in which the bottom of the sub always points down. This natural position keeps the airpocket from escaping, causing the sub to lose buoyancy. The air is supplied by a standard 72 cu. ft. scuba tank with a single-hose regulator. The propulsion unit is a trolling motor, and current is supplied from four automotive batteries.

WARNING: Any kind of diving can be dangerous. Only experienced scuba divers should operate the submarine, and all standard diving precautions should be applied.

Note: Get to know the plans well that you can visualize where every part goes and how each of them functions. It is possible that you will like to modify the designs to suit your requirements.

## Fiberglass Shell

Currently, the factory fiberglass body are not yet available. To build your own fiberglass body, use the following methods.

One simple way to make one sub body is the investment foam-mold method: Trace the cross-section contours on 14 pieces of 5" thick blue Styrofoam and cut off each piece with hot wire. Pile up and glue15 pieces of these cross-section with all center points aligned, then profile them into an smooth shape. Than, hand-lay fiberglass cloths with epoxy on the foam-mold to make the sub body. Use fiberglass cloth, rather than the mat, because it will require less work to finish. Three or four layers of cloth is sufficient. After the fiberglass body is cured, cut off the upper hull, than, crush and remove the foam-mold.

*Glue the Foam: Resins which cure and require no drying may be used for foam to foam bonding, because there is no way for moisture to breath through of a foam to foam. A mixture of micro balloons and epoxy is the best for these bonds. Foam to foam can be toothpicked or taped together while curing, but the toothpicks must be removed before the bond is fully cured or otherwise they will drag large piece of foam out on removal. Masking and strapping tape are great in holding parts together and providing a disposable means of clamping and fixturing.*

*Cut the Foam: Cutting of foam can be accomplished many ways, but generally a box-knife can be used for the cut-to-fit operations, and a hot-wire will be used for the cutting out parts such as wing ribs and spar webs. Hot-wire cutting tools are available in local hobby stores. Or it can be set up without hard to find parts. A battery charger will be a adequate power source, and stainless steel safety wire will work best as the cutting wire. The hot-wire can be mounted in a wooden bow or strung from a flat surface, like a table saw table, up to a hook in the ceiling. A spring should be used to tension the hot-wire. Experiment with your hot-wire set up finding the appropriate power setting and wire length to produce the best result.*

You can also build a mold that is constructed of plywood cross-sections with stringers and screen wire to create the surface

of the body. Fill the screen wire surface with plaster (the kind that sets up slowly). use several coats, making the mold smooth and uniform.

After the plaster is dry, wax it well with paste wax so the fiberglass shell will release. Start at the top and brush on the fiberglass resin. Then lay on the cloth, using small pieces wherever the parts curve sharply. Use fiberglass cloth, rather than the mat, because it will require less work to finish. Three or four layers of cloth is sufficient.

Since the fiberglass is molded in one piece, the body needs to be cut into upper and lower shells to release them from the mold.

## Acrylic Plastic

The plastic is 1/8 -in. acrylic Plexiglas. Form the front windshield by making a paper pattern and then transferring the outline to the plastic sheet. This is bent to shape and attached to the cut-off fiberglass upper hull with seal glue, and bolts (not too tight to crack the plastic.

## Propulsion System

The propulsion system consists of one or two electric trolling motors, switches, and four (or up to eight) 12-volt sealed automotive batteries.

You can use any available trolling motors. Larger unit that provides 35 LB of thrust or more is desirable. Trolling motors have watersealed housing and shaft. In addition, by running a small hose from the motor into the airpacket area, the water pressure of outside will never get more than one pound greater that inside the motor. Therefore there is no greater pressure on the seal than if the motor is normally used on a boat.

Batteries are connected in parallel. Connect the negative pole to the motor housing or its ground wire. A automotive starter relay is used as the switches for the motors. The sealed type batteries

and the relay switches are enclosed in the watersealed compartment. All the exposed metal parts of the batteries and the switches are packed with heavy grease. To further ensure the water not getting in the battery compartment, run a air hose to the air battle to brow the water out if there is any.

## The Air System

The air system consists of a standard 72-foot scuba diving tank, and a single-hose regulator.

The tank is located in front and within the reach of the pilot. The regulator mouthpieces may be kept in the pilot's mouth even though his head is out of water.

The air in the airpocket is constantly released through the buoyancy control valve and replaced with fresh air from the air tank. Therefore the danger of carbon dioxide build-up should not become a problem. However, in every dive, be alert to its possibility.

The buoyancy control valve is adjusted to vary the volume of the air pocket. Note: When the sub descends the increasing water pressure will compress the air inside the airpocket reducing the sub's buoyancy. This will make the sub descent even faster. Therefore more air must be introduced into the airpocket as the sub descends. Normally the air you breathe will compensate for the loss. However, if a very fast descent is made, then the purge valve should be used to blow in extra air as needed.

Remember all the rules of scuba diving apply. Ears have to be cleared to equalize the pressure. In coming up from a deep dive, take the standard diving precautions to avoid the bends. The Maximum safe depth using compressed air is generally agreed to be about 120 ft.

Finally, states have varying requirements for registering a motor boat. Check your state division of marine vehicles to learn if your submarine must be registered.

## Instrument

Two instruments are recommended - Compass and depth gauge. A liquid-filled automotive type compass can be mounted permanently in the sub. A simple watch-style depth gauge is available in scuba gear supply stores.

## Operation

After you finish building your sub, check and recheck it on dry land. When you are ready for your first dive, unload the sub closed to the edge of the water. Test the motors and check all connections.

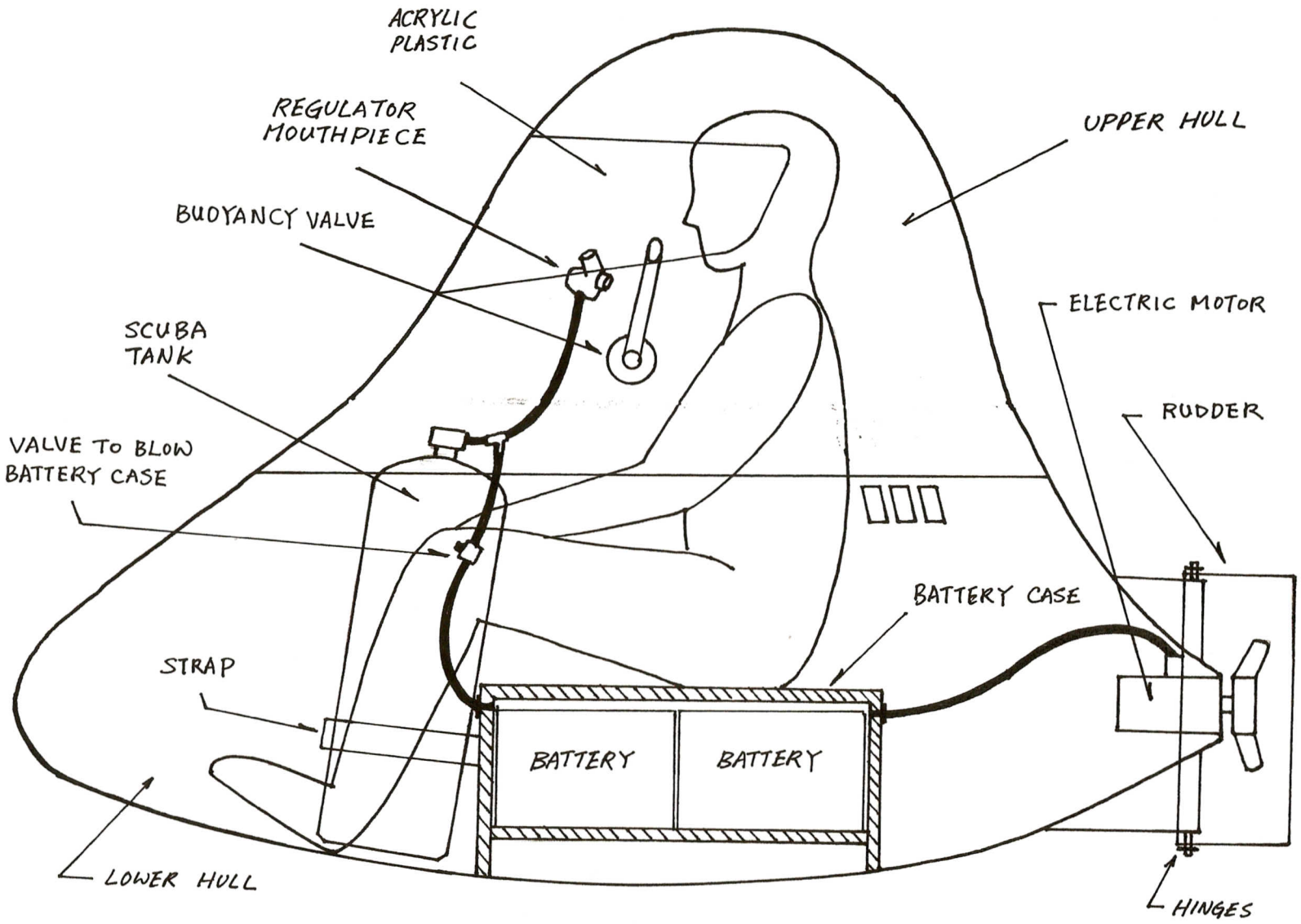
Next, install the air tank and check to see if air comes through the mouthpiece.

On the first test dive, have several experienced divers on site. With their help, push the sub into the water, and wait for the hull to fill up with water. Set the buoyancy valve at the max. airpocket volume. Now begin installing ballast bars (metal weights). Place them on the floor on both side of the battery compartment.

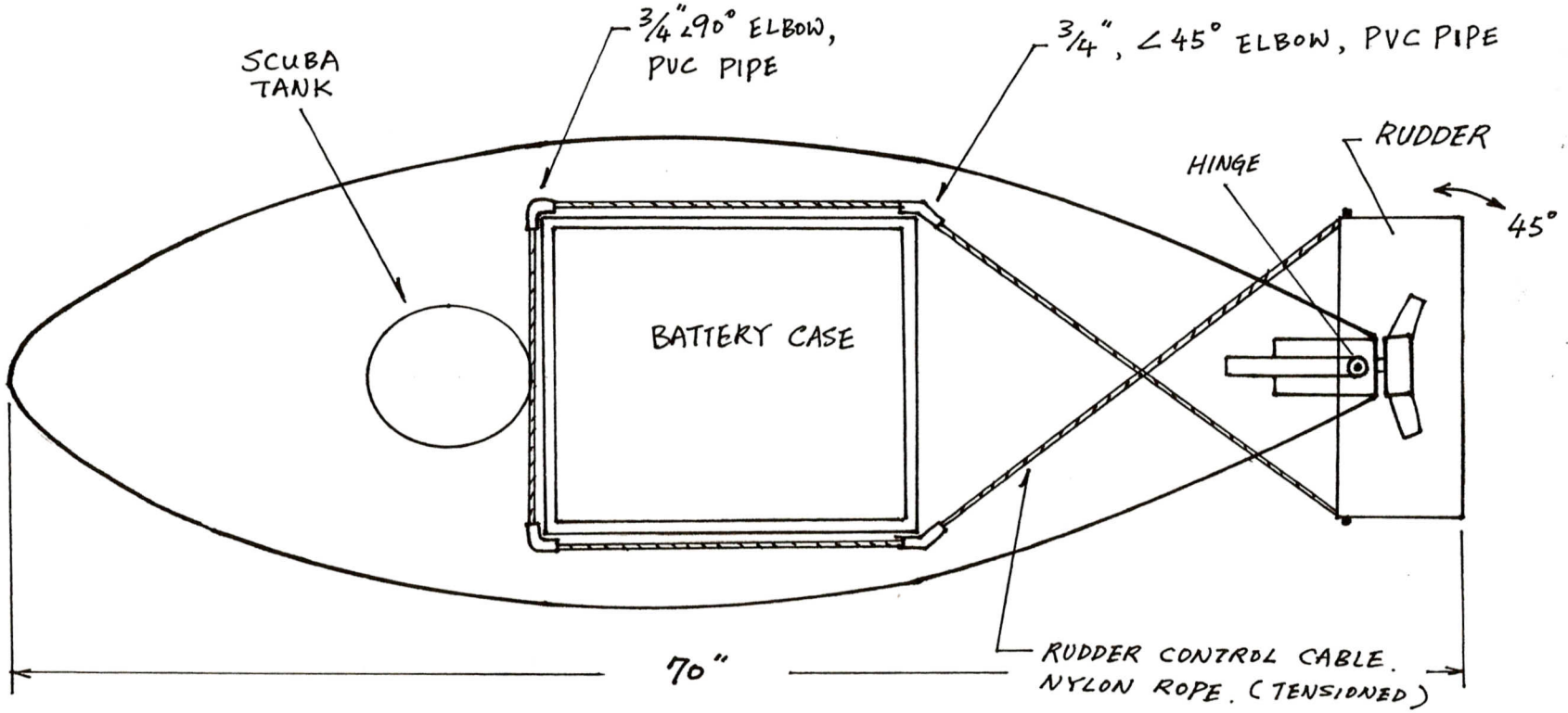
After the sub is fully loaded, move the valve up to reduce the airpocket volume. If the sub still floats, load more ballast. When adding ballast, always keep the sub's trim level.

Now, climb inside and start the motors. Run on the shallow water until you have checked out the sub completely. Have other divers to assist you as needed.

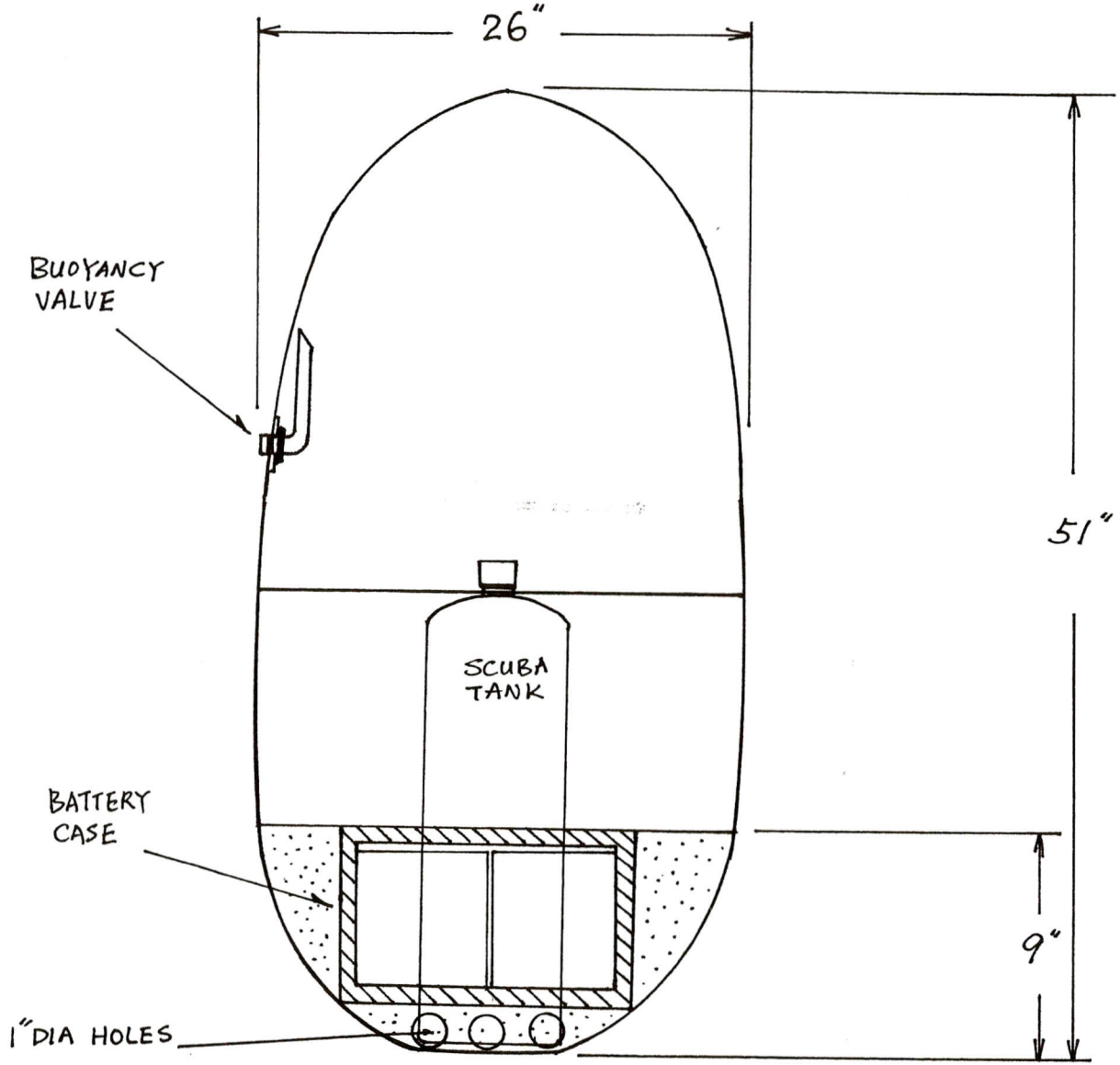
When you are certain that everything is working perfectly, pull up on the valve so the boat sinks lower in the water. Practice your sub in shallow dives until you are thoroughly familiar with your sub and its operating characteristics.


ACRYLIC PLASTIC
REGULATOR MOUTHPIECE
UPPER HULL
BUOYANCY VALVE
ELECTRIC MOTOR
SCUBA TANK
RUDDER
VALVE TO BLOW BATTERY CASE
BATTERY CASE
STRAP
BATTERY
BATTERY
LOWER HULL
HINGES

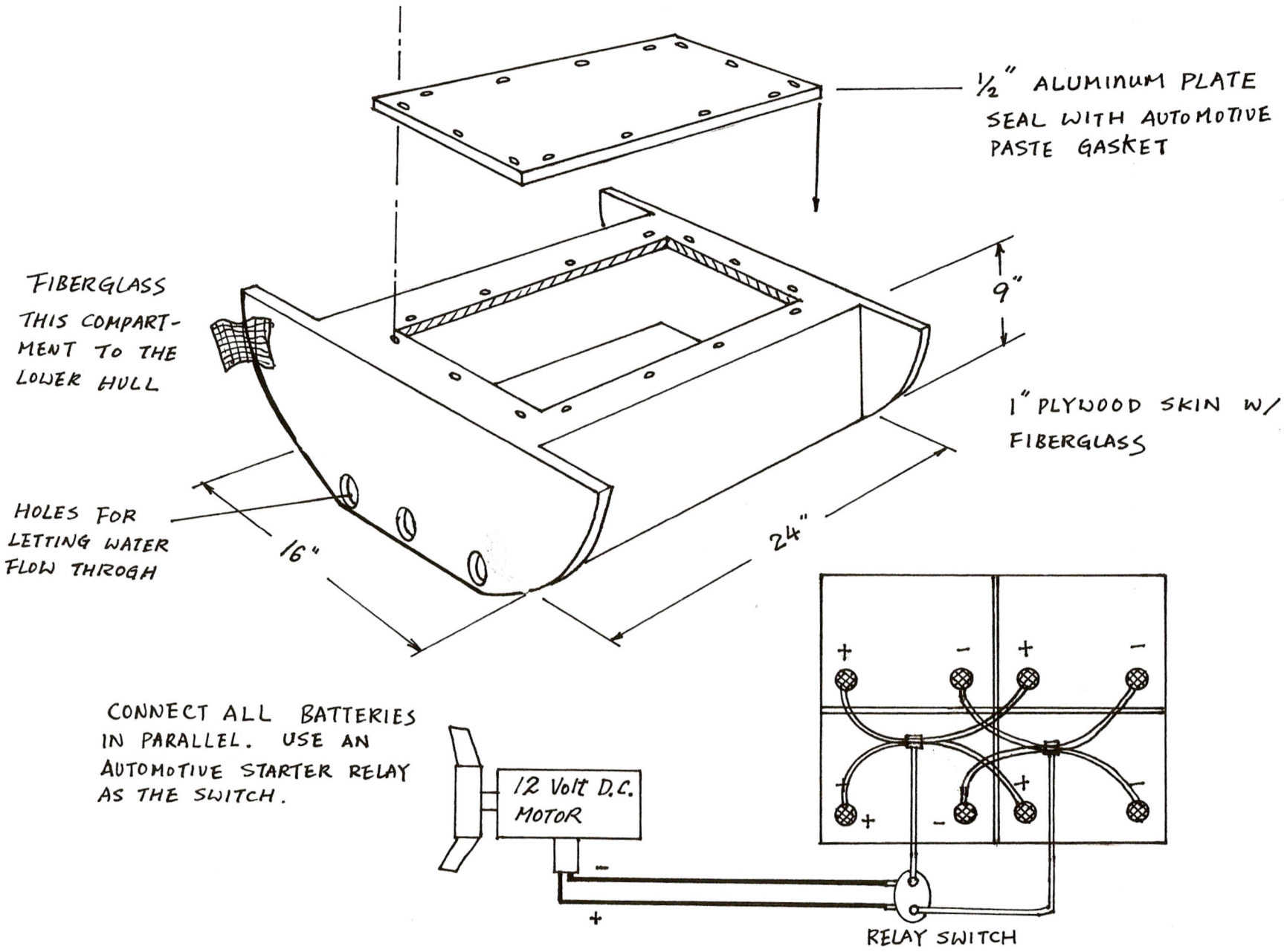
SIDE VIEW

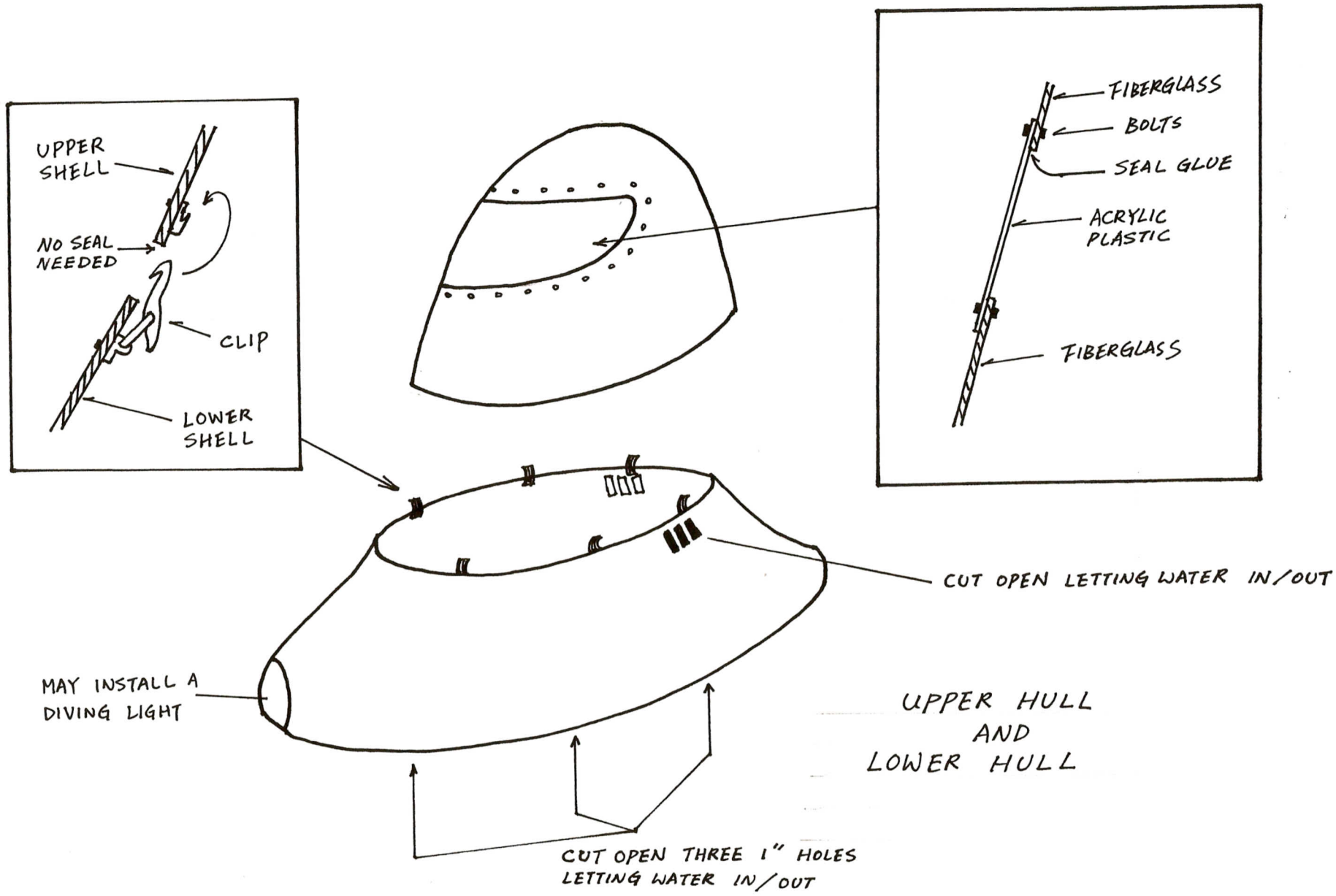

SCUBA TANK
3/4" ∠90° ELBOW, PVC PIPE
3/4", ∠45° ELBOW, PVC PIPE
HINGE
RUDDER
45°
BATTERY CASE
70"
RUDDER CONTROL CABLE. NYLON ROPE. (TENSIONED)

TOP VIEW

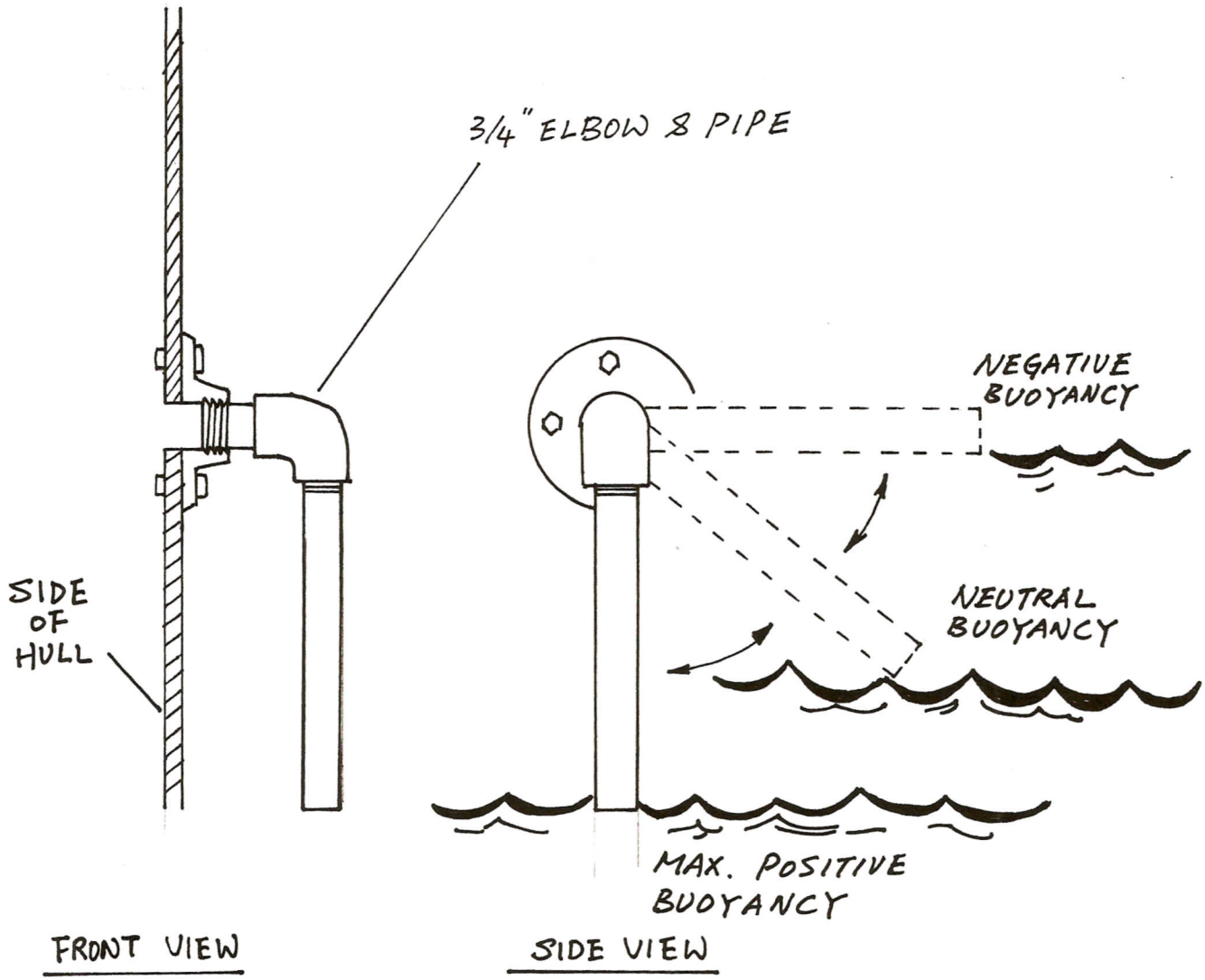



FRONT VIEW


½" ALUMINUM PLATE
SEAL WITH AUTOMOTIVE PASTE GASKET
FIBERGLASS THIS COMPARTMENT TO THE LOWER HULL
9"
1" PLYWOOD SKIN W/ FIBERGLASS
HOLES FOR LETTING WATER FLOW THROGH
16"
24"
CONNECT ALL BATTERIES IN PARALLEL. USE AN AUTOMOTIVE STARTER RELAY AS THE SWITCH.
12 Volt D.C. MOTOR
+
-
+
-
RELAY SWITCH

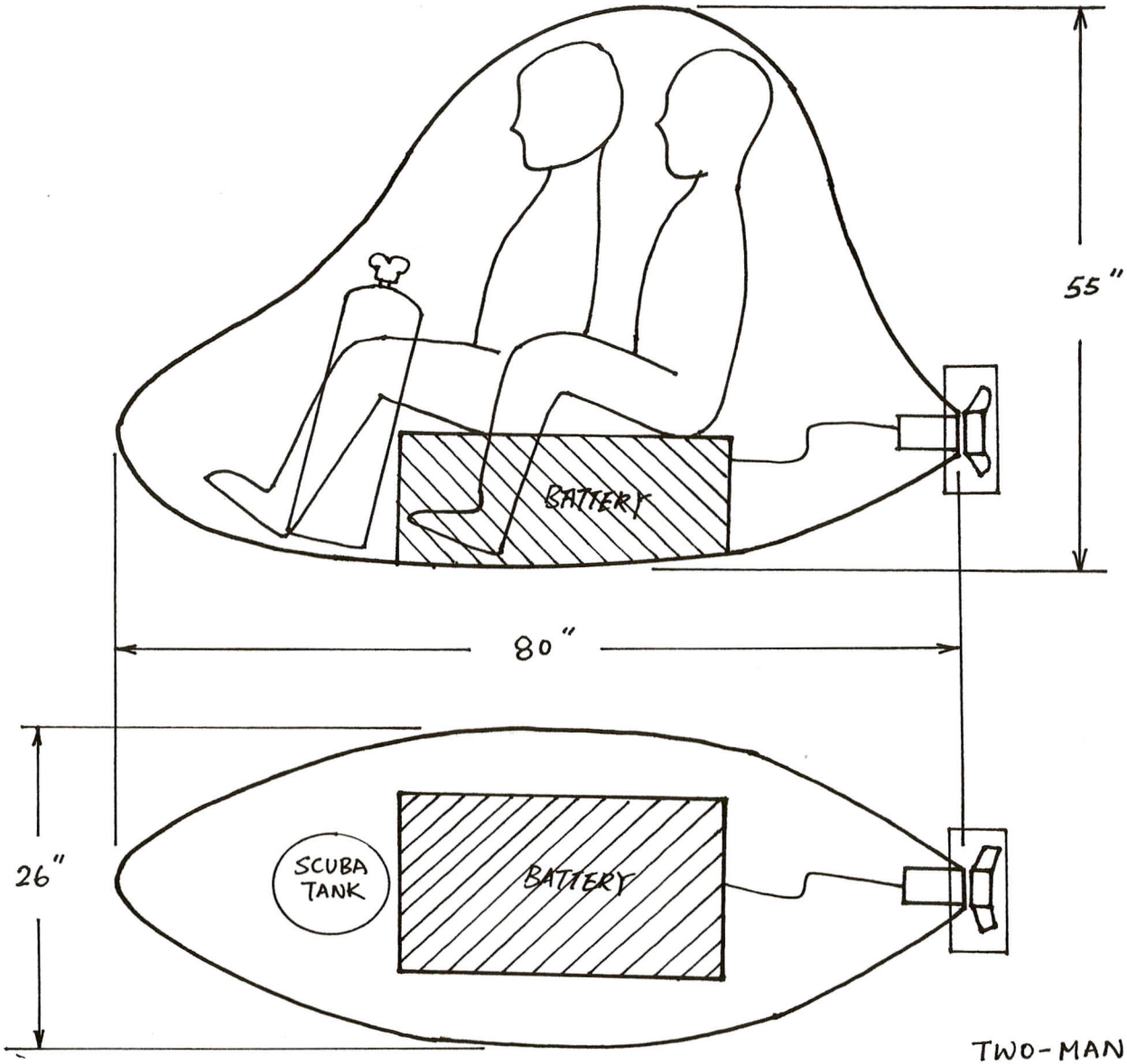



UPPER HULL
AND
LOWER HULL



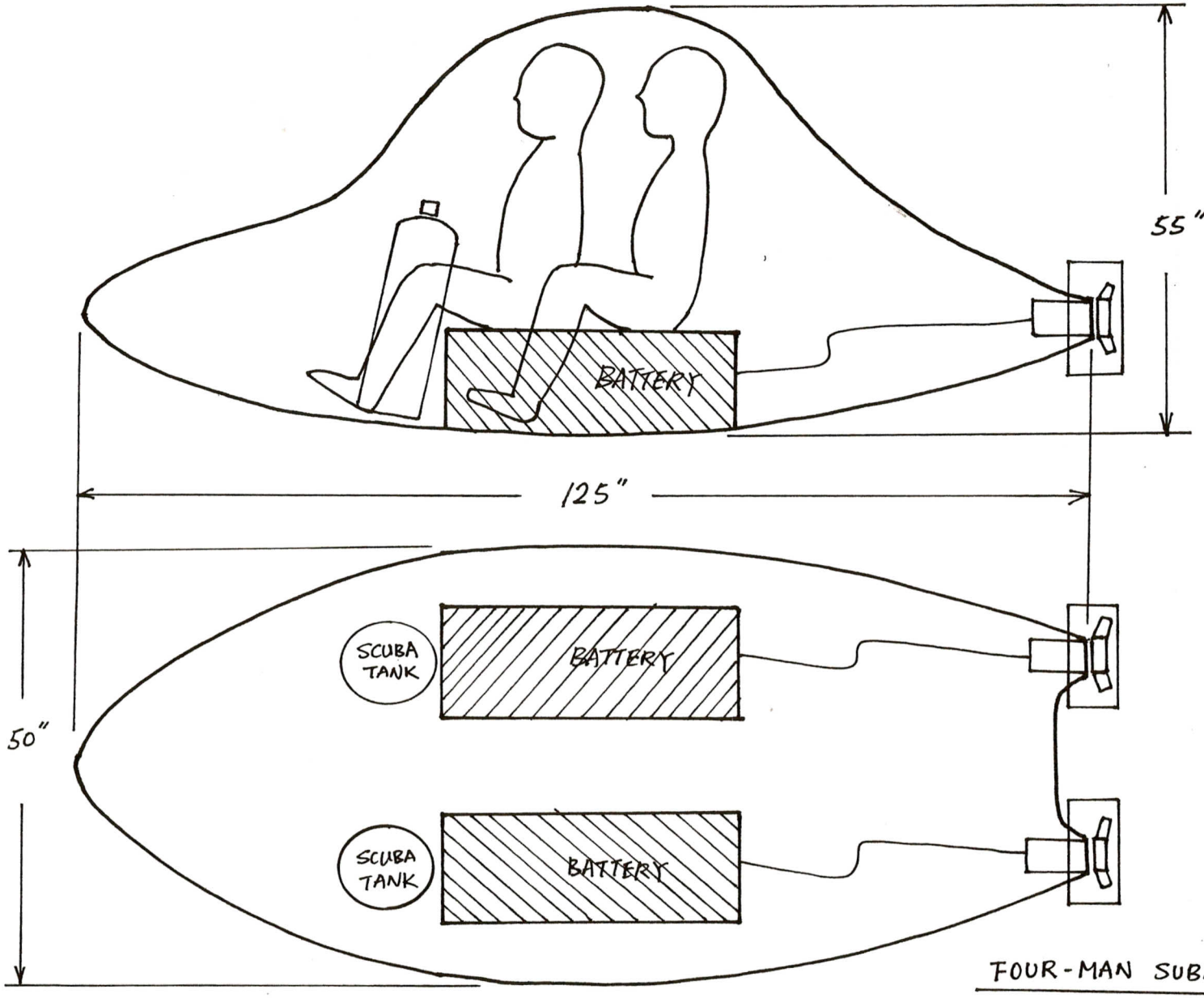

# VARIABLE BOOYANCY VALVE

NOTE: WATER INSIDE COCKPIT STAYS AT THE BOTTOM OF THE PIPE POSITION




TWO-MAN SUBMARINE

BUILD A LARGER HULL TO ACCOMMODATE TWO PERSON




FOUR-MAN SUBMARINE

TWO BATTERY COMPARTMENTS
TWO AIR TANKS, TWO MOTORS

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